Chapter 5

EXISTING SECTOR ARRANGEMENTS AND INSTITUTIONAL CAPACITY

5. EXISTING SECTOR ARRANGEMENTS AND INSTITUTIONAL CAPACITY

5.1 General

Much has happened in the sector since 1987 when the national master plan was initially prepared. The water supply, sewerage and sanitation sector today is in a transition stage. The Local Government Code (LGC) has essentially re-defined the role, relationship and linkages of central, provincial, municipal and barangay institutions in the provision of basic services, including water and sanitation. The responsibility for water supply and sanitation functions were lodged with various national agencies. The new direction mandates the LGUs to play a larger role in planning and implementing water supply and sanitation projects. This raises serious institutional capacity and resource reallocation issues.

Chapter Five provides an overview of existing sector policies and arrangements as a basis for formulating modifications and improvements. It identifies current capacity building issues which need to be addressed in the early stages of master plan implementation. Most importantly, it assesses the impact of the present centralized delivery system at the local levels.

5.2 Sector Reforms

The GOP has set the future agenda for sector reform. These initiatives followed the completion of the Water Supply Sector Reform Study and the National Urban Sewerage and Sanitation Strategy Study. The GOP has endorsed the major recommendations of these studies through the following NEDA resolutions:

(1) NEDA Resolution No. 4 (series of 1994): LGUs, in the context of the LGC and related decentralization efforts, now play a lead role in service delivery. The resolution allows LGUs to implement all levels of water supply projects and redefines the roles of other sector agencies. LWUA shall implement only financially viable Level III water supply projects in areas outside the MWSS jurisdiction. DILG's participation will consist of general administration and institution building, such as assistance to the LGUs in the formation of Rural and/or Barangay Waterworks and Sanitation Association and in the identification of water supply systems. *DPWH, together with DILG and DOH, will provide technical assistance (within a period of about 2 years) to LGUs in the planning, implementation and operation and maintenance of water supply facilities.*

(2) NEDA Resolution No. 5 reaffirms the principle of provision of sewerage and sanitation services on the basis of willingness-to-pay. The resolution mandates the establishment of a Central Project Support Office (CPSO) at LWUA to assist LGUs in the formulation, preparation and implementation of sewerage and sanitation projects.

5.3 Sector Institutions

(1) Existing Institutional Arrangements

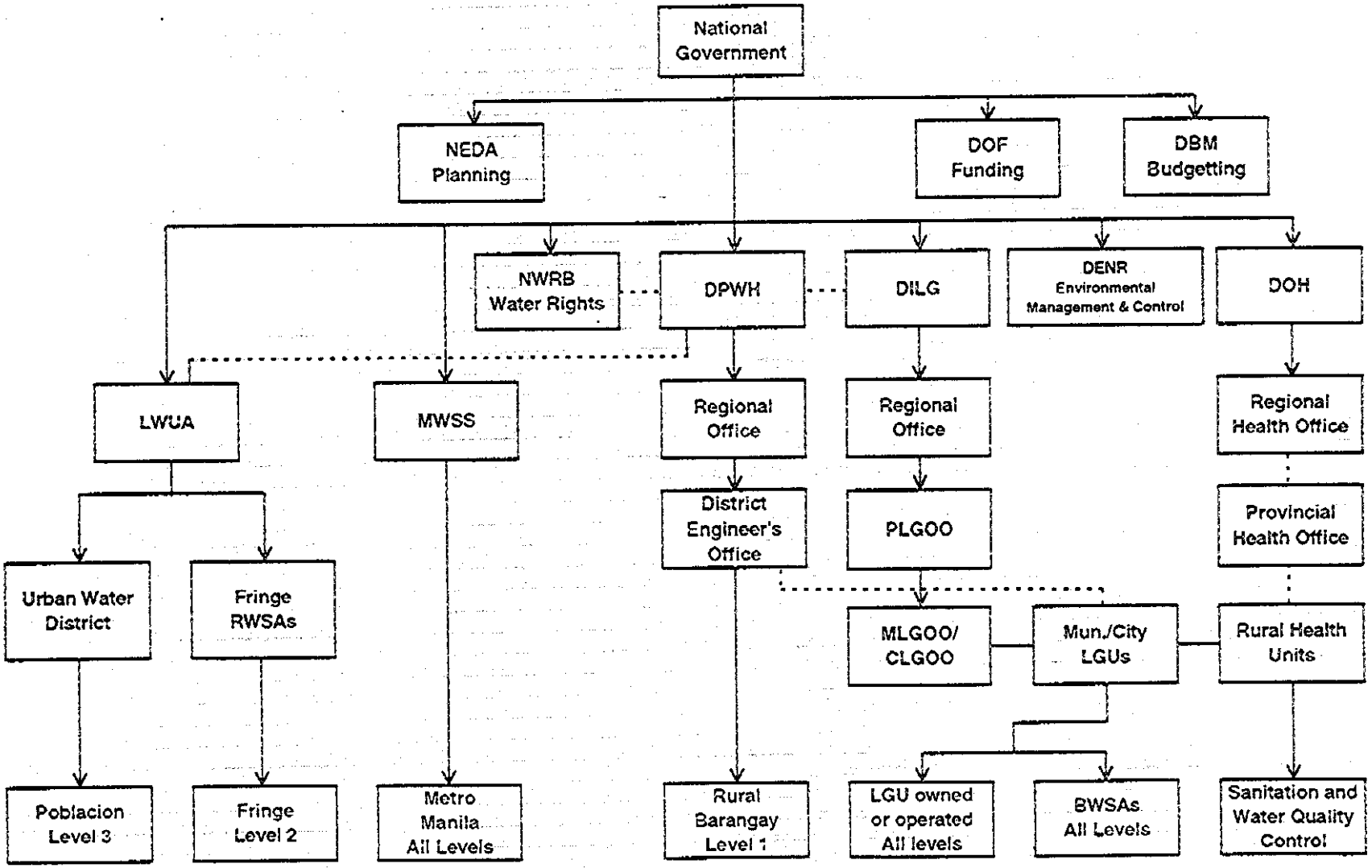
In the beginning of this chapter, it was noted that the sector is in transition. The LGC, however, mandates major changes on sector structure and performance in the future. New Implementing Rules and Regulations (IRR) reflecting the new sector role of the LGUs and national agencies are being prepared. Sector projects are still led generally by national agencies, in coordination with LGUs. The following discussion on institutional arrangements therefore presents the starting point of the transition (i.e., the existing set-up).

At the central level, there are three (3) line departments (DILG, DPWH and DOH) and two (2) government owned and controlled corporations (LWUA and MWSS) responsible for planning and implementation (refer to Figure 5.3.1, Functional Relationship). Other GOP departments are concerned with macro-planning, national resource allocation decisions, as well as exercise of regulatory powers for tariff setting, and environmental protection and management issues.

At the provincial and municipal levels, there are central agency field offices (of DPWH and DILG) and LGU offices working in the sector. DOH field offices have since been devolved and most of its resources are already under LGU supervision. Water districts, RWSAs and BWSAs have been organized to deal with the actual delivery of services. Some LGUs continue to operate municipal or provincial water and sanitation systems. As the LGC is gradually put into operation, many of the responsibilities and resources currently administered by central departments may be devolved to LGUs. Project management offices (PMOs, at the central level), *ad hoc* inter-agency committees and task forces have been organized to address coordination issues.

There are many water and sanitation activities outside the government realm. The private sector, NGOs and community-based organizations (CBOs), out of necessity, are rehabilitating publicly-installed, non-operating facilities or constructing new ones.

Figure 5.3.1 - Functional Relationships



The current major institutional issues are those of management of the transition process and of re-establishing leadership in the sector. Major resource realignments and capacity building initiatives are needed. The formulation of a new set of implementing rules and regulations will be started shortly.

(2) Sector finance

The water sector reform study reports that in order to increase nationwide water supply coverage to about 87% by 1998, new investments of about ₱39.3 B will be needed. Of this, only ₱12.8 B has been secured, i.e., carried over from existing projects. In addition, the level of public investment in water supply has declined in real terms in recent years. During the period 1988 through 1992, ₱17.268 B was allocated of which only ₱10.453 B was disbursed. Despite the declining trend in investments, the water sector fund utilization rate is only 60.5% - indicating serious institutional planning and implementation capacity issues. The delay in the institutional response to the policy shifts has invariably contributed to this decline in activity level.

If the new arrangements are to flourish, the issue of LGU access to external sources of capital development funds (backed by GOP guarantees) needs to be addressed.

5.4 Sector Agencies at the National Level

(1) Department of the Interior and Local Government (DILG)

Responsibility: The Department has the mandate of strengthening local capacity for delivery of basic services, including water and sanitation. It is responsible for providing general administration and institution-building support to LGUs including assistance in the formation and training of BWSAs; coordination of master plan preparation; sourcing of external funds; formulation and installation of sector management systems, including O&M and BWSA financial management systems. Ultimately, DILG is geared to provide a range of support activities to develop the capability of LGUs to provide, manage, operate and maintain water supply projects either directly or through community-based organizations, like BWSAs.

Current Activities: On a transitory basis, interagency provincial and municipal water task forces have been established in some provinces. These task forces (TFs) are the

current sector entry point of DILG. Through the TFs, barangays needing improved water supply and households needing sanitation improvements are identified and organizations are formed. Training activities are also done with the TFs. Conferences are held regularly to assess performance and review sector experiences. Training generally follows the cascade approach from the national up to the barangay level.

Resources: The PMO for Water Supply and Sanitation is established under the Assistant Secretary for Plans and Programs. About sixty (60) staff members comprise the PMO. It has four (4) operating divisions (Administration; Finance and Procurement; Project Planning; and Field Operations). Its Work Program is integrated with the DILG Annual Plan of Implementation. Like other line Departments, DILG's annual budget allocation goes through the general appropriations review and approval process in Congress which usually requires a one-year lead time. Action officers are assigned for every active province. Monitoring and evaluation of project implementation are done by the provincial (and municipal) local government operations officers (PLGOOs/ MLGOOs). Funds for sector training and BWSA formation are channeled through the regional and provincial DILG offices.

(2) Local Water Utilities Administration (LWUA)

Responsibility: LWUA is a specialized lending institution mandated to promote and oversee the development of provincial water utilities based on financial viability of projects. Most water utilities were under the LGUs until 1973, when some LGUs opted to waive their control over the utility and organize water districts (WDs) to qualify under the LWUA program. In 1987, LWUA responsibilities were expanded to include assistance to Level II Rural Waterworks and Sanitation Associations (RWSAs). The provision of Level II and III service and of wastewater disposal systems in communities outside Metropolitan Manila are largely coordinated through the LWUA. The WDs currently serve about 18.43 M consumers in about 703 cities and municipalities. NEDA Resolution No. 4 directs LWUA to focus on its development banking role and to finance only viable WDs. Since its establishment in 1972, LWUA has formed 544 WDs (486 of which have availed of loans totaling P 4.0 B). It has completed over 880 water supply projects.

Activities: LWUA has since developed a wide array of support services for WD development.

Institutional development services for WDs and RWSAs include: formation, management advisory services, training programs, management audits and operations reviews, installation of uniform commercial practices systems; information and marketing support.

Financial services include: economic and financial analysis, tariff analysis and fund sourcing. Various types of loans are available to finance the construction of water systems; reactivation of non-operating systems, rehabilitation and expansion of facilities; and training. Special loans finance watershed management projects; construction of administration buildings; purchase of service vehicles, communication and computer facilities; restoration of facilities damaged by calamities; initial or emergency operational needs. Commodity loans support generation of additional service connections.

Technical services: LWUA oversees the planning, design, construction, and control of quality standards to improve the water system facilities of WDs and RWSAs. LWUA formulates uniform standards for design, materials and construction to lower project costs and disseminates periodic water supply industry performance indicators.

LWUA consults with interested LGUs on the formation of WDs and RWSAs. Public hearings are held prior to the formation of WDs and tariff adjustments. Where tariff increases are not accepted, improvement projects are either reviewed or shelved altogether. LWUA collaborates with LGUs and consumers on all phases of WD improvement programs especially during the construction of water supply facilities.

Resources: LWUA maintains and fields a pool of management advisors, trainers, engineers and other professionals to give WDs and RWSAs proper guidance in their operation and administration. In addition, the Central Sewerage and Sanitation Program Support Office (CPSO) was recently established at LWUA to coordinate the implementation of sewerage and sanitation projects at the national level and to assist LGUs and WDs plan and manage sewerage and sanitation projects and programs at the local level.

LWUA training programs embrace efforts directed at the training and education needs of those who manage and operate water supply systems and those who provide assistance from the national level so that the water systems will succeed. Training for the water districts comprise about 20 technical and 20 management courses while in-house courses

cover cadetship training for fresh engineering graduates, management advisors, and supervisors courses on construction project management, and computer education.

(3) Department of Public Works and Highways (DPWH)

Responsibility: The Department is responsible for the construction and major repair/rehabilitation of rural water supply systems (Level 1) and for the planning and execution of sewerage projects in some cities and larger poblaciones in the country with participation of LGUs.

Activities: The actual construction of the projects are done through contract or force account by the regional and district offices of the Department or other designated agencies under supervision of the PMO and in accordance with approved work programs. The following describes the current project planning and programming process for water supply projects. The central office advises regional office that funding will be available and requests for proposals for a specified number of projects. The regional office allocates the total number of projects among the district offices and directs preparation of a Program of Work (PoW) with a listing of sites. A draft PoW is submitted to the PPDO for comments. In most instances, this is reviewed by the Provincial Board. PPDO endorses the PoW to the DPWH Regional Office. The PoW is sent to the PMO-RWS at the central office which authorizes the release of budget allotment. DEO is now cleared to start construction. Reporting is done based on accomplishments.

Resources: The PMO for Rural Water Supply was established in 1981 (Ministry Order 14) to "manage and direct the planning, design, construction, organization and maintenance of foreign-assisted rural water supply projects" of the Department. It consists of a 44 technical and 26 administrative staff (regular). In addition, as the loan project packages may require, project staff are recruited on contract. At the field level, the Department maintains about 92 District Engineering offices. Most of the DEOs are staffed with a water engineer, drilling crews and equipment. In some DEOs, staff have been assigned to oversee BWSA formation and training activities.

(4) Department of Health (DOH)

Responsibility: The Department is the principal health policy-making and implementing agency. Its main function is to develop and implement sanitation programs nationwide

and administer health education aimed at reducing morbidity due to, among others, waterborne and sanitation related illnesses specifically diarrhea diseases which ranked second leading cause of morbidity among the population in the past years. Its role in the water supply program is in the promotion of safe water supplies through water quality surveillance.

Activities: A major program of DOH (Environmental Health Service) is the improvement of the environmental sanitation conditions to make it more conducive to promotion and maintenance of the health of the people. The priority program components include water supply and sanitation (water treatment and disinfection, quality monitoring and surveillance), excreta and sewage disposal, wastewater collection and disposal. DOH also implements *Water for Life* project which calls for spring development for use in Level I systems and for organizing BWSAs. DOH is also responsible for the provision of sanitation facilities in rural areas.

Operating budgets come from general appropriations in the national budget. Capital expenditure funds to support construction of excreta and waste disposal systems come from project funds. Under the First Water Supply, Sewerage and Sanitation Sector Project, DOH administered a project subsidy of P105.00 (cost of the bowl) per toilet. Similar arrangements are ongoing with the IBRD-assisted FW4SP. In addition, it supervises the construction of public school toilets and sullage removal units and the distribution of household toilet bowls.

Resources: The health care system is delivered through five organizational levels: Central headquarters; Regional Health Offices and general and special hospitals; Provincial Health Offices, including provincial and district hospitals; Municipal Health Offices; and, Rural Health Units/Barangay Health Stations. Its unique structure enables the Department to reach up to the barangay level through its grassroots network of barangay health workers and volunteers. DOH manages regional and provincial laboratories with technicians who carry out water quality tests. It should be noted that a substantial segment of its institutional structure (from the provincial level downwards) has been devolved and is now supervised by the respective LGU.

Through its far-reaching network, DOH conducts health education campaigns which focus on women and children health in rural communities. The program is supported by centrally-produced information, education and communication materials. Enrichment of

hygiene education lesson plans for the school curricula is undertaken by DECS and DOH. Together with UNICEF, CIDA and other bilateral agencies, DOH has produced and distributed IEC materials with key messages on water supply, sanitation and hygiene behavior.

DOH provides training focused on skills development of its health workers, volunteers and community artisans. Its training programs are either conducted by in-house staff or commissioned through non-government organizations (NGOs). Provincial and district sanitary engineers and inspectors are trained on skills development and planning. Chemists and laboratory technicians are trained on tools and techniques to support on-going drinking water quality programs. BWSAs are instructed, among others, on protection and disinfection of water supply sources, constructing and maintaining toilets.

(5) Other National Agencies

Other national agencies provide macro-planning, funding and support, and regulatory guidelines for the water supply and sanitation sector.

The National Economic and Development Authority (NEDA), as the central planning office, ensures that all agency plans and programs are consistent with national priorities in the Medium-Term Public Investment Program and the Priority Sub-Sector Activity Layout. External grants and loan proposals are reviewed and approved at NEDA. It also coordinates the establishment of a system for national sector master planning and the monitoring system (with DILG).

The Department of Finance (DOF) is responsible for the generation and management of the financial resources of the government. It reviews and approves all public sector debt; oversees the fiscal soundness of public investments based on equity, cost recovery and economic growth, and sets the fiscal deficit of major government corporations, as part of the public sector borrowing program.

The Department of Budget and Management (DBM) plans the budget allocations for the government agencies, including capital and operating expenditures, equity infusion to public corporations, grants and subsidies for Congressional approval. DBM also ensures that budget releases conform with approved plans and programs.

The Department of Environment and Natural Resources (DENR) formulates and enforces policies and guidelines for environmental protection and pollution control. It is responsible for watershed protection and water resources management. It checks compliance of major projects with environmental guidelines. DENR works with all environmental management agencies and special regulatory bodies.

The Department of Education, Culture and Sports (DECS) implements hygiene education programs through schools using the *Teacher-Child-Parent (TCP)* approach. Health and sanitation messages are integrated in the curricula and special activities are designed to make the parents and other family members learn and put them into practice. The program is supplemented by a wide range of learning materials (workbooks) while prototypes of safe water sources and water-sealed toilets are set up in schools. DECS assists in the GOP school toilet building project by identifying priority schools and by supporting DOH's integrated health information, education and communication campaign using the formal and non-formal educational system.

The National Water Resources Board (NWRB) coordinates the overall policy framework for water resources development and management. NWRB was created to guide an orderly and scientific development of all water resources in the Philippines consistent with the principles of optimum utilization, conservation and protection to meet present and future needs. NWRB also deals with water rights issues. NEDA Board Resolution No. 4 strengthens the NWRB by increasing its control over the private extraction of groundwater.

The Metropolitan Waterworks and Sewerage System (MWSS) provides for the potable water supply and sewerage needs of Metropolitan Manila and its contiguous areas.

5.5 Sector Agencies at the Local Level

(1) Provincial Level

Under Sec. 17 of the Local Government Code, the LGU is responsible for the sector functions including: delivery of health services and infrastructure facilities intended to service the needs of the province, such as inter-municipal waterworks, drainage and sewerage, among others.

1) The Provincial Planning and Development Office (PPDO) is the nerve center of all provincial planning activities. The office conducts research and studies necessary to support plan formulation. It likewise integrates and coordinates sectoral plans and studies done by the different groups or agencies and monitors and evaluates the implementation of development programs and projects. It serves as the secretariat of the Provincial Development Council and its different sectoral committees.

Under the 20% development fund, a certain amount is allotted to the sector based on the priority of the province, which passes to the Social Development Committee (SODCOM) for deliberation and approval. After the allotment has been determined and approved, the proposed projects are then prioritized according to the criteria set by the committee. Only projects that can be accommodated by the budget will be implemented. Under the existing organizational set-up, the PPDO is composed of 23 personnel deployed in five divisions - Administrative (with 10 personnel), Development Administration (4), Infrastructure (4) Human Resource and Social Division (3), and Economic (2) (refer to Figure 5.5.1, Supporting Report). The Office also maintains a Special Project Division which performs analysis on plans and programs as well as the implications and resource requirements of development plans and projects before implementation process.

The following projects have been implemented by PPDO under the 20% Development Fund:

(a) Tiblac Spring Development; Tiblac, Ambaguio
(b) Upper Busilac Spring Development; Bayombong
(c) Construction of one (1) deep well in Amballao, Bagabag
(d) Nalubbunan Spring Development (Nalubbunan, Quezon)

2) The Provincial Engineer's Office (PEO) primarily takes charge of the construction, maintenance, improvement and repair of provincial road, bridges and other public infrastructure projects. It provides engineering services like investigation and survey, engineering designs, feasibility studies, and project management.

The office has five divisions consisting of 81 regular personnel (refer to Figure 5.5.2, Supporting Report). Distribution of personnel by division is as follows:

Administrative	7
Quality Control and Monitoring Division	4
Planning and Program Division	5
Construction Division	3
Maintenance Division	
South Section	26
North Section	36
Total	81

The Planning Section handles activities such as plan formulation, layout, work program preparation and feasibility study. The implementation of projects are being taken cared of by the Construction Division while monitoring activities are under the Quality Control and Monitoring Division.

For water projects, the PPDO is still the one preparing the design, program of works, feasibility studies and even the implementation of water projects. This is due to lack of proper delineation of work between the PPDO and the PEO.

3) The Provincial Health Office (PHO) is given the power to manage the provincial hospital and implement rural health program in the province. Most of its programs are meant to realize the Medium Term Development Plan's objective which is to improve the quality of life of Filipinos. These programs intend to meet the health and nutritional needs of mothers and children, to control communicable diseases and to ensure the sanitary living condition and safe water supply to the community.

The PHO is composed of two divisions, namely the Technical and the Administrative. The Technical Division is further subdivided into two sections - the Medical/Dental/Nursing Services and the Sanitary and Midwife section. (refer to Figure 5.5.3, Supporting Report).

In 1994, the Environmental Health and Sanitation Program of PHO comprised four major components, namely: water, sanitation, proper excreta disposal, food sanitation and public places sanitation. It has also included a special project to support its Sanitation improvement efforts by providing skills training for sanitary inspectors and water laboratory technician.

4) Provincial Waterworks Office (PWO)

The province has set up a Waterworks Division under the Provincial Economic Enterprise and Management Office to assume responsibility for the operation and maintenance of the water system which covers the municipalities of Bayombong and Solano. Moreover, the office renders advisory and technical assistance in the preparation of programs of work and cost estimates for the construction of shallow wells, deepwells, spring development projects and other sources within the province. It also supervises the installation of water supply, drainage and toilet facilities in buildings constructed by the provincial government. It likewise conducts inspection of watershed reservation area.

The Waterworks Division consists 16 personnel distributed in three sections, namely Billing, Collection and Repair/Maintenance.

(2) Municipal and Barangay Levels

The municipality is responsible for solid waste disposal or environmental management systems, general hygiene and sanitation and infrastructure facilities intended primarily to service the needs of the residents of the municipality and which are funded out of the municipal funds.

1) Municipal Planning and Development Office (MPDO)

Mandate: The MPDO is mandated to take charge of the planning and development and shall formulate an integrated economic, social, physical, and development plans and policies for consideration of the local development council.

Activities: The regular activities include: preparation of planning documents, monitoring and evaluation of projects.

Resources: The Municipal Planning and Development Office typically consists of the following personnel: Municipal Planning and Development Coordinator; Project Development Officer; Draftsman; and, Clerk.

2) Municipal Engineer's Office (MEO)

Mandate: The MEO provides engineering services to the local government unit concerned, including investigation and survey, engineering designs, feasibility studies, and project management. It also administers, coordinates, supervises and controls the construction, maintenance, improvement and repair of public works projects.

Activities: The MEO regularly performs engineering surveys to acquire data for designs, layout or construction of waterworks systems, sanitation facilities and other infrastructure projects. It also inspects works of contractors based on presented plans and specifications.

Resources: The MEO is typically composed of the following personnel: Municipal Engineer, Engineers and Engineering Assistants, Draftsmen, Foremen, Electricians, Equipment Operator, Utility Workers and Administrative Assistants.

3) Barangay Councils (BCs)

The Barangay Council manages the services and facilities related to health and social welfare services, e.g. barangay health and day care centers; hygiene and sanitation including solid waste disposal; and, the maintenance of water wells

4) Rural Health Units/Barangay Health Stations (RHU/BHS)

RHU implements programs such as: primary/maternal health care, dental, nutrition, family planning, and environmental health and sanitation. It coordinates with other government agencies and NGOs in the promotion and delivery of health services. RHUs are typically under the supervision of the Municipal Health Officer. In 1993 there were 15 rural health units and 94 barangay health stations in the province, each of which is under the direction of a rural health officer.

(3) Field Offices of Central Sector Agencies

1) DPWH District Engineering Office (DEO)

Mandate: The DEO undertakes project studies and design; implements construction (by administration), maintenance and repair works of identified projects as well as

supervises projects undertaken by contract. It also provides assistance to LGUs in their infrastructure projects.

Activities: Its present water supply activities include identification, rehabilitation and construction of projects. It also conducts drilling activities. Its present water supply projects in the province include the:

(a) Rehabilitation of Baliling Spring
(b) Rehabilitation of Atbu Spring
(c) Rehabilitation of Muta Spring
(d) Rehabilitation of Lupa Spring
(e) Construction of Alloy Spring
(f) Construction of Mankatad Spring
(g) Construction of Daruba Spring.
(h) Construction of one deepwell each in San Fernando, Baras and Bambang.

(4) Water Districts (WDs)

A water district is a local government corporation formed pursuant to Presidential Decree No. 198, organized for the purpose of serving the water supply requirements of the residents within its franchise area. Technical and financial assistance (loans) are provided by LWUA to the water districts. LWUA also exercises regulatory functions vis a vis the districts. A water district, to be self-sufficient, is operated in a business-like manner to generate enough revenues from its water sales. The income is used to meet operational expenses, debt service and reasonable reserves for contingencies.

At present, however, there are no water districts formed and operating in the province. There were attempts to form water districts in Solano and Bayombong but these were not realized due to various reasons. In lieu of this, the Provincial Waterworks Office has taken the responsibility of providing Level III service to the two municipalities.

(5) Rural Waterworks and Sanitation Associations (RWSAs)

RWSAs are organized by beneficiaries to facilitate participation in the planning, construction, operations, maintenance and management of water supply and sanitation projects. The RWSA operates and maintains the community water supply system. The members contribute at least 10% of the project cost as local equity and pay a monthly

service fee sufficient to operate, maintain and amortize the project. Most RWSAs provide Level II or III service.

In the province, there are no existing or operating RWSAs.

(6) Barangay Waterworks and Sanitation Association (BWSAs)

Republic Act 6716 mandated the construction of al least one Level I (point source) water supply system in all barangays and the formation of a BWSA to operate and maintain the system/s. The association consists of at least 50 households whose goal is to improve the health and economic well-being of its members, by improving access to safe and potable water for domestic use at a reasonable cost. It is a non-stock cooperative which manages and owns the water supply facility constructed through their own resources or with external capital development assistance.

The association is mandated 1) to operate, manage and own the water supply facility; 2) to mobilize the members' resources (financial contributions to the cooperative fund) for the construction, operation and maintenance of the system.

The organizational structure of the BWSA consists of 1) General assembly of members; 2) Board of directors; 3) Election committee; 4) Education and training committee; 5) Audit and supervisory committee and 6) Management staff.

To organize a BWSA, a community meeting is convened and the barangay leaders are informed that the barangay has been selected by the LGU for possible water supply assistance. This is usually preceded by a resolution from the barangay requesting for the assistance. A structural survey is conducted to determine whether the barangay meets the criteria for assistance. The survey also forms the basis of the feasibility study. The LGU then prepares a preliminary engineering report and feasibility study which is presented to the barangay for approval. Upon acceptance by the people, the LGU submits the annual implementation plan (AIP), together with the FS for funding allocation.

Upon approval of the AIP, the application to organize a BWSA is filed with the PPDO who forwards the application to the Director of the Cooperative Development Authority, and the BWSA is formed.

In the province, there were 17 BWSAs formed and registered although some associations are not active at present. Of the17 BWSAs, five (5) were formed through the PCHD program while the rest were organized by DPWH through RA 6716.

(7) Others (including the private sector and NGOs/CBOs).

1) Provincial Development Council (PDC)

The main function of the PDC is to formulate a long term, medium term and annual socio-economic development plan and policies as well as investment program of the province. The PDC is headed by the Governor and is composed of the following: Representative of the Congressman, Chairman of Sangguniang Panlalawigan's Committee on Appropriations; 15 municipal mayors, representatives from 13 NGOs, president of the Association of Barangay Captains, President of the Councilors League and the Sangguniang Kabataan President.

2) Private Sector

The private sector has been involved in water supply development in the form of investments, technical studies and construction of water supply and sanitation facilities. Non-government organizations (NGOs) have also demonstrated capability to undertake project development and implementation with community participation.

(a) The Nueva Vizcaya Health Coalition is the umbrella organization of all NGOs dealing with health and sanitation activities in the province. It coordinates the implementation of the Partnership for Community Health Development program.

(b) The Council for Health Concerns was established in 1990 to primarily implement community-based health development program through community organizing, education, training, networking and advocacy activities. It undertook the Parai Spring development project.

(c) The Saint Francis Mission Foundation, Inc. conducts training activities on health related issues. It has recently completed spring development projects in Sitio Tiblac and Camandag, Ambaguio.

(d) Plan International undertakes various water and health related projects. It implements various programs on community-based health care and sustainable economic development. It conducts human resource development, community

assemblies, institutional linkages and organizational development activities. Through its effort, the Upper Busilac Spring was developed.

(e) The Philippine Rural Reconstruction Movement (PRRM) has a provincial operation focusing on organization and leadership formation, livelihood enterprise development, credit assistance and primary health care program. It has undertaken the Nueva Vizcaya Community Based Water Supply System.

(f) The Medical Ambassadors of the Philippines (MAP) was organized on April 17, 1989. It implements programs on the provision of potable water supply and sanitary waste disposal, health education through the promotion of community participation. It has undertaken the Muta Spring Development project.

(g) Lubong Salakniban Movement, Inc. was founded in 1991 to undertake community organizing project monitoring and social development advocacy. It supports the sector through its environmental information management, reforestation and health education.

5.6 Project Management Policies/Activities at the Local Level

(1) Project identification and priority setting

Most projects that are being considered for funding are usually based on proposals or resolutions submitted by either the barangay or the municipality. In the past the practice of prioritization is on a first-come-first-serve-basis. At present, however, the Social Development Committee (SODCOM) is the one assessing each proposal or resolution submitted for funding. Proposals that fully comply with the requirements and set criteria are first prioritized. The requirements include complete estimate, program of works and detail plans while set criteria involve province-wide implication, urgency of the project, social impact and the number of beneficiaries. The proposals are ranked to determine priority projects.

(2) Project preparation and planning

For water supply projects, the feasibility study is done by the proponents after which it will be reviewed and evaluated by the SODCOM. Once a project is deemed feasible, the DEO will undertake its detail design which will also include, among others, specifications, quantity and cost estimates, and program of works.

(3) Procurement of goods and services and contract administration

Procurement of services like consultancy goes through bidding, especially it the service entails large amount. Bidding for construction projects is made after the detailed engineering investigation, survey and design for the project have been sufficiently carried out or in accordance with PD 1594 implementing rules and regulations. The central procurement unit is the Provincial General Services Office which prepares the bidding documents and advertisement and which acts as the PBAC secretariat. All goods and services to be procured must pass the approval of the General Services Officer. If the service or good is emergency in nature, the procurement is being negotiated. Spare parts procurement also passes the bidding process. The province purchase spare parts in bulk directly from Manila although local hardware stores can supply the necessary spare parts.

(4) Project implementation

The Provincial Engineer's Office supervises the construction of infrastructure projects including water supply and sanitation facilities. Community-based projects are usually implemented with the participation of the community which provides free labor counterpart, rehabilitation as well major and minor repairs of existing facilities

(5) Financing/budget allocation

The present source of local financing for the sector projects is the 20% Fund from the IRA of the province. There are also foreign and local donors for sector projects. General appropriations funding is generally channeled through central-level agencies although budget allocation is determined by the SODCOM. As there are no definite criteria being followed, the percentage distribution of funds being given per sector is upon the discretion of the SODCOM members which decided through a votation.

(6) Operation and maintenance

For most of the water supply projects, it is mandated that water associations be organized to handle the operation and maintenance of the facilities. All completed projects are therefore turned-over to the community through a community-based organization which shall oversee the proper operation and maintenance of the system. However, the Provincial Government receives technical assistance from the DOH and the DILG.

(7) Repairs and rehabilitation

Minor system repairs are being undertaken by the community or by the LGUs. Funds for this are shouldered by the association and are taken from its revolving funds/monthly dues. For major repairs, the association also shoulders them if funds are available and sufficient. Otherwise, the association prepares and submits a request, together with a proposal, to either municipal or provincial level for funding. The proposal undergoes the prioritization process.

5.7 External Support Agencies Active in the Sector

(1) Multilateral Agencies

The World Bank (IBRD) currently supports the First Water Supply, Sewerage and Sanitation Sector Project or FW4SP (Loan 3242PH). This project provides capital funds (US$ 58.0 M) for rural water supply in Luzon provinces and sanitation nationwide based on completed provincial master plans. The project concept calls for a community-based approach through BWSAs. The project is due to close in 1995 and preparations for a successor project, with DILG as implementing agency, will be started shortly. In addition, the Bank is preparing two new loans for LWUA implementation - the Urban Water Supply Project and the Urban Sewerage and Sanitation Project. Through its various trust fund facilities, the Bank has arranged for various technical assistance grants and other support activities.

The Asian Development Bank (ADB) supports the Second Island Provinces Project (1052-PHI-SF). The project provides US$24.0 M (loan) to a counterpart budget of Pesos 202.45 M. A small technical assistance component has been allocated for well drilling training, water quality and installation of pumps. This DWPH-executed project was effective through 1994. Both of the island provinces projects focus on technology and the physical installation of facilities. A follow-on third "islands project" is under discussion. ADB is also supporting the LWUA Municipal Water Supply Project which includes a technical assistance grant for institution building activities at LWUA and the eight (8) participating WDs.

The United Nations Development Programme (UNDP), through its Danish Trust Fund facilities, has actively supported the preparation of provincial master plans. In addition,

its Institution Building through Decentralized Implementation of Community-Managed Water and Sanitation Projects, is assisting DILG-PMO in developing models and approaches for community-based water and sanitation in selected pilot areas. The project bears a strong poverty alleviation focus. UNDP is also in the final stages of a country project to assist GOP in strengthening the groundwater databank in the country through a US$ 682,500 grant.

The United Nations Children's Fund (UNICEF) supports the sector through the Philippines Plan of Action for Children. Apart from hardware support in priority project sites, UNICEF assists NEDA in updating of the national master plan. UNICEF works through the inter-agency committee on environmental health and through NGOs. With the World Health Organization (WHO), UNICEF is assisting in the preparation of information, education and communication (IEC) materials and in strengthening the sector monitoring system.

(2) Bilateral Agencies

The Japan International Cooperation Agency (JICA) extends technical cooperation in the basic design study for the Rural Environmental Sanitation Project (Phase III). This project, to be jointly implemented by DPWH and DOH, envisages the construction of Level I and II water systems and school toilet facilities in rural areas of ten (10) provinces through grants. With DPWH, rural water supply systems are being constructed at the evacuation centers for the Pinatubo refugees. JICA also supports the groundwater development study in Cavite province (with LWUA) and the institutional development activities at MWSS. JICA is providing the services of the Study Team preparing provincial sector plans in nine (9) provinces.

The Overseas Economic Cooperation Fund (OECF) is financing the RWS IV project through 1995. It provides a loan of up to Yen 5.08 B to counterpart funds of Pesos 400 M. It envisages construction/rehabilitation of level I systems, construction of workshop buildings and procurement of various equipment. OECF is supporting the Provincial Cities Water Supply Project of LWUA and the Angat Water Supply Optimization Project of MWSS.

The Australian International Development Assistance Bureau (AIDAB) is supporting the Central Visayas Water and Sanitation Project through a A$ 14.65M grant. The project is

implemented by the LGUs and the regional development council. Project components include: planning and monitoring information systems; infrastructure planning and rehabilitation; and institution building with an emphasis on community management based on experiences from other AIDAB-funded projects. The Project has been extended through 1997.

5.8 Current Community Development and Training Approaches

5.8.1 Community Development

Most of the LGUs in the province rarely conduct community mobilization to tackle relevant issues including water and sanitation. In 1994, however, the province was included in DOH's Partnership for Community Health Development (PCHD) program aimed at undertaking health development projects thru dynamic partnership among the LGUs, NGOs and people organizations (POs). The ultimate goal of the project is to put health in the hands of the people in the continued search for alternative health care systems. The spectrum of community projects implemented under PCHD consisted of 11 project types. Installation of potable water systems and community organizing capability building were the two most common projects, followed by toilet construction, training of barangay health workers and nutrition scholars. Drainage and watershed protection were also included. The four major strategies that have been adopted by PCHD include: partnership building at the provincial, municipal and barangay level; building up the capabilities of the LGUs, NGOs and POs; enabling communities to mobilize their resources and produce sustainable quality of life; and, provision of grants or additional resources for priority communities. Program activities include: dialogues/consultation; planning proposal preparation; provincial multisectoral planning; screening and approval of proposals; implementation of community health projects and capability building; monitoring and evaluation of program implementation; and advocacy and program expansion.

Through the PCHD program, the following projects have been implemented:

(1) Construction and improvement of water system and sanitary toilet bowls in Barangay Dagupan, Quezon. A population of 625 population (137 households) benefited. Same program was implemented in Barangay Arwas, Diadi with 591 population or 119 households benefiting. Proponent: Philippine National Red Cross.

(2) Muta Spring Development, Muta, Kasibu benefiting 1,332 residents (211 households). Proponent: Medical Ambassadors of the Philippines.

(3) Camandag Spring Development, Camandag, Ambaguio benefiting Sitio Pihipi and Sitio Poblacion with 336 poppulation (56 households). Proponent: Saint Francis Mission.

(4) Kimbutan Spring Development, Kimbutan, Dupax del Sur covering the sitios of Danggi, Binayawan, Panacditan, Gunot, Kimbutan Proper, Dintog and Payo. Total number of beneficiaries: 625 (178 households). Proponent: United Church of the Philippines.

5.8.2 Human Resources Development and Training

There are training activities organized by the province but these are mostly on general management and administrative issues. The PPDO focuses its training program on development plan preparation. Budget for these activities come from the province's 20% development fund

The DOH, through its national and regional offices, conducts periodic training for its rural sanitary inspectors on environmental health program; training of food handlers and food operators on food safety. In 1994, the province sponsored participation of one inspector to the National Sanitation Course while 7 sanitary inspectors attended the regional training course.

5.8.3 Sanitation/Hygiene Education

The existing health/hygiene education program in the province is a collaborative effort of various agencies with the PHO taking the lead. The regional office as well as the provincial unit of the Philippine Information Agency support health and hygiene IEC (information, education and communication) campaign of PHO through radio spots, film showings at public places and community assemblies. Various NGOs also conduct health and hygiene education campaign through different approaches. House-to-house campaign is being undertaken by BHUs' health workers who are provided with training and information materials (stickers, posters, comics, etc) by PHO .

5.9 Existing Sector Monitoring

(1) National Level

The primary sources of sector data are the field office and staff of DPWH, DOH, LWUA, DILG and NSO. Other agencies, including NEDA and LGUs, use data from these

agencies. Each of these agencies run its own project (or activity) monitoring systems largely based on required reports of its field offices. Current reporting requirements focus on physical accomplishments and capital expenditures. One serious shortcoming is the assumption that all constructed facilities are functioning and in use.

Apart from regular project monitoring, instructions are issued to conduct inventories of facilities (with actual status). The last completed inventory was done in 1990. These surveys are done in conjunction with sector or area planning studies. Only the NSO gathers and assesses information nationwide on a regular basis as part of its Census on Population and Housing (CPH). The CPH "long form" is administered on 10% of the households once every ten years. NSO plans to increase the CPH "short form" frequency to every five years. Water and sanitation is not included in the short form.

There is wide dissatisfaction among implementors themselves over the existing monitoring system. Monitoring report preparation is seen as a nuisance to performing one's job, and is thus haphazardly done. This leads to the problem of reliability of information coming from the field. There is a need to establish a system which is perceived as having a direct link to performance, similar to project-based monitoring.

(2) Local Level

There is no particular provincial-level agency that is given the sole responsibility to monitor the water and sanitation sector activities and performance in the province, although there is a Provincial Monitoring Committee which conducts monitoring of all programs and projects being implemented by the provincial government. The PPDO and the PEO also conduct their own monitoring activities.

Most of the activities being monitored concern implementation of infrastructure projects although small projects such as construction of shallow wells and deep wells are often neglected and are limited to verifying how far targets are being accomplished. Monitoring rarely looks into the socio-economic impact of projects to the communities.

Project Monitoring Committee (PMC). For water and sanitation, the PMC utilizes accredited NGOs in monitoring sector activities. It provides list and schedule of all programs and projects to NGOs which, in turn, monitor the status of project

implementation. The committee pinpoints problems and verifies information and submit these to the Provincial Development Council for analysis and proper action. The PMC likewise prepares and disseminates periodic monitoring reports. The monitoring scheme being adopted by the committee on water and sanitation projects is as follows:

1) A monitoring plan is prepared as basis of regular monitoring activities. This contains a list of projects to be verified or validated.
2) A detailed program of work (`PoW) is secured for each project and a schedule is set for project visits/inspections.
3) Project implementors are required to submit project reports which is analyzed. Findings and recommendations are submitted to PDC or EXECOM for deliberation.
4) Upon completion of project, the PMC conducts an evaluation to determine compliance to specifications. A final certificate of acceptance shall be issued on projects found to be in order.

Provincial Planning and Development Office (PPDO). The PPDO conducts monitoring when projects are already in motion until completion. Projects that are getting negative feedback and require validation and verification are closely monitored. However, not all projects being implemented are monitored considering that the PPDO is presently undermanned. Whatever projects that the PPDO could not monitor are being passed to the Provincial Monitoring Committee (PMC) for proper evaluation. The monitoring activities of PPDO is focused on whether supplies have been delivered and implementation of the work program is on schedule. These are reflected in the reports which PPDO prepares and which are endorsed to the concerned agency for proper action.

Provincial Engineering Office (PEO). The Provincial Engineer's Office conducts ocular inspection of projects that are being implemented or that need verification due to delay. Its monitoring activities include: interview with project personnel and local residents to determine proper compliance with specifications and work schedules; determine whether any deviation is authorized or not; and, assessment of quality of works. PEO prepares and submits findings to higher authorities for proper evaluation.

Chapter 6

PAST FINANCIAL PERFORMANCE IN WATER SUPPLY AND SANITATION

6. PAST FINANCIAL PERFORMANCE IN WATER SUPPLY AND SANITATION

6.1 General

Locally funded programs and projects for the water supply and sanitation sector have been devolved from central government agencies to LGUs since 1992 according to the Local Government Code of 1991 and NEDA Board Resolution No. 4 (1994).

In order to clarify the flow and contents of funds to the sector under this transitional period and to apply for the planning of financial arrangements, this chapter sets forth: (1) past public investment to the sector by central government agencies and LGUs; (2) roles of the Internal Revenue Allotment (IRA) to the sector financing; (3) cost recovery and financial performances of the waterworks/associations; and (4) affordability of users at present.

6.2 Past Public Investment

6.2.1 Past Public Investment by the Central Government Agencies and LGUs

The recent development of the water supply and sanitation sector in the province was mainly achieved by line agencies such as DPWH, LWUA, DILG and DOH as well as the provincial government, which is shown in Table 6.2.1.

Table 6.2.1 Previous Sector Investment to the Province by Concerned Agency

Unit: 1,000 Pesos

Funding Category		1990-94				
Agency	Funds	Level I	Level II	Level III	Sewerage	Sanitation
DILG						
DPWH	Foreign Fund 1) Local Fund 2)	451 18,161				
LWUA						
DOH						3,000
Province	Provincial Government	218	644	790		158
Municipality	Municipal Government	506	1,977	598		373
Others 3)		2,462	7,356			

Sources: Each central agency and the provincial government

Notes:

1) Investment in 1990 only.
2) Investment between 1990 and 1991; Locally funded projects were devolved to LGUs since 1992.
3) ERP-DA (Earthquake Rehabilitation Program), Plan International (NGO), UNICEF and others.
4) Countryside Development Fund (CDF).

Investments for Level I facilities from the local fund of DPWH amounted to ₱ 18,161 thousand during the years 1990 and 1991, covering 91 shallow wells, 100 deep wells, 100 spring development and 76 rehabilitation works. DPWH had not provided any local funds to the sector since 1992.

DILG had no investment from 1990 to 1994. DOH accomplished 12 and 1 school toilets under the FW4SP program in 1993 and 1994, respectively. The provincial government also financed an amount of ₱ 1,810 thousand for the relevant sector in the period of 1990-1994. Also, the Earthquake Rehabilitation Program (ERP-DA), CDF, NGO, UNICEF and others provided a total of ₱ 9,288 for the sector in the same period.

According to "Philippines Water Supply Reform Study in 1993", ₱ 311 per capita was invested on water projects in Metro Manila, ₱ 200 per capita on projects in urban areas outside Metro Manila, and about ₱ 30 benefiting the rural population during 1990-1991.

In the province, it was estimated that ₱ 62 per capita was invested by only DPWH during the same period. From the fact that most of the investments were allocated to Level I water supply system in the rural areas, per capita investment of the province is larger than the national average of ₱ 30 per capita, even if the investments by other agencies and LGUs are disregarded.

6.2.2 Sources of Local Funds

According to the Local Government Code of 1991, 40% of the national internal revenue taxes of the 3rd fiscal year preceding the current year (from 1994 onwards) is allocated to LGUs nationwide, specifically to the administrative units of (1) province (23%); (2) city (23%); (3) municipality (34%); and barangay (20%). Further, respective Internal Revenue Allotments (IRA) in different administrative levels are allotted to all administrative units concerned according to the manner of calculation in terms of population, land area and other factors.

As shown in Table 6.2.2, IRA allotted to the province ranged from 0.8 to 1.0 % of the national total IRA between 1990 and 1994. On the other hand, the total IRA to all municipalities of the province was arranged with 0.8 - 0.9% to the national total IRA for nationwide municipalities (refer to Table 6.2.1, Supporting Report).

Table 6.2.2 Past Internal Revenue Allotment to the Province of Nueva Vizcaya in 1990-94

Unit: Pesos

		1990	1991	1992	1993	1994
National	I National Total of IRA					
	(a) IRA to all provinces	2,031,174,331	2,697,481,707	4,571,136,402	8,445,600,000	11,498,994,198
	(b) IRA to all municipalities *	3,054,601,475	4,046,837,742	7,127,522,550	12,484,800,000	16,325,288,074
Province	II IRA to Nueva Vizcaya Province					
	(1) Total: (2) + (3)	41,895,005	54,795,230	110,952,347	185,919,202	261,154,218
	(2) Provincial Government	16,933,890	21,780,936	45,544,748	73,053,582	115,389,048
	Percentage against (a)	(0.83)	(0.81)	(1.00)	(0.86)	(1.00)
	(3) Municipalities	24,961,115	33,014,294	65,407,599	112,865,620	145,765,170
	Percentage against (b)	(0.82)	(0.82)	(0.92)	(0.90)	(0.89)
	III Total Income of the Provincial Government	21,253,101	36,318,600	49,433,818	92,168,079	131,738,366
	Percentage of IRA	(79.68)	(59.97)	(92.13)	(79.26)	(87.60)
	IV Total Income of Municipalities	n. a.	52,057,915	79,583,943	131,670,885	173,873,142
	Percentage of IRA		(63.42)	(82.19)	(85.72)	(83.83)
Municipality	V IRA to Municipalities **					
	Total	24,961,115	33,014,294	65,407,599	112,865,620	145,765,170
		(100.0)	(100.0)	(100.0)	(100.0)	(100.0)
	1. Alfonso Castaneda	1,045,377	1,440,102	3,867,584	6,656,801	8,331,975
		(4.2)	(4.4)	(5.9)	(5.9)	(5.7)
	2. Ambaguio	790,804	1,184,568	2,990,091	5,019,821	6,392,022
		(3.2)	(3.6)	(4.6)	(4.4)	(4.4)
	3. Aritao	1,976,892	2,544,905	4,817,201	8,351,006	10,913,964
		(7.9)	(7.7)	(7.4)	(7.4)	(7.5)
	4. Bagabag	1,763,735	2,333,784	4,339,577	7,460,924	9,701,824
		(7.1)	(7.1)	(6.6)	(6.6)	(6.7)
	5. Bambang	2,412,330	3,242,970	5,827,712	10,237,915	13,249,796
		(9.7)	(9.8)	(8.9)	(9.1)	(9.1)
	6. Bayombong	2,309,451	3,040,151	5,034,351	8,746,957	11,636,212
		(9.3)	(9.2)	(7.7)	(7.7)	(8.0)
	7. Diadi	1,272,776	1,652,549	3,272,897	5,509,418	7,164,803
		(5.1)	(5.0)	(5.0)	(4.9)	(4.9)
	8. Dupax del Norte	1,778,737	2,389,800	4,931,551	8,592,703	11,010,638
		(7.1)	(7.2)	(7.5)	(7.6)	(7.6)
	9. Dupax del Sur	1,606,865	2,124,047	4,465,250	7,768,040	9,855,871
		(6.4)	(6.4)	(6.8)	(6.9)	(6.8)
	10. Kasibu	1,691,689	2,393,127	4,752,481	8,346,498	10,497,204
		(6.8)	(7.2)	(7.3)	(7.4)	(7.2)
	11. Kayapa	2,458,845	2,869,237	5,580,334	9,798,147	12,452,329
		(9.9)	(8.7)	(8.5)	(8.7)	(8.5)
	12. Quezon	1,130,622	1,498,910	3,349,089	5,566,205	7,257,979
		(4.5)	(4.5)	(5.1)	(4.9)	(5.0)
	13. Santa Fe	1,207,600	1,713,617	3,971,742	6,748,255	8,678,337
		(4.8)	(5.2)	(6.1)	(6.0)	(6.0)
	14. Solano	2,546,057	3,287,216	5,378,724	9,359,753	12,216,634
		(10.2)	(10.0)	(8.2)	(8.3)	(8.4)
	15. Villa Verde	969,335	1,299,311	2,829,015	4,703,177	6,405,582
		(3.9)	(3.9)	(4.3)	(4.2)	(4.4)

Sources:
(1) Department of Budget and Management, (2) Bureau of Local Government Finance (DOF) and (3) Provincial Annual Report
Notes:
*IRA to barangays is not included. **Figures in bracket are shares (%) in the total of all municipalities in the province.

For the provincial government, the IRA has been the most important financial source of the total revenue as experienced, with 80% of the total revenue of the provincial government in 1993. The expenditures of the provincial government for the relevant sector in 1994 were reported at ₱ 830 thousand, about 0.7% of the IRA.

As for municipality, distribution share to each municipality in the province was within a certain range between 1990 and 1994. Municipalities, which had the share of more than 8% of the provincial total in 1994, were Bambang, Bayombong, Kayapa and Solano.

6.3 Cost Recovery

The capital cost for Level I systems is free to the community, while operation and maintenance is the responsibility of the associations or barangays. As for Level II systems, the capital cost is shouldered by the RWSA through a loan or grants. Water charges collected by each association cover cost of operation and maintenance, and loan amortization. According to the Loan Department of LWUA, the new loan disbursement to RWSAs has been stopped for the last couple of years.

For Level III system, the provincial waterworks bears the capital cost by loans with concessional terms. The cost of amortizing the loan and operation and maintenance of the system is recovered through monthly water bills. On the other hand, municipal waterworks received a grant for the initial cost. Details of financial performance with cost recovery are discussed in section 6.5.

Regarding sanitation sector, construction of the superstructure and the depository of household toilet is through self-help.

6.4 Affordability

Table 6.4.1 indicates the affordability by level of sector service. At present the current water bills in the province seem to be within an affordable range based on the experiences, although actual income is different from municipality to municipality and barangay to barangay.

Table 6.4.1 Affordability in Water and Sanitation Services

Income/Level of Services	Amount (Pesos)	% to Monthly Income	Affordable Range (%) 5)
Median of Monthly Income 1)	4,007	100.0	-
Average Level III: Monthly Water Bill 2)	69	1.7	5.0 or less
Average Level II: Monthly Water Bill 3)	30 - 50	0.7 - 1.2	2.0 - 3.0
Mo. Level I Expenditures 3)	5 - 10	0.1 - 0.2	1.0 or less
Private Toilet Construction Cost - Flush Type Toilet 4)	34,900	-	-

Notes:
1) 1991 Family Income and Expenditures Survey, NSO
(Median of the provincial figure is inflated to 1994 prices.)
2) Data from PSPT. It is assumed that 23 cum will be consumed per family.
3) Common figures in the province.
4) Current prices by JICA Study Team
5) Based on the experiences mainly from LWUA, DPWH and DILG.

On the other hand, construction cost of private toilet seems to be expensive comparing with the family income. The estimated cost of flush type toilet facility is 8 times higher than the median monthly family income in the province. Therefore, subsidy from LGUs may be necessary.

6.5 Past Financial Performance of Provincial/Municipal Waterworks System and RWSAs/ BWSAs

Three (3) waterworks for Level III water supply are currently managed in the province. Table 6.5.1 and Table 6.5.2 show financial indicators and loan status of the systems in 1995, respectively. The Provincial Waterworks seems to be financially sound under the status that the revenue exceeded the total cost of the operation and maintenance and monthly amortization, although some arrears are reported. As of now, the waterworks has received loans of P 1,110 thousand.

Most of the facilities managed by RWSAs and BWSAs were constructed under grant conditions by DPWH and LGUs with the recipient providing some equity contribution in the form of materials or labor. The associations are responsible for the operation and maintenance of the systems, but financial performance of the associations tends to face difficulties partly because the beneficiaries do not recognize the cost requirements. The information from the LWUA on the registration of Level II systems revealed that there are 13

RWSAs in the province, to which a total of ₱ 3,720 thousand was invested for the construction of facilities by different central agencies.

Table 6.5.1 Financial Indicators of Provincial/Municipal Waterworks System

Waterworks System	Descriptions						
	No. of Metered Connec-tions	No. of Flat Rate Connec-tions	Average Monthly Rate	Average Consump. per Conn.	Average O&M Costs	Average Revenue	Collection Efficiency
	Nos.	Nos.	Pesos/cu.m	cu.m./mo.	Pesos/mo.	Pesos/mo.	Percent (%)
Provincial W.S.	1,392	140	2.41	27	71,264	97,306	-
Bagabag W.S.	337	337	4.00	19	10,986	13,034	92
Arwasa Inc.	389	120	6.00	12	7,267	-	98

Sources: PSPT
Note: Provincial Waterworks System covers Bayombong and Solano. Arwasa Inc. covers Aritao.

Table 6.5.2 Loan Status of Provincial/Municipal Waterworks System

Waterworks System	Descriptions			
	Total Loan Availed	Remaining Payment Period	Average Monthly Amortization	Current Arrears
	1000 Pesos	Months	Pesos	1000 Pesos
Provincial W.S.	1,100	48	2,312	110
Bagabag W.S.	(Grant)	-	-	-
Arwasa Inc.	(Grant)	-	-	-

Source: PSPT

Chapter 7

WATER SOURCE DEVELOPMENT

7. WATER SOURCE DEVELOPMENT

7.1 General

The study on water source development covers the entire province to come up with a "Groundwater Availability Map" which identifies the areas with available potable water sources. The study gives an emphasis on groundwater sources rather than surface water considering the better quality and economy of utilizing groundwater for domestic water supply.

The study has two major components: (1) interpretation of existing geological and groundwater conditions, (2) preparation of Groundwater Availability Map to show groundwater potential areas under three categories. Standard well specifications by municipality were also established as reference for the future requirement of the water supply sub-sector.

The major data used in the study were obtained from concerned agencies (NAMRIA, BMGS, NWRB, LWUA, DPWH and PPDO) and supplemented by the information gathered through questionnaires. Among the information, the Geologic Map published by then BMGS, the Water Resource Investigation Report and the Well Inventory Database of NWRB were essential for the analysis of geological characteristics, projection of high yielding area and possible area with salt water intrusion, and classification of groundwater potential areas, respectively.

The Groundwater Availability Map may be used for provincial level master plan at present. However, updating the map is a requisite to gain more information on prevailing groundwater conditions using the questionnaires prepared for the study. An annual review and updating of the database will enable the LGUs to implement water source development on a project site basis.

The database on existing groundwater sources and their conditions is summarized in Table 7.1.1 (Well data from each municipality are presented in Table 7.1.1, Water Source Information, Data Report). It shows that there are 15,077 shallow wells, 1,143 deep wells and 425 developed springs existing in the province. About 8% of these water sources is public facilities. Of the total wells, 96% remains functional at present. In addition to the above sources, 40 undeveloped springs are accounted.

Table 7.1.1 Existing Groundwater Sources in the Province

Description	Shallow Well	Deep Well	Spring	Total
1. Number of water sources	15,077	1,143	425	16,645
2. Profile of different sources	91%	7%	2%	100%
3. Owned by Government Agency	424	512	417	1,353
4. Privately owned	14,653	631	15	15,299
5. Sources with quality problem	-	-	-	-
6. Non-functional wells	231	337		568
7. Undeveloped springs			40	40
8. Untapped springs			6	6

7.2 Geology

The rock units in the province are classified into three (3) main groups based on the ages of rock formations. These are, from the oldest to youngest, the Pliocene and Older Rocks, the Pliocene to Pleistocene Rocks and the Recent Deposits. The grouping of the rocks is related to their potential as groundwater sources. The younger rocks are considered the most important to groundwater because of their high porosity and permeability relative to the older rocks. The distribution of these rock groups is shown in Figure 7.2.1, Geological Map of the Province.

(1) Pliocene and older rocks

These rocks, covering about 92% of the province, mainly underlie the mountainous terrain of Nueva Vizcaya. In the southern half of the province, the Cretaceous to Oligocene lava flows and pyroclastics with intercalation of sandstone, mudstone, tuff, and limestone are extensive. These rocks are intruded by Eocene to Oligocene diorite. On the other hand, the northern portion is largely made up of Lower to Upper Miocene conglomerate, sandstone, mudstone and limestone.

(2) Pliocene to Pleistocene rocks

The rocks belonging to this group comprised approximately 2% of the total provincial land area. They are limited in the gently sloping and low-lying hills of Villaverde, Solano, Bayombong and Alfonso Castañeda. These rocks are mainly alternating layers of semi-consolidated sandstone and mudstone.

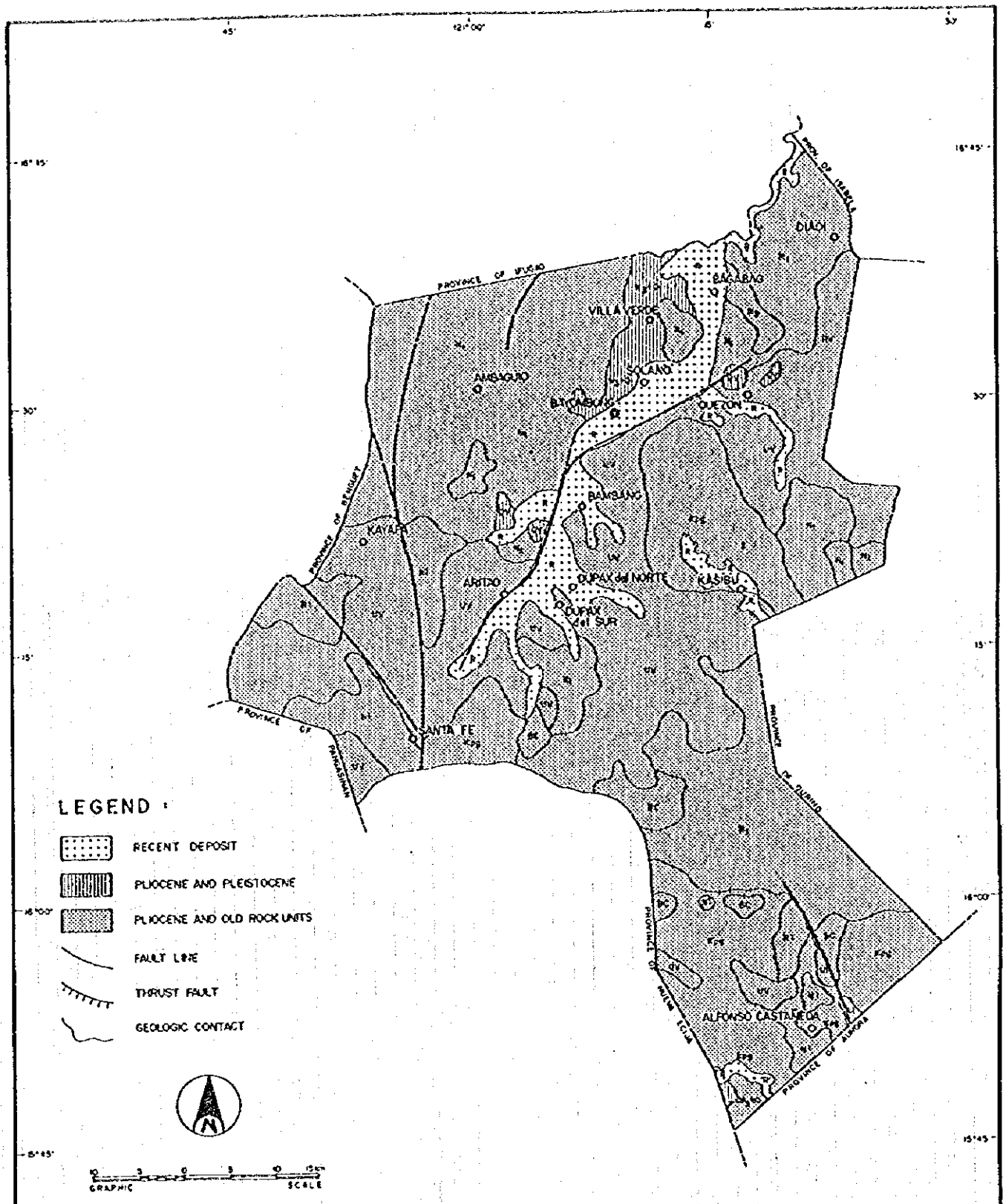


FIGURE 7.2.1
GEOLOGICAL MAP

3) Recent deposits

The Recent Deposits are widespread in the floodplains of the Magat river and its tributaries, which cover about 6% of the total land of the province. They could be found in the low lying portions of Diadi, Bagabag, Quezon, Solano, Bayombong, Bambang, Dupax del Norte, Dupax del Sur, Aritao, Santa Fe and portions of Kasibu and A. Castaneda. These deposits are made up of unconsolidated clay, silt, sand and gravel deposits with apparent thickness of more than 20m as reflected by the existing wells.

7.3 Groundwater Sources

7.3.1 Classification of Groundwater Sources

For planning purposes, the province is divided into the following groundwater categories:

(1) Shallow well areas

These are areas having water bearing rock formations extending not more than 20m in depth from the ground surface. Shallow well areas are usually located in alluvial and coastal plains where Recent unconsolidated materials overlie impervious rocks at shallow depth. The extent of completely shallow well area is limited, because most of the Recent formations are thick or deposited on the Late Pliocene to Pleistocene rocks that usually have mutiple aquifers located at greater depths.

(2) Deep well areas

In deep well areas, the aquifers are located more than 20m from the ground level. These areas could be found in portions underlain by the Pliocene to Pleistocene and Recent formations. Most of these areas have more than one aquifer occurring at various depths. Areas where shallow and deep wells could be developed are categorized as deep well areas.

(3) Difficult areas

These are areas not suitable for well. The areas under this category are largely consist of rock formations older than Pliocene in age. The groundwater availability in the aforesaid rocks is very low and is usually confined in the opened rock fractures. Springs are the common sources of water supply in these areas.

In addition to the above classification, areas potential to have high yielding aquifers and with saline water intrusion problem are also presented based on NWRB's geo-resistivity survey and results of water quality examination of some wells.

7.3.2 Groundwater Availability in the Province

The Groundwater Availability Map presented in Figure 7.3.1 shows the distribution of the three groundwater categories in the province. It also depicts areas potential for high yielding wells and with saline water intrusion. The well information, such as depth, static water level, and specific capacity; given in the figure are averages of limited data available in each municipality that were taken as reference. The major databases used in the preparation of the map were obtained from BMGS and NWRB. The methodology and procedure with respective outputs are discussed in Section 7.3, Supporting Report. Technical well information in each municipality is also presented in Table 7.6.1 of the same report.

As mentioned above, the interpretation of existing groundwater condition is based on limited data. The well parameters (depth, static water level and specific capacity) indicated in the map are anticipated to vary within a specific municipality, since the ground characteristics change with depth and direction. Particularly, the specific capacities of wells are very variable, which depend on aquifer characteristics, well type and design, and method of construction. Most of the wells in the inventory of NWRB are driven wells, which have limited intake sections that are usually not properly set in the most permeable layers. Thus, majority of these wells have low specific capacities. Bored and gravel packed wells are expected to have higher specific capacities than wells constructed using conventional methods.

(1) Shallow well areas

No shallow well area is defined in the province. The Recent alluviums, where shallow aquifers usually occur, are thick or underlain by Plio-Pleistocene and Miocene formations that have deeper aquifers. Shallow wells in the province have average depth of 13.61 meters (6.10 to 19.82m). These wells have average static water level of 4.97 mbgl (0.61 to 10.37 mbgl) and average specific capacity of 1.23 l/sec/m of drawdown (0.05 to 6.20 l/sec/m).

(2) Deep well areas

About 45% of the province is considered as deep well areas. These are located in the flat to hilly portions of Nueva Vizcaya, particularly on the northwestern half section. Based on the well data obtained, the existing deep wells in the province have an average depth of 35.25m (20.42 to 82.32m) with average static water level of 7.55 mbgl (0.91 to 21.34 mbgl) and average specific capacity of 0.62 l/sec/m of drawdown (0.03 to 3.17 l/sec/m).

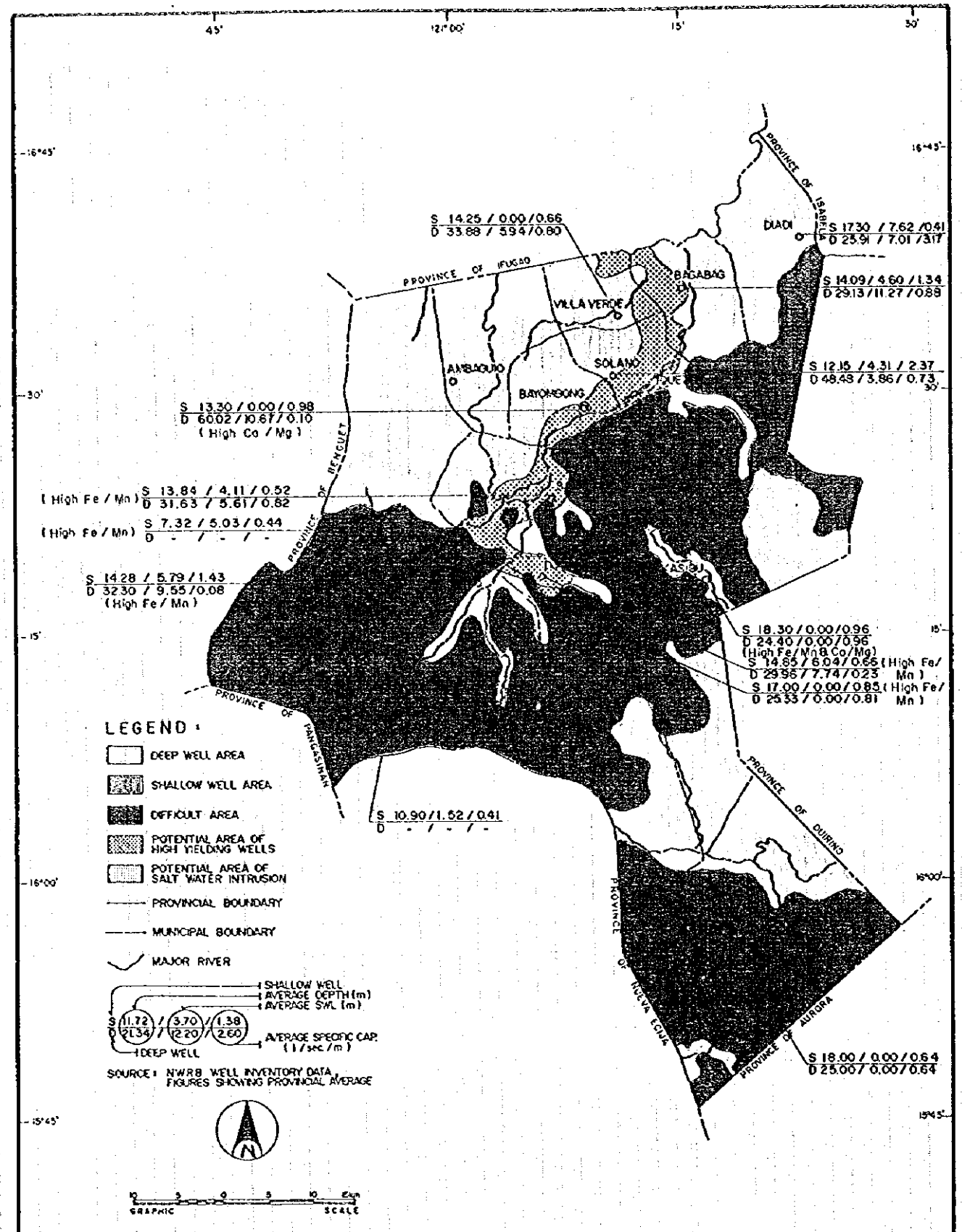


FIGURE 7.3.1

GROUNDWATER AVAILABILITY MAP

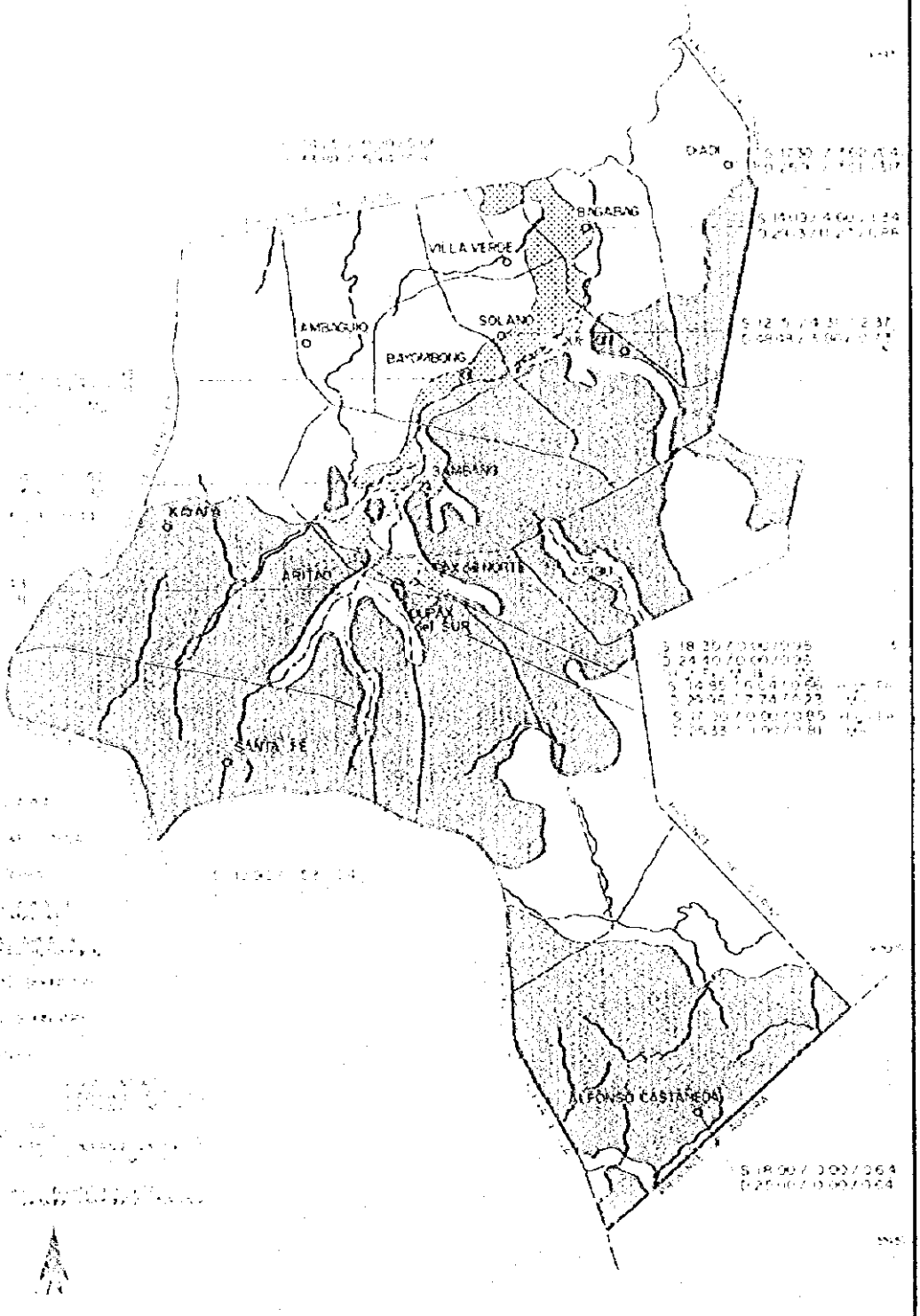


FIGURE 7.3.1

GROUNDWATER AVAILABILITY MAP

(3) Difficult areas

Since Miocene and other older rock formations are extensively distributed in the province, large portions are classified as difficult areas. These areas are located in the southern half section and cover about 55% of the total provincial area.

(4) Water quality of groundwater

The groundwater in the province is generally potable. However, connate water trapped in the fine sediments of Miocene formations may contaminate the water in the deep aquifers. In limestone areas, such as in Kasibu and Ambaguio, the groundwater is expected to be hard due to high calcium and magnesium concentrations. Groundwater in some parts of Kayapa, Bambang, Dupax del Norte, Quezon and Kasibu known to have metallic mineral deposits, are possible to contain high iron and manganese.

7.4 Spring Sources

Spring is a natural outlet of groundwater at the ground surface. It occurs when water table intersects the ground surface, usually along the contacts of pervious and impervious rock formations and through rock fractures. Because of the intense fracturing, particularly older formations, and the presence of large solution openings in limestone, secondary permeability is induced to the rocks that favors spring development.

For this study, springs are categorized into developed, undeveloped and untapped springs. A developed spring is utilized and must have sanitary protection, otherwise it is classified as undeveloped spring, which is considered as unsafe water source. An untapped spring, as the name implies, is unutilized and flowing in its natural state.

The province is dissected by several faults such as the Digdig fault, and has undergone series of folding that resulted in an intensely fractured rocks. In addition, it has fairly extensive limestone formations with numerous sinkholes that capture surface runoff. Based on the inventory of water sources made in the study, there are 425 developed springs reported in the province. These springs have discharges ranging from 0.04 to 8.00 l/sec. Likewise, a total of 40 undeveloped springs is accounted in Bagabag, Diadi, Dupax del Norte, Quezon and Villaverde. In Diadi and Dupax del Norte, six (6) untapped springs have been identified with potential yields from 0.50 to 3.00 l/sec. Technical information on springs in each municipality is presented in Table 7.4.1, Supporting Report.

7.5 Surface Water Source

Magat river is the main river draining most part of the northwestern half of Nueva Vizcaya, while Casecnan and Tubo are the prominent rivers on the southeastern half section. In addition, the Pampang river drains small portion on the southwest. Except for Pampang river, all the rivers are discharging into the Cagayan river. Magat river is the most important among the major river systems considering its relatively larger catchment area that encompasses the highly populated municipalities in the province. It has four tributaries, namely, Matuno, Sta. Cruz, Sta. Fe and Marang rivers. These rivers have average discharges ranging from 54 and 68 cu m/sec. At present, they are used for agricultural purposes.

Magat and Matuno rivers are considered potential water sources. Water quality analysis of the two rivers was conducted to determine the surface water quality in the province. The results of the analysis showed that both river waters were turbid with high iron content and Biochemical Oxygen Demand (BOD), which measures the degree of organic contamination. These levels exceeded the maximum limit for Class "A" fresh surface water (refer to 7.5 Water Quality Analysis Results, Supporting Report). Likewise, the water from Matuno river is slightly acidic, possibly caused by oxidation of base metal sulfide deposits in its basin. Both river waters will require complete treatment when use as source of domestic water supply.

7.6 Future Development Potential of Water Sources

Based on the study of existing water sources, groundwater is considered safe and more economical source for future water supply requirements of the province.

Shallow wells are the most practical source for Level I service. Considering the existing wells in the province, the potential aquifers for shallow wells occur between 8 and 20 mbgl. One disadvantage of shallow wells is the lowering of water level during dry spell that consequently reduces the discharges of the wells. Another disadvantage is the usual high susceptibility of shallow aquifers to direct infiltration of surface pollutants.

In general, deep wells have better water quality and invariable yields when developed with appropriate technology. This is because of aquifers' relatively deeper location that makes them less susceptible to surface contaminants. The usual confinement of deep aquifers resulted in rise of water level above the aquifers. Lowering of water level does not affect the saturated thickness, therefore, deep well discharges remain constant. In the Recent alluvium

of the valley flats, Pliocene to Pleistocene rocks and probably in the upper fractured zones of older rocks, good aquifers occur from 21 to 30 mbgl. However, based on the results of georesistivity survey of NWRB, the potential aquifers in the Recent to Pliocene rocks could extend up to 200 mbgl.

Additional wells can still be developed to meet the future water supply demand of the province. Prior to any well development, a detailed groundwater resource study must be considered for its optimum utilization. For planning purpose, standard well specifications for each of the municipality were prepared as presented in Table 7.6.3, Supporting Report. The parameters such as well depth, static water level and specific capacity provided in the specifications were estimated from the available data gathered for the study.

The identified untapped springs can be developed as supplemental/alternative sources for wells. These are the most reliable water sources in areas considered difficult for well development, particularly in the southern section of Nueva Vizcaya. Prior to spring development, supplementary study must also be conducted to determine the effect of seasonal fluctuation of discharge and water quality.

Chapter 8

FUTURE REQUIREMENTS IN WATER SUPPLY AND SANITATION IMPROVEMENT

8. FUTURE REQUIREMENTS IN WATER SUPPLY AND SANITATION IMPROVEMENT

8.1 General

Phased investments for provincial sector development are planned in the same manner as adopted in the National Sector Master Plan (NSMP); Medium-Term Investment covering the years 1996 to 2000 and Long-Term Development covering the period 2001 to 2010.

Targets of provincial service coverage for the two phases are established as percentages of beneficiaries or utilities to be served by sub-sector. Service coverage in the base year (1995) and national sector targets indicated in the NSMP and the Medium-Term Philippine Development Plan (MTPDP) are the bases of the study. Sector targets which are not prescribed in the national plan; school and public toilets as well as sewerage are assumed based on the current conditions. In addition, preliminary discussions on solid waste management are included as a vital component of sanitation sector.

Projection of frame values by municipality is undertaken for respective sub-sectors; future population by urban and rural area, the number of student enrollment to public schools and the number of public utilities. Reference base figures for the study of framework are the 1990 Census of Population and Housing and the statistical data of the province and information from relevant agencies. Provincial population by target year is projected referring to the manner of declining growth rates of regional population projected by NSO, while the base year population (1995) is estimated in application of the 1980-1990 growth rates by municipality (broken down to urban and rural area). The population distribution to urban and rural areas prepared by NSO in 1990 is modified to meet actual conditions in the classification of the areas.

Types of required facilities and their implementation criteria according to service level standards are referred to the said Master Plan. Some planning conditions and assumptions not prescribed in the national plan are conferred to the relevant standards of sector agencies and provincial government. For sewerage requirements, the deficit in sanitation must first be addressed. Partial upgrading of on-site disposal to a sewerage system (off-site disposal) is envisaged in the final target year.

In estimating future requirements by municipality, additional population (or number of students/public utilities) to be served by sub-sector is first calculated as a shortfall at target years in comparison between target and base year service coverage. In this regard, planned/on-

going projects to be completed by 1995 are considered as part of base year service coverage. Required number of facilities by sector component is then estimated corresponding to the said additional population (or number of students/public utilities) to be served. Rehabilitation work for Level I facilities limited to new deep wells to be constructed under PW4SP is taken into account. Generally, rehabilitation of deep wells and shallow wells constructed by means of conventional method is difficult.

Logistic support is considered as a minimum requirement of LGUs for community development and training, and other relevant activities along with the implementation of PW4SP. The types and number of well drilling/rehabilitation equipment and supporting vehicle for Level I facilities are also suggested as reference information.

Project priority for medium-term development is discussed entailing general criteria to identify specific projects. However, at the provincial level master plan, municipal priority ranking is rather suggested to be used for allocation of provincial fund.

8.2 Targets of Provincial Sector Plan

Provincial sector targets for the year 2000 and 2010 are determined as the provincial average of the desirable minimum level for each sub-sector. Table 8.2.1 summarizes the target percentages to be served by sub-sector. Details by sub-sector are discussed in this sub-section.

(1) Water supply

The base year service coverage was calculated as a total of those in 1995 and expected by planned/on-going projects scheduled to be completed by the end of 1995. Table 8.2.2 shows service coverage for the planning purpose (details are referred to Supporting Report).

The base year service coverage in urban area (86%) is exceeding the MTPDP sector target (71%) for the year 2000, while rural area (58%) is far behind the sector target of 85%. As identified in Chapter 4, the lower service coverage in rural area is caused by the presence of a large number of unsafe sources/facilities and/or no provision of water supply facilities.

Considering the existing conditions, water supply sector targets were determined by urban and rural area. Phase I development shall be focused on the bottom up of rural water supply to 85% of MTPDP sector target, while in urban area, 90% is adopted for

Table 8.2.1 Provincial Sector Targets

Sub-Sectors		Phase I (1996-2000)		Phase II (2001-2010)	
Water Supply		Population Coverage (%)	Additional Population to be Served	Population Coverage (%)	Additional Population to be Served
Urban Water Supply		90	13,902	95	100,269
Rural Water Supply		85	81,766	95	57,357
Sanitation		Households Coverage (%)	Additional Households to be Served	Households Coverage (%)	Additional Households to be Served
Household Toilets		87	17,197	94	42,763
Urban	Flush	10	1,261	50	14,009
	Pour Flush	90	1,608	50	0
	VIP	0	0	0	0
Rural	Flush	5	318	20	395
	Pour Flush	85	12,751	80	28,359
	VIP	10	1,259	0	0
School Toilet		Coverage (%)	Additional Public School Students to be Served	Coverage (%)	Additional Public School Students to be Served
		70	14,717	90	24,096
Public Toilet		Coverage (%)	Additional Public Utilities with Sanitary Toilets	Coverage (%)	Additional Public Utilities with Sanitary Toilets
		80	12	100	11
Sewerage		Not Applicable		Coverage (%)	Population to be Served
				50	57,039
Solid Waste		Coverage (%)	Additional Households to be Served	Not Applicable	
		50	5,317		

Table 8.2.2 Base Year Service Coverage of Water Supply

Municipalities	Type	Population 1995	Population Served by 1995 Facilities				
			Level III	Level II	Level I	Total	% Coverage
Alfonso Castañeda	Urban	0	0	0	0	0	0
	Rural	4,344	0	1,890	593	2,483	57
	Total	4,344	0	1,890	593	2,483	57
Ambaguio	Urban	0	0	0	0	0	0
	Rural	9,923	0	991	717	1,708	17
	Total	9,923	0	991	717	1,708	17
Aritao	Urban	11,204	1,626	0	8,350	9,976	89
	Rural	16,964	708	4,183	7,230	12,121	71
	Total	28,168	2,334	4,183	15,580	22,097	78
Bagabag	Urban	14,942	2,035	0	11,015	13,050	87
	Rural	14,310	0	954	10,433	11,387	80
	Total	29,252	2,035	954	21,448	24,437	84
Bambang	Urban	13,190	0	0	10,934	10,934	83
	Rural	24,974	0	1,258	18,375	19,633	79
	Total	38,164	0	1,258	29,309	30,567	80
Bayombong (Capital)	Urban	25,140	6,599	275	15,143	22,017	88
	Rural	19,643	2,268	103	14,598	16,969	86
	Total	44,783	8,867	378	29,741	38,986	87
Diadi	Urban	1,931	0	0	1,718	1,718	89
	Rural	11,107	0	450	5,858	6,308	57
	Total	13,038	0	450	7,576	8,026	62
Dupax del Norte	Urban	6,084	0	1,250	3,596	4,846	80
	Rural	17,316	0	2,996	4,406	7,402	43
	Total	23,400	0	4,246	8,002	12,248	52
Dupax del Sur	Urban	3,423	0	0	2,897	2,897	85
	Rural	10,505	0	1,407	2,177	3,584	34
	Total	13,928	0	1,407	5,074	6,481	47
Kasibu	Urban	0	0	0	0	0	0
	Rural	25,581	0	1,377	3,414	4,791	19
	Total	25,581	0	1,377	3,414	4,791	19
Kayapa	Urban	744	0	667	0	667	90
	Rural	20,119	0	7,319	4,745	12,064	60
	Total	20,863	0	7,986	4,745	12,731	61
Quezon	Urban	0	0	0	0	0	0
	Rural	13,681	0	92	5,024	5,116	37
	Total	13,681	0	92	5,024	5,116	37
Santa Fe	Urban	1,366	0	0	1,040	1,040	76
	Rural	11,216	0	4,235	1,201	5,436	48
	Total	12,582	0	4,235	2,241	6,476	51
Solano	Urban	27,494	4,970	100	18,598	23,668	86
	Rural	21,282	0	558	16,343	16,901	79
	Total	48,776	4,970	658	34,941	40,569	83
Villaverde	Urban	4,300	0	0	3,556	3,556	83
	Rural	11,064	0	239	8,143	8,382	76
	Total	15,364	0	239	11,699	11,938	78
Provincial Total	Urban	109,818	15,230	2,292	76,847	94,369	86
	Rural	232,029	2,976	28,052	103,257	134,285	58
	Total	341,847	18,206	30,344	180,104	228,654	67

furtherance of service coverage. Phase II targets are planned to increase both urban and rural water supply coverage to 95% as envisaged in the NSMP or higher level.

(2) Sanitation

1) Household toilets

As with water supply, the base year service coverage is calculated as shown in Table 8.2.3 reflecting any planned or on-going projects scheduled to be completed by 1995 (details are referred to Supporting Report).

The province has a base year service coverage of 73%, which is below the current national average coverage of 77%. Urban area registers a level of 87% that is well above the national average coverage. Rural area however, has only 67% considering the numerous unsanitary facilities. By type of sanitary toilet facility, the existing percentage composition to total households is as follows:

Type	Urban (%)	Rural (%)
Flush	4	1
Pour-flush	90	84
VIP latrine	6	15

To lessen the gap of the service coverage between the urban and rural area and to attain an equitable distribution of this basic facility, the same target is applied to both areas. Provincial target of Phase I for household toilets is planned to be 87%, which is the current service coverage in urban area. For Phase II, 94% as set by the NSMP is adopted.

The existing composition of the 3 facility types serves as an indicator in the distribution for Phase I, while for Phase II, VIP latrine is phased-out.

2) School toilets

The base year service coverage of public school students is shown in Table 8.2.4 counting expected coverage of any planned or on-going projects scheduled to be completed by 1995 (details are referred to Supporting Report).

Base year service coverage is 55% applying the standard number of public school students to be served by one (1) unit of toilet facility. The low level is due to a large number of unsanitary or absence of facilities.

Table 8.2.3 Base Year Service Coverage of Household Toilets

Municipality	Area	1995		Households and Population Using Sanitary Toilets								
		Population	No. of HHs	Number of Households				Served Population	Coverage (%)			
				Flush	Pour Flush	VIP Latrine	Total		Flush	Pour Flush	VIP Latrine	Total
Alfonso Castañeda	Urban	0	0	0	0	0	0	0	0	0	0	0
	Rural	4,344	822	0	361	137	498	2,650	0	44	17	61
	Total	4,344	822	0	361	137	498	2,650	0	44	17	61
Ambaguio	Urban	0	0	0	0	0	0	0	0	0	0	0
	Rural	9,923	1,773	0	227	541	768	4,267	0	13	31	43
	Total	9,923	1,773	0	227	541	768	4,267	0	13	31	43
Aritao	Urban	11,204	2,164	50	1,678	0	1,728	8,963	2	78	0	80
	Rural	16,964	3,287	5	2,250	0	2,255	11,705	0	68	0	69
	Total	28,168	5,451	55	3,928	0	3,983	20,668	1	72	0	73
Bagabag	Urban	14,942	2,799	58	2,249	264	2,571	13,747	2	80	9	92
	Rural	14,310	2,816	0	1,985	192	2,177	11,019	0	70	7	77
	Total	29,252	5,615	58	4,234	456	4,748	24,766	1	75	8	85
Bambang	Urban	13,190	2,623	58	2,129	0	2,187	10,948	2	81	0	83
	Rural	24,974	4,944	14	3,424	358	3,796	19,230	0	69	7	77
	Total	38,164	7,567	72	5,553	358	5,983	30,178	1	73	5	79
Bayombong (Capital)	Urban	25,140	4,522	153	3,832	24	4,009	22,375	3	85	1	89
	Rural	19,643	4,511	26	2,616	143	2,785	12,179	1	58	3	62
	Total	44,783	9,033	179	6,448	167	6,794	34,554	2	71	2	75
Diadi	Urban	1,931	366	0	144	117	261	1,371	0	39	32	71
	Rural	11,107	2,144	0	837	333	1,170	6,109	0	39	16	55
	Total	13,038	2,510	0	981	450	1,431	7,480	0	39	18	57
Dupax del Norte	Urban	6,084	1,184	0	1,097	0	1,097	5,658	0	93	0	93
	Rural	17,316	3,374	0	3,050	0	3,050	15,584	0	90	0	90
	Total	23,400	4,558	0	4,147	0	4,147	21,242	0	91	0	91

Table 8.2.3 Base Year Service Coverage of Household Toilets (Cont'd.)

Municipality	Area	1995		Households and Population Using Sanitary Toilets								
		Population	No. of HHs	Number of Households				Served Population	Coverage (%)			
				Flush	Pour Flush	VIP Latrine	Total		Flush	Pour Flush	VIP Latrine	Total
Dupax del Sur	Urban	3,423	632	6	622	0	628	3,389	1	98	0	99
	Rural	10,505	1,942	0	892	85	977	5,253	0	46	4	50
	Total	13,928	2,574	6	1,514	85	1,605	8,642	0	59	3	62
Kasibu	Urban	0	0	0	0	0	0	0	0	0	0	0
	Rural	25,581	4,956	0	2,261	663	2,924	15,093	0	46	13	59
	Total	25,581	4,956	0	2,261	663	2,924	15,093	0	46	13	59
Kayapa	Urban	744	139	4	135	0	139	744	3	97	0	100
	Rural	20,119	3,757	2	1,335	387	1,724	9,255	0	36	10	46
	Total	20,863	3,896	6	1,470	387	1,863	9,999	0	38	10	48
Quezon	Urban	0	0	0	0	0	0	0	0	0	0	0
	Rural	13,681	2,699	0	1,308	707	2,015	10,261	0	48	26	75
	Total	13,681	2,699	0	1,308	707	2,015	10,261	0	48	26	75
Santa Fe	Urban	1,366	239	25	155	8	188	1,079	10	65	3	79
	Rural	11,216	2,161	0	937	190	1,127	5,832	0	43	9	52
	Total	12,582	2,400	25	1,092	198	1,315	6,911	1	46	8	55
Solano	Urban	27,494	5,539	358	3,838	646	4,842	23,920	6	69	12	87
	Rural	21,282	4,240	7	3,416	364	3,787	18,941	0	81	9	89
	Total	48,776	9,779	365	7,254	1,010	8,629	42,861	4	74	10	88
Villaverde	Urban	4,300	778	25	650	0	675	3,741	3	84	0	87
	Rural	11,064	2,080	14	979	480	1,473	7,855	1	47	23	71
	Total	15,364	2,858	39	1,629	480	2,148	11,596	1	57	17	75
Provincial Total	Urban	109,818	20,985	737	16,529	1,059	18,325	95,935	4	79	5	87
	Rural	232,029	45,506	68	25,878	4,580	30,526	155,233	0	57	10	67
	Total	341,847	66,491	805	42,407	5,639	48,851	251,168	1	64	8	73

Table 8.2.4 Base Year Service Coverage of Public School Toilets and Public Toilets

Municipality	Public Schools Toilets			Public Toilets		
	1995 Total No. of Public Schools Students	Std. No. of Public School Students that can be Served by Base Year (1995) Sanitary Toilets	Coverage (%)	Number of PU with Toilets in 1995	Number of PU in Base Year (1995)	Coverage (%)
Alfonso Castaneda	1,003	550	55	1	1	100
Ambaguio	994	0	0	1	0	0
Aritao	4,460	3,750	84	1	1	100
Bagabag	4,728	4,728	100	2	2	100
Bambang	8,625	6,200	72	2	1	50
Bayombong (Capital)	8,970	3,950	44	2	1	50
Diadi	3,598	2,400	67	1	1	100
Dupax del Norte	4,899	1,400	29	3	1	33
Dupax del Sur	2,351	600	26	1	1	100
Kasibu	4,757	500	11	1	1	100
Kayapa	3,599	1,950	54	4	1	25
Quezon	2,868	2,500	87	0	0	0
Santa Fe	2,511	1,300	52	5	1	20
Solano	8,692	4,150	48	2	2	100
Villaverde	3,242	1,800	56	1	0	0
Provincial Total	65,297	35,778	55	27	14	52

Note: PU - Public Utilities

In the absence of national targets for school toilets, the existing level of service coverage is the base in setting up the targets. It is expected that all new construction of schoolbuildings will entail sanitary toilets enabling the coverage to increase on a high level. For Phase I and II, 70% and 90% are set, respectively.

3) Public toilets

The base year service coverage considering expected additional coverage by 1995 is shown in Table 8.2.4 (details are referred to Supporting Report).

Only 52% of the existing public utilities is served with at least one sanitary toilets. This can be attributed by the fact that majority of the public utilities (mostly public markets) are not provided with sanitary toilet facilities.

In setting up the targets without national targets as of now, the indicator would be the existing level of coverage. Accordingly, an 80% coverage for Phase I and a 100% coverage for Phase II are assumed.

(3) Sewerage

Given the non-existence of sewerage systems in any municipality at the present time, this plan does not consider the service during Phase I. For Phase II, a target of 50% coverage was applied to urban population of municipalities with more than 10,000 urban population provided by Level III water supply systems.

(4) Solid waste

The municipal level data in 1995 on the number of households served by the municipal refuse collection revealed that the current practice is concentrated to urban areas. The base year service coverage for urban area by municipality is reflected in Table 8.2.5.

About 11% of the total households in the province relied on municipal refuse collection using trucks or a 35% urban household coverage. These municipalities have a total of 11 units of collection truck.

No national targets have yet been set. However, considering the present level of coverage, a 50% urban household coverage is applied for the medium-term period (2000).

Table 8.2.5 Base Year Service Coverage of Municipal Solid Waste System in 1995

Municipality	Total No. of Households	No. of Urban Households	No. of House-hold Served	Coverage of Households (%)	Coverage of Urban HHs (%)
Alfonso Castañeda	822	0	0	0	0
Ambaguio	1,773	0	0	0	0
Aritao	5,451	2,146	490	9	23
Bagabag	5,615	2,799	115	2	4
Bambang	7,567	2,623	823	11	31
Bayombong (Capital)	9,033	4,522	1,126	12	25
Diadi	2,510	366	0	0	0
Dupax del Norte	4,558	1,184	247	5	21
Dupax del Sur	2,574	632	452	18	72
Kasibu	4,956	0	0	0	0
Kayapa	3,896	139	0	0	0
Quezon	2,699	0	0	0	0
Santa Fe	2,400	239	0	0	0
Solano	9,779	5,539	4,035	41	73
Villaverde	2,858	778	0	0	0
Provincial Total	66,491	20,985	7,188	11	35

8.3 Projection of Frame Values

8.3.1 Population Projection

Future population for all municipalities by urban and rural area was projected for the target years of 2000 and 2010 together with the present population in 1995 as a planning base year.

The NSO projection at provincial and municipal levels was not available during the time of study. The future population was therefore projected in the following manner (details are included in the Supporting Report). Reference information/data used for the study are:

- Population census data of 1980 and 1990 on different administrative levels,
- Annual population growth rates for future regional population projected by NSO, and
- The 1992 Philippine Yearbook.

The past population development at different administrative levels was first reviewed to come up with the demographic characteristics of the region and province. Through review of NSO regional population projection and the 1992 Philippine Yearbook, the behavior of population development through the future was analyzed. Referring to these demographic study, population projection of the province by target year was carried out in assumption of declining annual growth rates employing a simple compounded formula $(1+r)^n$. Present population in 1995 was also estimated in the same manner. Major study results are presented as follows:

(1) Review of past population development in the province and population distribution in 1990 to urban and rural areas.

The past population development during the census period from 1980 to 1990 revealed that:

- The province recorded 2.2% of average annual growth rate, almost the same as the regional rate at 2.0%, as a conservative growth, and
- Percentage of provincial population to the regional population slightly increased from 12.6% in 1980 to 12.9% in 1990 caused by the increase of rural population, although urban population percentage adversely decreased.

(2) Review of the NSO regional population projection in view of annual growth rates (base year 1990) and the demographic conditions presented in the 1992 Philippine Yearbook.

Annual growth rates of regional population projected by NSO were analyzed using simplified formula. The conservative growth rates were calculated reflecting demographic characteristics of moderate decline of fertility and mortality described in the 1992 Philippine Yearbook. Future behaviors of provincial population are assumed to follow more or less the same as those of regional ones, unless specific development takes place in the province.

(3) Estimation of present provincial population (1995) applying 1980-1990 average annual growth rate of respective municipalities (further broken down to urban and rural areas) assuming that the behaviors of past population development prevailed up to the present.

(4) Projection of provincial population by target year:

- The manner of discount in annual growth rates of regional population for the target years was applied for provincial population projection.
- Population in 2000 was projected from the base year 1995 applying the annual growth rate of 1.82% (17.4% discount of the growth rate of the province observed during the last census decade, 1980-1990).
- Population in 2010 with the base year of 2000 was projected applying the annual growth rate of 1.24% (31.9% discount of the growth rate of province adopted from 1996 to 2000).
- Present profile of population distribution both in urban and rural areas is assumed to prevail through the future.

Population by target year and the year 1995 is presented in Table 8.3.1 covering all municipalities broken down to urban and rural areas. Number of households by target year was also studied and included in Table 8.3.5, Supporting Report.

Table 8.3.1 Future Population by Urban and Rural Area by Municipality

Municipality	1990			1995			2000			2010		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Alfonso Castaneda	0	3,751	3,751	0	4,344	4,344	0	4,759	4,759	0	5,388	5,388
Ambaguio	0	7,241	7,241	0	9,923	9,923	0	10,870	10,870	0	12,308	12,308
Aritao	10,303	15,639	25,942	11,204	16,964	28,168	12,274	18,583	30,857	13,897	21,041	34,938
Bagabag	12,470	13,558	26,028	14,942	14,310	29,252	16,368	15,676	32,044	18,533	17,749	36,282
Bambang	11,833	21,830	33,663	13,190	24,974	38,164	14,449	27,358	41,807	16,360	30,977	47,337
Bayombong (Capital)	23,721	16,165	39,886	25,140	19,643	44,783	27,540	21,518	49,058	31,184	24,365	55,549
Diadi	1,648	9,703	11,351	1,931	11,107	13,038	2,115	12,167	14,282	2,395	13,776	16,171
Dupax del Norte	5,749	15,155	20,904	6,084	17,316	23,400	6,665	18,968	25,633	7,546	21,477	29,023
Dupax del Sur	3,234	9,063	12,297	3,423	10,505	13,928	3,750	11,507	15,257	4,246	13,029	17,275
Kasibu	0	21,425	21,425	0	25,581	25,581	0	28,023	28,023	0	31,730	31,730
Kayapa	667	18,018	18,685	744	20,119	20,863	815	22,039	22,854	923	24,954	25,877
Quezon	0	12,206	12,206	0	13,681	13,681	0	14,987	14,987	0	16,969	16,969
Santa Fe	1,298	8,662	9,960	1,366	11,216	12,582	1,496	12,287	13,783	1,694	13,912	15,606
Solano	26,096	18,150	44,246	27,494	21,282	48,776	30,118	23,314	53,432	34,101	26,398	60,499
Villaverde	3,757	9,837	13,594	4,300	11,064	15,364	4,710	12,120	16,830	5,333	13,723	19,056
Provincial Total	100,776	200,403	301,179	109,818	232,029	341,847	120,300	254,176	374,476	136,212	287,796	424,008

8.3.2 School Enrollment Projection

From the 1995 total population of the province, the number of children who would be enrolling in elementary and high school levels for all municipalities is derived.

School age population is extrapolated from the NSO age group classification of 5-9, 10-14 and 15-19 years old bracket by municipality. The age group for the elementary level is from 7 to 13 years, while that for the high school level is from 14 to 17 years. The percentages of school age population for the target years are based on the existing composition or structure of the 1990 population.

From the school age population, the number of children who would attend either private or public school, by target year is computed using the projected participation rate. The participation rate by target year varies depending on the socio-economic condition of the province. Generally, an improved economy will result to a higher participation rate. For the province, an increase in the participation rate in both private and public schools is foreseen by year 2010.

The number of public school students by target year is then derived from the projected number of children who will attend school. A participation rate for public school enrollment is established based on the existing participation rate of public school students to the total school age population. Based on DECS projection, a slight decrease of 2% from the 1995 rate is foreseen in 2000 and an increase of 4% from the 2000 rate in 2010 (details are referred to Table 8.3.6, Supporting Report).

Table 8.3.2 shows the projected number of public school students by municipality, by target year. A total of 69,594 and 80,901 public school students is estimated to enroll for years 2000 and 2010, respectively.

Table 8.3.2 Projected Public School Enrollment and Number of Public Utilities by Municipality

Municipality	Number of Public School Students			No. of Public Utilities		
	1995	2000	2010	1995	2000	2010
Alfonso Castaneda	1,003	1,046	1,203	1	1	2
Ambaguio	994	878	850	1	1	1
Aritao	4,460	4,963	6,082	1	1	1
Bagabag	4,728	5,092	5,963	2	2	2
Bambang	8,625	9,204	10,812	2	2	3
Bayombong (Capital)	8,970	9,615	11,376	2	2	3
Diadi	3,598	3,779	3,872	1	1	1
Dupax del Norte	4,899	5,290	6,329	3	3	3
Dupax del Sur	2,351	2,498	2,964	1	1	1
Kasibu	4,757	4,846	5,399	1	1	2
Kayapa	3,599	3,903	4,632	4	4	5
Quezon	2,868	3,088	3,289	0	0	1
Santa Fe	2,511	2,401	2,505	5	5	5
Solano	8,692	9,515	11,513	2	3	6
Villaverde	3,242	3,476	4,112	1	1	1
Provincial Total	65,297	69,594	80,901	27	28	37

8.3.3 Projection of the Number of Public Utilities

The number of public utilities (limited to public markets and bus/jeepney terminals) by target year is projected in urban areas for all municipalities. The provincial physical framework plan and the hierarchy of urban settlements study serve as references in the projection. Bus or jeepney terminals are considered in major transport routes of the province.

Only one (1) bus terminal is planned to be constructed by year 2000, and another nine (9) by the year 2010. Refer to Table 8.3.2 for the number of public utilities by municipality by target year (details are referred to Supporting Report).

8.3.4 Planning Area and its Projected Population for Sewerage

Urban areas with more than 10,000 population provided by Level III water supply systems in 2010 serve as the planning area. Population in the area is considered as the potential population to be served.

Only five (5) municipalities with a total urban population of 114,075 are considered (refer to Table 8.5.5).

8.3.5 Number of Households to be Served by Municipal Solid Waste Collection System

The number of urban households in 2000 is the potential households for the planning (refer to Table 8.3.5, Supporting Report).

8.4 Types of Facilities and Implementation Criteria

In principle, types of facilities and their implementation criteria as prescribed in the NSMP are adopted to this PW4SP.

8.4.1 Water Supply

The following are major conditions and assumptions applied to urban and rural water supply, which are intended as a guide for the implementation of sector projects.

(1) Urban water supply

1) Service level

It shall be noted that a national policy for urban water supply is a Level III system in general as the most suitable measure. Therefore, for the investment needs of the sector development, it is assumed in this PW4SP that underserved and/or unserved urban population at present and in the future will be provided with individual house connections. However, it does not intend to exclude Level I and II facilities from being implemented in urban area in the future as individual cases.

2) Utilization of existing facilities

The existing Level I and II facilities are considered to be utilized during the Phase I period. However, the population served by these facilities are assumed to be absorbed by Level III service in Phase II.

3) Water source

Majority of existing Level III systems are utilizing deep wells in view of economy and easy O&M. In this context, priority is given to deep wells wherever applicable.

The groundwater productivity was assumed based on the study results of water sources in Chapter 7 and presented in Table 8.4.1.

Table 8.4.1 Groundwater Productivity

Municipality	Specific Capacity (liter/sec/m)	Well Depth (meter)	Groundwater Productivity per Deep Well (cu. m/16 hr)
Alfonso Castaneda	0.00	0	0
Ambaguio	1.00	70	576
Aritao	2.50	30	1,440
Bagabag	2.50	30	1,440
Bambang	2.50	30	1,440
Bayombong (Capital)	2.50	70	1,440
Diadi	2.50	30	1,440
Dupax del Norte	2.50	30	1,440
Dupax del Sur	2.50	30	1,440
Kasibu	1.50	30	864
Kayapa	1.00	30	576
Quezon	2.50	30	1,440
Santa Fe	2.50	30	1,440
Solano	2.50	30	1,440
Villaverde	2.50	50	1,440

4) Number of systems

In principle, one (1) Level III system is considered for urban area of every municipality. When any Level III system exists, the future requirements are considered as an expansion of the existing system, otherwise a new system was considered.

In addition to the above, any rural barangay/s being served by the existing urban Level III system are considered to be continued throughout the future. A merged Level III system covering more than two municipalities is also considered, if technical and economic conditions are being met.

5) Rehabilitation

Rehabilitation of existing and future facilities is assumed to be undertaken by the operating bodies.

(2) Rural water supply

1) Service level

The Level I systems are generally planned for rural areas where houses are scattered (deep and/or shallow wells). Spring development is excluded from the Level I planning in view of cost effectiveness. Level II systems are considered where houses are clustered and suitable untapped spring is available.

Service level standards are setforth as 15 households per source for Level I and 5 households per communal faucet for Level II, as defined in the national plan.

Application of Level III systems in rural areas may be considered in a case to case basis in actual implementation.

2) Utilization of existing facilities

The existing facilities/systems in all service levels were considered to be utilized throughout the future.

3) Water source

For Level I facilities, deep well construction is given priority wherever applicable in view of safety against possible contamination and stable water supply. Standard specifications of shallow and deep wells are summarized in Table 8.4.2 based on the water source evaluation results presented in Chapter 7. Conventional construction method (driven well) may be employed under the favorable substrata or hydrogeological conditions. The standard structure of wells in application of "open-hole drilling and gravel pack" is presented in Figure 8.4.1, Supporting Report.

Table 8.4.2 Standard Specifications of Level I Wells

Specification	Shallow Well	Deep Well
Construction Method	Open-hole drilling and gravel pack	
Casing Diameter	50 mm	100 mm
Borehole Diameter	150mm	200 mm
Ranges of Well Depth	Standard Depth	
0 - 20 m	20 m	N.A.
21 - 40 m	N.A.	30 m
41 - 60 m	N.A.	50 m
61 - 80 m	N.A.	70 m

For Level II systems, only untapped springs suitable for water supply purpose are considered. Identified untapped springs are presented in Table 7.4.1, Supporting Report.

4) Number of systems/facilities

Number of Level I wells is estimated based on the service level standard; while, the number of springs coincides with the number of Level II systems.

5) Rehabilitation

Rehabilitation of existing Level I wells is not considered, since most of the existing wells constructed by driving method are not suitable for rehabilitation to recover their functions. However, minor repair work for handpump and concrete apron is a requisite.

8.4.2 Sanitation

The conditions and assumptions are established for the different sanitation components to serve as guides in the implementation of projects.

(1) Household toilets

Three types of sanitary toilet facilities for individual houses are considered for Phase I; flush, pour-flush and VIP. While for Phase II, flush and pour-flush are planned considering the improvement of living standard.

The type of toilet facilities is dependent on the existing or planned service level of water supply in the community. In urban and rural areas with Level I or II water supply facilities, only pour-flush and/or VIP are considered, while in urban areas with Level III water supply systems, flush type toilets requiring a piped water connection are included.

(2) School toilets

Standard service level currently used by DECS (50 students per unit facility) is employed for both phases.

The standard toilet facility (1 building) with 5 units of toilet bowl to serve for 250 students is adopted for the planning purpose, which is modified from FW4SP design to provide a shallow well as a water source.

(3) Public toilets

As a minimum requirement, at least 1 sanitary toilet facility is assumed to be provided for respective utilities: public market and bus/jeepney terminal.

The standard FW4SP design with 6-units of toilet bowl for the market is adopted. In this design, it is assumed that water supply will be tapped from the existing system, hence an elevated water tank is provided.

8.4.3 Urban Sewerage

The commencement of staged implementation of the sewerage program is planned in Phase II for the limited urban area (50% of urban population served by Level III system for the municipalities with urban population of more than 10,000). It is practical to start the program fully using the existing facilities to allow for lower initial investment cost than starting at once a conventional sewerage system (refer to Figure 8.4.2 Staged Improvement in Sewage Collection Method, Supporting Report).

Low cost off-site technologies such as small bore sewer for collection of effluent from septic tank are to be adopted. Improvement of sewage collection method may be gradually achieved from combined sewer to separate sewerage system.

Sewage treatment facilities may range from community scale septic tank or imhoff tank to aerated lagoon systems and to a more advanced treatment process such as oxidation ditch. For this PW4SP, aerated lagoons are assumed as a representative treatment facility for planning purpose. Daily average wastewater quantity is assumed to be 100 liters per capita per day.

8.4.4 Solid Waste

In terms of facility requirements, this PW4SP only studied the number of refuse collection trucks required for the year 2000. A rated capacity of 5 cu.m truck/vehicle is considered for calculation of required units of truck. Disposal of solid waste shall be studied in detail through investigations, F/S and D/D. Unit solid waste generation for urban area is assumed to be 0.418 kg. per capita per day.

8.5 Service Coverage by Target Year

8.5.1 Water Supply

The service coverage in terms of population to be served by target year was estimated by urban and rural area by municipality. The service coverage in rural area was further subdivided by service level (Level I & Level II) to finally come up with physical requirements.

Base figures applied to estimate the future service coverage and the additional population to be served are:

- provincial sector targets,
- population projection by target year, and
- base year service coverage (served population) by existing facilities.

Future requirements in terms of additional population to be served were then estimated by urban (Level III) and rural (Level I & II) area by municipality as a shortfall to meet the population to be served in each target year. The population served in base year is adopted as the population served in target year, when the former population exceeds the population to be served in the target year/s. Manner of calculation is specifically presented by phase.

(1) Phase I requirements

Additional service coverage was estimated as a shortfall of the population to be served in Phase I comparing with the population served in base year. In this connection, existing facilities both in urban and rural areas are assumed to be utilized during the Phase I period.

The utilization of untapped springs for Level II systems was given priority during Phase I period for rural water supply. At the time of this plan preparation, six (6) untapped springs in two (2) municipalities were identified.

(2) Phase II requirements

Additional service coverage was estimated as a shortfall of the population to be served in Phase II comparing with the population served in Phase I. In this regard, existing facilities in rural area were assumed to be utilized through the two Phases, while urban population served by Level I and II facilities in base year was assumed to be absorbed by Level III service during Phase II period.

Table 8.5.1 exhibits the population to be served by target year, while Figures 8.5.1 and 8.5.2 present maps showing service coverage by 2000 and 2010, respectively (details are referred to Supporting Report).

Through the Phase I development, approximately 95,700 persons in the province will be served by additional water supply services, of which 13,900 persons or 15% of the total will be urban population and 81,800 persons or 85% will be rural population.

In the Phase II period, a total of 157,600 persons, of which 100,300 persons or 64% in urban area and 57,300 persons or 36% in rural area, will be further benefited by water supply services. This additional service coverage in urban area includes upgrade of service level for 79,100 persons served by Level I and II facilities in 1995.

8.5.2 Sanitation

(1) Household toilets

The service coverage (number of households to be served) by different types of sanitary facility is estimated by urban and rural area by municipality for the years 2000 and 2010.

The future service coverage and additional households to be served are estimated to meet the provincial targets using the number of household served in the base year and the number of households in target years.

Additional number of households to be served by different type of facility by urban and rural area by municipality is the shortfall of the number of households to be served in target years comparing with either that in base year or in Phase I (details are referred to Supporting Report). However, when the number of households to be served in target year/s is less than or equal to that in base year, no additional number of households to be served is counted.

In the determination of the number of households to be served by flush type toilet, when the number of households to be served in the target year is bigger than in base year, the target coverage is applied with conditions. When the target coverage is bigger than Level III water supply coverage, the latter coverage is adopted, while in the other case, the target coverage is applied. In cases where the target coverage is less than that in base year, the base year coverage is adopted.

Table 8.5.1 Population to be Served by Target Year (Water Supply)

Municipalities	Type	Phase I (2000)									Phase II (2010)								
		Total Population	Service Coverage				Additional Population to be Served				Total Population	Service Coverage				Additional Population to be Served			
			Level III	Level II	Level I	Total	Level III	Level II	Level I	Total		Level III	Level II	Level I	Total	Level III	Level II	Level I	Total
Alfonso Castañeda	Urban	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rural	4,759	0	1,890	2,155	4,045	0	0	1,562	1,562	5,388	0	1,890	3,229	5,119	0	0	1,074	1,074
	Total	4,759	0	1,890	2,155	4,045	0	0	1,562	1,562	5,388	0	1,890	3,229	5,119	0	0	1,074	1,074
Ambaguio	Urban	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rural	10,870	0	991	8,249	9,240	0	0	7,532	7,532	12,308	0	991	10,702	11,693	0	0	2,453	2,453
	Total	10,870	0	991	8,249	9,240	0	0	7,532	7,532	12,308	0	991	10,702	11,693	0	0	2,453	2,453
Aritao	Urban	12,274	2,697	0	8,350	11,047	1,071	0	0	1,071	13,897	13,202	0	0	13,202	10,505	0	0	10,505
	Rural	18,583	708	4,183	10,905	15,796	0	0	3,675	3,675	21,041	708	4,183	15,098	19,989	0	0	4,193	4,193
	Total	30,857	3,405	4,183	19,255	26,843	1,071	0	3,675	4,746	34,938	13,910	4,183	15,098	33,191	10,505	0	4,193	14,698
Bagabag	Urban	16,368	3,716	0	11,015	14,731	1,681	0	0	1,681	18,533	17,606	0	0	17,606	13,890	0	0	13,890
	Rural	15,676	0	954	12,371	13,325	0	0	1,938	1,938	17,749	0	954	15,908	16,862	0	0	3,537	3,537
	Total	32,044	3,716	954	23,386	28,056	1,681	0	1,938	3,619	36,282	17,606	954	15,908	34,468	13,890	0	3,537	17,427
Bambang	Urban	14,449	2,070	0	10,934	13,004	2,070	0	0	2,070	16,360	15,542	0	0	15,542	13,472	0	0	13,472
	Rural	27,358	0	1,258	21,996	23,254	0	0	3,621	3,621	30,977	0	1,258	28,170	29,428	0	0	6,174	6,174
	Total	41,807	2,070	1,258	32,930	36,258	2,070	0	3,621	5,691	47,337	15,542	1,258	28,170	44,970	13,472	0	6,174	19,646
Bayombong (Capital)	Urban	27,540	9,368	275	15,143	24,786	2,769	0	0	2,769	31,184	29,625	0	0	29,625	20,257	0	0	20,257
	Rural	21,518	2,268	103	15,919	18,290	0	0	1,321	1,321	24,365	2,268	103	20,776	23,147	0	0	4,857	4,857
	Total	49,058	11,636	378	31,062	43,076	2,769	0	1,321	4,090	55,549	31,893	103	20,776	52,772	20,257	0	4,857	25,114
Diadi	Urban	2,115	186	0	1,718	1,904	186	0	0	186	2,395	2,275	0	0	2,275	2,089	0	0	2,089
	Rural	12,167	0	2,530	7,812	10,342	0	2,080	1,954	4,034	13,776	0	2,530	10,557	13,087	0	0	2,745	2,745
	Total	14,282	186	2,530	9,530	12,246	186	2,080	1,954	4,220	16,171	2,275	2,530	10,557	15,362	2,089	0	2,745	4,834
Dupax del Norte	Urban	6,665	1,153	1,250	3,596	5,999	1,153	0	0	1,153	7,546	7,169	0	0	7,169	6,016	0	0	6,016
	Rural	18,968	0	4,016	12,107	16,123	0	1,020	7,701	8,721	21,477	0	4,016	16,387	20,403	0	0	4,280	4,280
	Total	25,633	1,153	5,266	15,703	22,122	1,153	1,020	7,701	9,874	29,023	7,169	4,016	16,387	27,572	6,016	0	4,280	10,296
Dupax del Sur	Urban	3,750	478	0	2,897	3,375	478	0	0	478	4,246	4,034	0	0	4,034	3,556	0	0	3,556
	Rural	11,507	0	1,407	8,374	9,781	0	0	6,197	6,197	13,029	0	1,407	10,971	12,378	0	0	2,597	2,597
	Total	15,257	478	1,407	11,271	13,156	478	0	6,197	6,675	17,275	4,034	1,407	10,971	16,412	3,556	0	2,597	6,153

Table 8.5.1 Population to be Served by Target Year (Water Supply) (Cont'd.)

Municipalities	Type	Phase I (2000)									Phase II (2010)								
		Total Population	Service Coverage				Additional Population to be Served				Total Population	Service Coverage				Additional Population to be Served			
			Level III	Level II	Level I	Total	Level III	Level II	Level I	Total		Level III	Level II	Level I	Total	Level III	Level II	Level I	Total
Kasibu	Urban	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rural	28,023	0	1,377	22,443	23,820	0	0	19,029	19,029	31,730	0	1,377	28,767	30,144	0	0	6,324	6,324
	Total	28,023	0	1,377	22,443	23,820	0	0	19,029	19,029	31,730	0	1,377	28,767	30,144	0	0	6,324	6,324
Kayapa	Urban	815	67	667	0	734	67	0	0	67	923	877	0	0	877	810	0	0	810
	Rural	22,039	0	7,319	11,414	18,733	0	0	6,669	6,669	24,954	0	7,319	16,387	23,706	0	0	4,973	4,973
	Total	22,854	67	7,986	11,414	19,467	67	0	6,669	6,736	25,877	877	7,319	16,387	24,583	810	0	4,973	5,783
Quezon	Urban	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rural	14,987	0	92	12,647	12,739	0	0	7,623	7,623	16,969	0	92	16,029	16,121	0	0	3,382	3,382
	Total	14,987	0	92	12,647	12,739	0	0	7,623	7,623	16,969	0	92	16,029	16,121	0	0	3,382	3,382
Santa Fe	Urban	1,496	306	0	1,040	1,346	306	0	0	306	1,694	1,609	0	0	1,609	1,303	0	0	1,303
	Rural	12,287	0	4,235	6,209	10,444	0	0	5,008	5,008	13,912	0	4,235	8,981	13,216	0	0	2,772	2,772
	Total	13,783	306	4,235	7,249	11,790	306	0	5,008	5,314	15,606	1,609	4,235	8,981	14,825	1,303	0	2,772	4,075
Solano	Urban	30,118	8,408	100	18,598	27,106	3,438	0	0	3,438	34,101	32,396	0	0	32,396	23,988	0	0	23,988
	Rural	23,314	0	558	19,259	19,817	0	0	2,916	2,916	26,398	0	558	24,520	25,078	0	0	5,261	5,261
	Total	53,432	8,408	658	37,857	46,923	3,438	0	2,916	6,354	60,499	32,396	558	24,520	57,474	23,988	0	5,261	29,249
Villaverde	Urban	4,710	683	0	3,556	4,239	683	0	0	683	5,333	5,066	0	0	5,066	4,383	0	0	4,383
	Rural	12,120	0	239	10,063	10,302	0	0	1,920	1,920	13,723	0	239	12,798	13,037	0	0	2,735	2,735
	Total	16,830	683	239	13,619	14,541	683	0	1,920	2,603	19,056	5,066	239	12,798	18,103	4,383	0	2,735	7,118
Provincial Total	Urban	120,300	29,132	2,292	76,847	108,271	13,902	0	0	13,902	136,212	129,401	0	0	129,401	100,269	0	0	100,269
	Rural	254,176	2,976	31,152	181,923	216,051	0	3,100	78,666	81,766	287,796	2,976	31,152	239,280	273,408	0	0	57,357	57,357
	Total	374,476	32,108	33,444	258,770	324,322	13,902	3,100	78,666	95,668	424,008	132,377	31,152	239,280	402,809	100,269	0	57,357	157,626

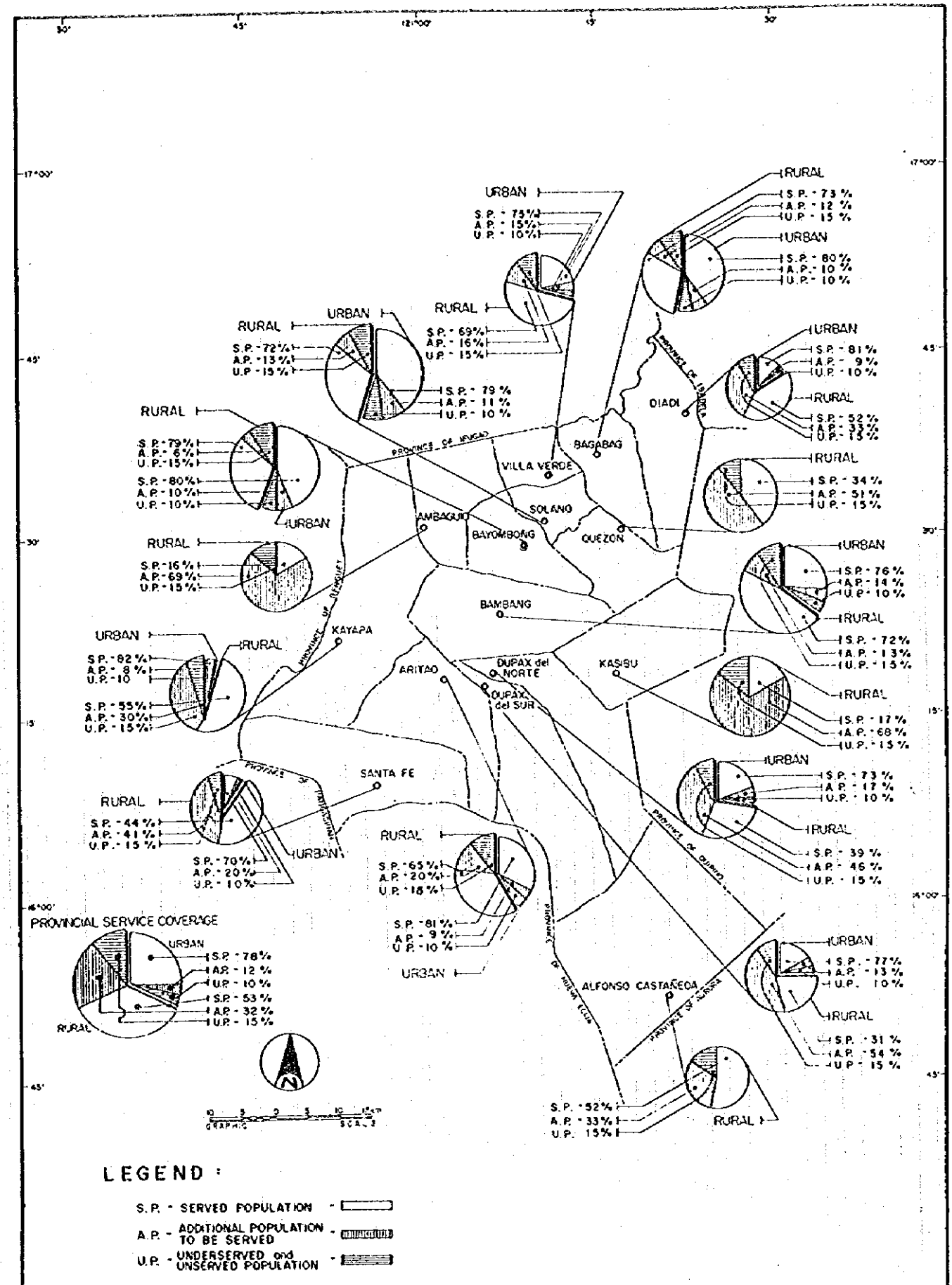


FIGURE 8.5.1

MAP SHOWING FUTURE WATER SUPPLY SERVICE COVERAGE BY 2000

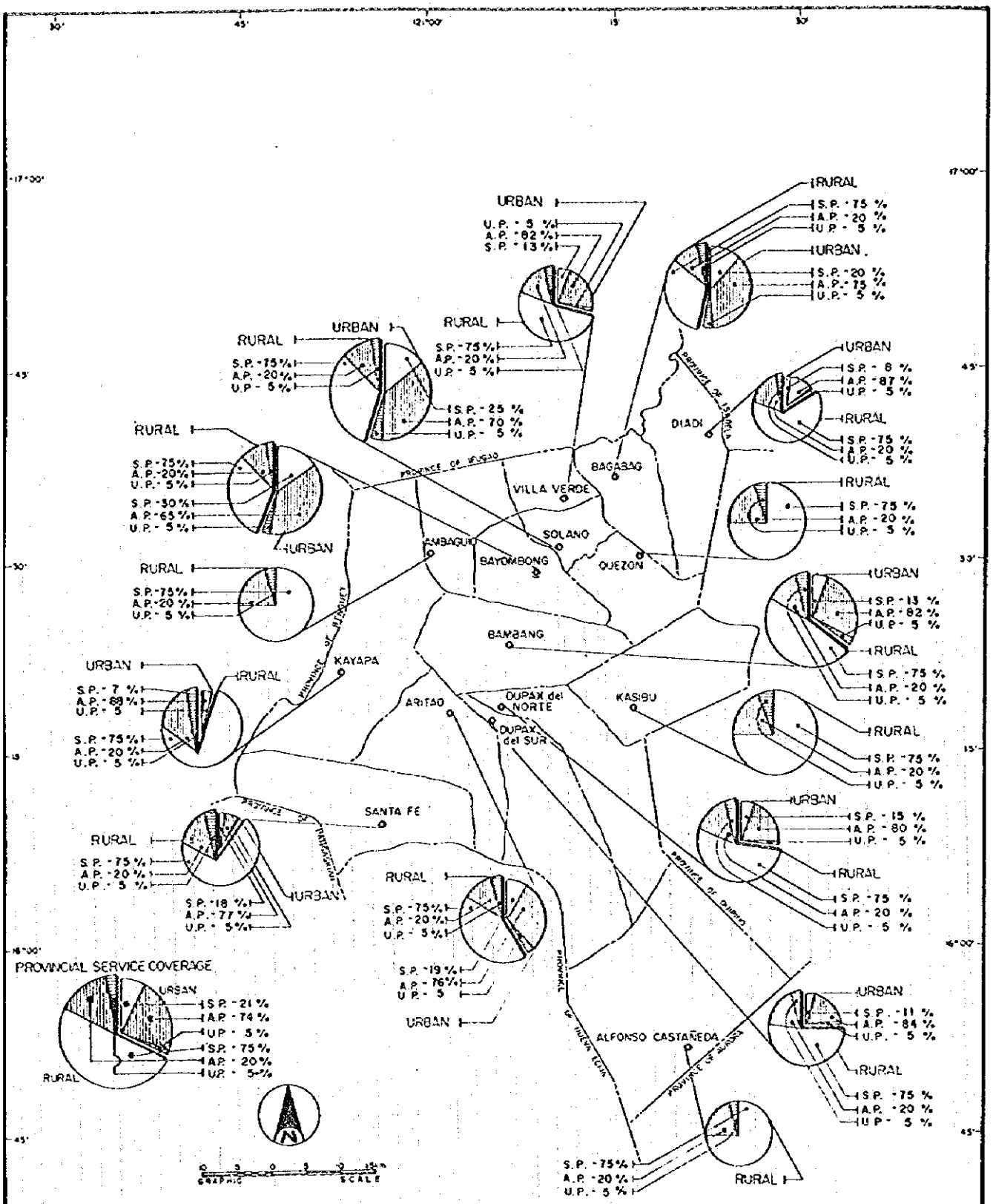


FIGURE 8.5.2

MAP SHOWING FUTURE WATER SUPPLY SERVICE COVERAGE BY 2010

For Phase I, any type of existing facilities both in urban and rural areas is to be utilized during Phase I period. For Phase II, water-sealed toilet facilities in Phase I both in urban and rural areas are to be utilized.

The projected number of served households at the end of the Phase I period is 63,167. The additional households to be served totaled to 17,197, of which 17% is urban households and 83% is rural households. While at the end of Phase II period, the number of served households is 99,643 with an additional households to be served at 42,763. Table 8.5.2 summarizes the number of households to be served by target year for urban and rural areas by municipality. Figures 8.5.3 and 8.5.4 present maps showing service coverage by 2000 and 2010, respectively.

(2) School toilets

The service coverage (number of public school students to be served) is estimated by municipality for the years 2000 and 2010.

The future service coverage and additional number of students to be served are estimated using the number of students served in the base year, the number of students in target years and the provincial sector targets.

Additional number of students to be served by municipality is the shortfall of the number of students to be served in targets comparing with either that in base year or in Phase I (details are referred to Supporting Report). However, when the number of students to be served in target/s is less than or equal to the base year, no additional number of households to be served is considered.

The existing facilities are to be utilized during Phase I period, while the facilities in Phase I are to be utilized during Phase II period.

The projected number of served students at the end of Phase I period is 48,717. The additional students to be served are 14,717. While at the end of Phase II period, the projected number of served students is 72,813 with an additional students to be served at 24,096. Table 8.5.3 summarizes the number of public school students to be served by target year.

(3) Public toilets

The service coverage of public utilities with sanitary toilet facility is estimated by municipality for the years 2000 and 2010.

Table 8.5.2 Additional Number of Households to be Served by Target Year (Household Toilets)

Municipality	Area	Phase I (2000)									Phase I I (2010)								
		Total Households	No. of Served Households				Add'l No. of Households to be Served				Total Households	No. of Served Households				Add'l No. of Households to be Served			
			Flush	Pour Flush	VIP Latrine	Total	Flush	Pour Flush	VIP Latrine	Total		Flush	Pour Flush	VIP Latrine	Total	Flush	Pour Flush	VIP Latrine	Total
Alfonso Castañeda	Urban	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rural	898	0	703	78	781	0	342	0	342	1,347	0	1,266	0	1,266	0	563	0	563
	Total	898	0	703	78	781	0	342	0	342	1,347	0	1,266	0	1,266	0	563	0	563
Ambaguio	Urban	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rural	1,941	0	1,520	169	1,689	0	1,293	0	1,293	3,077	0	2,892	0	2,892	0	1,372	0	1,372
	Total	1,941	0	1,520	169	1,689	0	1,293	0	1,293	3,077	0	2,892	0	2,892	0	1,372	0	1,372
Aritao	Urban	2,360	205	1,848	0	2,053	155	170	0	325	3,474	1,633	1,633	0	3,266	1,428	0	0	1,428
	Rural	3,574	136	2,662	311	3,109	131	412	311	854	5,260	177	4,767	0	4,944	41	2,105	0	2,146
	Total	5,934	341	4,510	311	5,162	286	582	311	1,179	8,734	1,810	6,400	0	8,210	1,469	2,105	0	3,574
Bagabag	Urban	3,088	269	2,418	0	2,687	211	169	0	380	4,633	2,178	2,177	0	4,355	1,909	0	0	1,909
	Rural	3,074	0	2,407	267	2,674	0	422	75	497	4,437	0	4,171	0	4,171	0	1,764	0	1,764
	Total	6,162	269	4,825	267	5,361	211	591	75	877	9,070	2,178	6,348	0	8,526	1,909	1,764	0	3,673
Bambang	Urban	2,890	251	2,263	0	2,514	193	134	0	327	4,090	1,922	1,923	0	3,845	1,671	0	0	1,671
	Rural	5,364	14	4,186	467	4,667	0	762	109	871	7,744	14	7,265	0	7,279	0	3,079	0	3,079
	Total	8,254	265	6,449	467	7,181	193	896	109	1,198	11,834	1,936	9,188	0	11,124	1,671	3,079	0	4,750
Bayombong (Capital)	Urban	4,918	428	3,851	0	4,279	275	19	0	294	7,796	3,664	3,664	0	7,328	3,236	0	0	3,236
	Rural	4,890	213	3,616	425	4,254	187	1,000	282	1,469	6,091	567	5,159	0	5,726	354	1,543	0	1,897
	Total	9,808	641	7,467	425	8,533	462	1,019	282	1,763	13,887	4,231	8,823	0	13,054	3,590	1,543	0	5,133
Diadi	Urban	399	35	312	0	347	35	168	0	203	599	282	281	0	563	247	0	0	247
	Rural	2,340	0	1,832	204	2,036	0	995	0	995	3,444	0	3,237	0	3,237	0	1,405	0	1,405
	Total	2,739	35	2,144	204	2,383	35	1,163	0	1,198	4,043	282	3,518	0	3,800	247	1,405	0	1,652
Dupax del Norte	Urban	1,307	114	1,023	0	1,137	114	0	0	114	1,887	887	887	0	1,774	773	0	0	773
	Rural	3,719	0	2,912	324	3,236	0	0	324	324	5,369	0	5,047	0	5,047	0	2,135	0	2,135
	Total	5,026	114	3,935	324	4,373	114	0	324	438	7,256	887	5,934	0	6,821	773	2,135	0	2,908
Dupax del Sur	Urban	694	60	544	0	604	54	0	0	54	1,062	499	499	0	998	439	0	0	439
	Rural	2,131	0	1,669	185	1,854	0	777	100	877	3,257	0	3,062	0	3,062	0	1,393	0	1,393
	Total	2,825	60	2,213	185	2,458	54	777	100	931	4,319	499	3,561	0	4,060	439	1,393	0	1,832

Table 8.5.2 Additional Number of Households to be Served by Target Year (Household Toilets) (Cont'd.)

Municipality	Area	Phase I (2000)									Phase I I (2010)								
		Total Households	No. of Served Households				Add'l No. of Households to be Served				Total Households	No. of Served Households				Add'l No. of Households to be Served			
			Flush	Pour Flush	VIP Latrine	Total	Flush	Pour Flush	VIP Latrine	Total		Flush	Pour Flush	VIP Latrine	Total	Flush	Pour Flush	VIP Latrine	Total
Kasibu	Urban	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rural	5,389	0	4,219	469	4,688	0	1,958	0	1,958	7,933	0	7,457	0	7,457	0	3,238	0	3,238
	Total	5,389	0	4,219	469	4,688	0	1,958	0	1,958	7,933	0	7,457	0	7,457	0	3,238	0	3,238
Kayapa	Urban	154	13	121	0	134	9	0	0	9	231	109	108	0	217	96	0	0	96
	Rural	4,081	2	3,193	355	3,550	0	1,858	0	1,858	6,239	2	5,863	0	5,865	0	2,670	0	2,670
	Total	4,235	15	3,314	355	3,684	9	1,858	0	1,867	6,470	111	5,971	0	6,082	96	2,670	0	2,766
Quezon	Urban	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rural	2,939	0	2,301	256	2,557	0	993	0	993	4,242	0	3,987	0	3,987	0	1,686	0	1,686
	Total	2,939	0	2,301	256	2,557	0	993	0	993	4,242	0	3,987	0	3,987	0	1,686	0	1,686
Santa Fe	Urban	262	25	203	0	228	0	48	0	48	424	199	200	0	399	174	0	0	174
	Rural	2,363	0	1,850	206	2,056	0	913	16	929	3,478	0	3,269	0	3,269	0	1,419	0	1,419
	Total	2,625	25	2,053	206	2,284	0	961	16	977	3,902	199	3,469	0	3,668	174	1,419	0	1,593
Solano	Urban	6,024	524	4,717	0	5,241	166	879	0	1,045	8,525	4,007	4,007	0	8,014	3,483	0	0	3,483
	Rural	4,663	7	3,644	406	4,057	0	228	42	270	6,600	7	6,197	0	6,204	0	2,553	0	2,553
	Total	10,687	531	8,361	406	9,298	166	1,107	42	1,315	15,125	4,014	10,204	0	14,218	3,483	2,553	0	6,036
Villaverde	Urban	856	74	671	0	745	49	21	0	70	1,333	627	626	0	1,253	553	0	0	553
	Rural	2,287	14	1,777	199	1,990	0	798	0	798	3,431	14	3,211	0	3,225	0	1,434	0	1,434
	Total	3,143	88	2,448	199	2,735	49	819	0	868	4,764	641	3,837	0	4,478	553	1,434	0	1,987
Provincial Total	Urban	22,952	1,998	17,971	0	19,969	1,261	1,608	0	2,869	34,054	16,007	16,005	0	32,012	14,009	0	0	14,009
	Rural	49,653	386	38,491	4,321	43,198	318	12,751	1,259	14,328	71,949	781	66,850	0	67,631	395	28,359	0	28,754
	Total	72,605	2,384	56,462	4,321	63,167	1,579	14,359	1,259	17,197	106,003	16,788	82,855	0	99,643	14,404	28,359	0	42,763

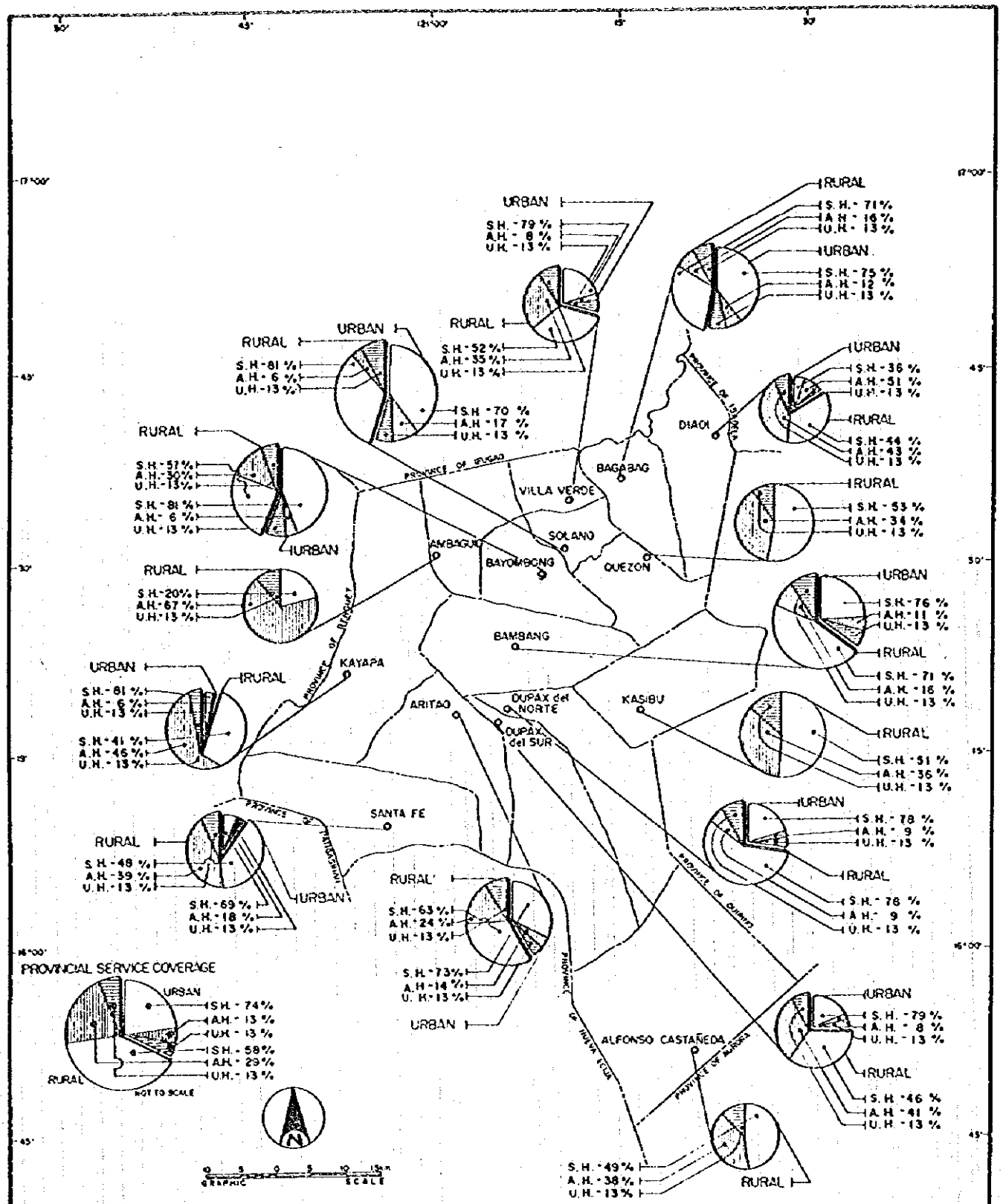


FIGURE 8.5.3

MAP SHOWING HOUSEHOLD TOILETS SERVICE COVERAGE BY 2000

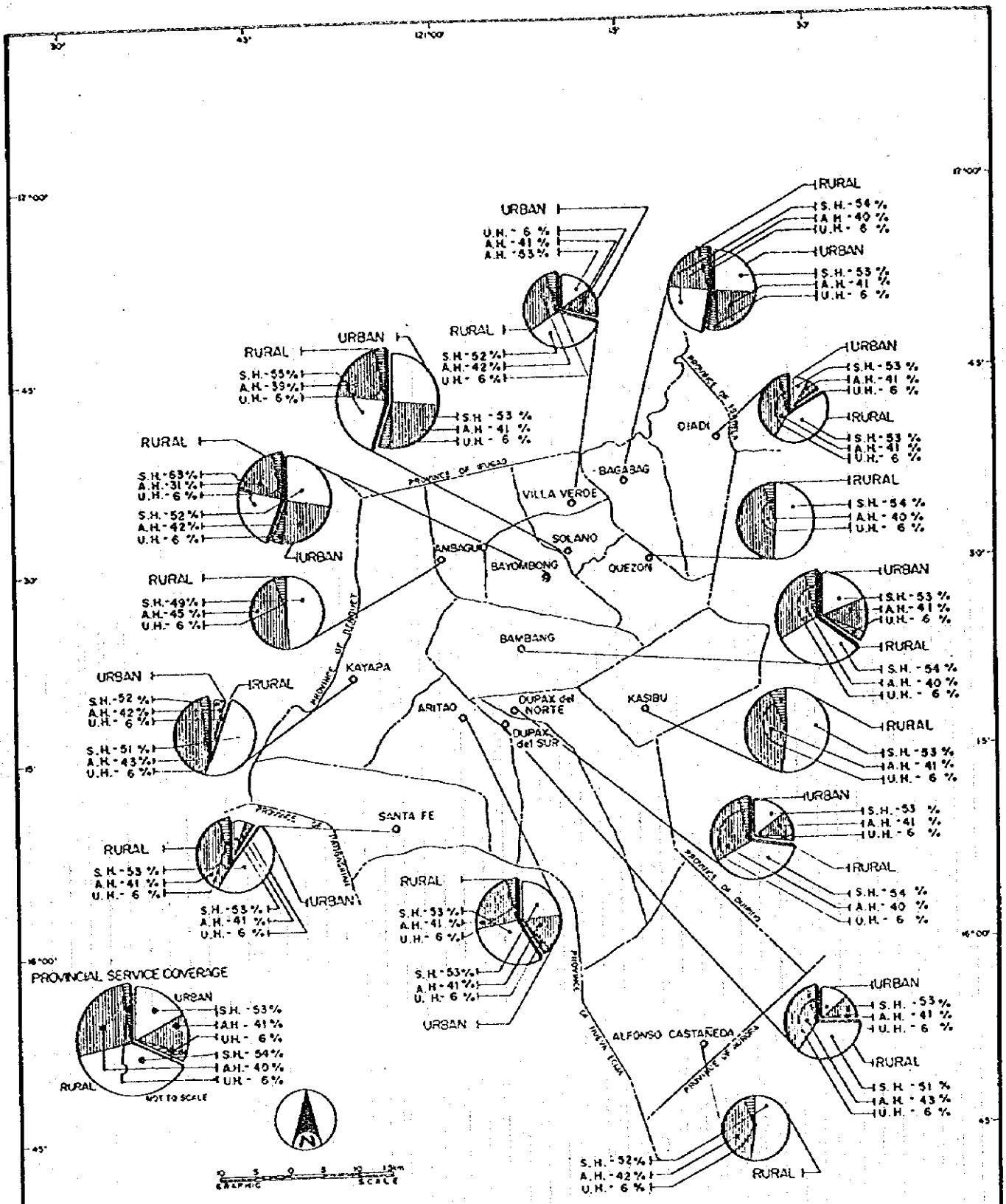


FIGURE 8.5.4

MAP SHOWING HOUSEHOLD TOILETS SERVICE COVERAGE BY 2010

Table 8.5.3 Additional Number of Public School Students to be Served by Target Year (School Toilets)

Municipality	Phase I (2000)			Phase II (2010)		
	Total No. of Public School Students	Std. No. of Public School Students to be Served	Add'l No. of Public School Students to be Served	Total No. of Public School Students	Std. No. of Public School Students to be Served	Add'l No. of Public School Students to be Served
Alfonso Castaneda	1,046	732	182	1,203	1,083	351
Ambaguio	878	615	615	850	765	150
Aritao	4,963	3,474	0	6,082	5,474	2,000
Bagabag	5,092	3,564	0	5,963	5,367	1,803
Bambang	9,204	6,443	243	10,812	9,731	3,288
Bayombong (Capital)	9,615	6,731	2,781	11,376	10,238	3,507
Diadi	3,779	2,645	245	3,872	3,485	840
Dupax del Norte	5,290	3,703	2,303	6,329	5,696	1,993
Dupax del Sur	2,498	1,749	1,149	2,964	2,668	919
Kasibu	4,846	3,392	2,892	5,399	4,859	1,467
Kayapa	3,903	2,732	782	4,632	4,169	1,437
Quezon	3,088	2,162	0	3,289	2,960	798
Santa Fe	2,401	1,681	381	2,505	2,255	574
Solano	9,515	6,661	2,511	11,513	10,362	3,701
Villaverde	3,476	2,433	633	4,112	3,701	1,268
Provincial Total	69,594	48,717	14,717	80,901	72,813	24,096

The future service coverage and additional coverage are estimated using the existing number of public utilities with sanitary toilets in the base year, the number of public utilities in target years, and provincial sector targets.

The additional number of public utilities with sanitary toilets needed by municipality is the shortfall of the number of public utilities in target year comparing with either the existing coverage or Phase I coverage (details are referred to Supporting Report).

The existing sanitary facilities are to be utilized during Phase I period. The facilities in Phase I are to be utilized during Phase II period.

The number of served public utilities at the end of Phase I period is 26. The additional public utilities to be served are 12. While at the end of Phase II period, the number of served public utilities is 37 with an additional public utilities to be served at 11. Table 8.5.4 summarizes the additional number of public utilities to be served by municipality by target year.

8.5.3 Urban Sewerage

The service coverage in 2010 (Phase II) is estimated for the municipalities with population of more than 10,000 in urban area provided by Level III water supply. It is assumed that half of

Table 8.5.4 Additional Number of Public Utilities with Sanitary Toilets by Target Year

Municipality	Type	Phase I Coverage (2000)		Phase II Coverage (2010)	
		Additional No. of Public Utilities with Sanitary Toilets	Number of Public Utilities with Sanitary Toilets	Additional No. of Public Utilities with Sanitary Toilets	Number of Public Utilities with Sanitary Toilets
Alfonso Castañeda	Public Market	0	1	0	1
	Bus/Jeep Terminal	0	0	1	1
	Total	0	1	1	2
Ambaguio	Public Market	1	1	0	1
	Bus/Jeep Terminal	0	0	0	0
	Total	1	1	0	1
Aritao	Public Market	0	1	0	1
	Bus/Jeep Terminal	0	0	0	0
	Total	0	1	0	1
Bagabag	Public Market	0	1	0	1
	Bus/Jeep Terminal	0	1	0	1
	Total	0	2	0	2
Bambang	Public Market	1	2	0	2
	Bus/Jeep Terminal	0	0	1	1
	Total	1	2	1	3
Bayombong (Capital)	Public Market	1	2	0	2
	Bus/Jeep Terminal	0	0	1	1
	Total	1	2	1	3
Diadi	Public Market	0	1	0	1
	Bus/Jeep Terminal	0	0	0	0
	Total	0	1	0	1
Dupax del Norte	Public Market	2	3	0	3
	Bus/Jeep Terminal	0	0	0	0
	Total	2	3	0	3
Dupax del Sur	Public Market	0	1	0	1
	Bus/Jeep Terminal	0	0	0	0
	Total	0	1	0	1
Kasibu	Public Market	0	1	0	1
	Bus/Jeep Terminal	0	0	1	1
	Total	0	1	1	2
Kayapa	Public Market	2	3	1	4
	Bus/Jeep Terminal	0	0	1	1
	Total	2	3	2	5
Quezon	Public Market	0	0	1	1
	Bus/Jeep Terminal	0	0	0	0
	Total	0	0	1	1
Santa Fe	Public Market	3	4	1	5
	Bus/Jeep Terminal	0	0	0	0
	Total	3	4	1	5
Solano	Public Market	0	1	1	2
	Bus/Jeep Terminal	1	2	2	4
	Total	1	3	3	6
Villaverde	Public Market	1	1	0	1
	Bus/Jeep Terminal	0	0	0	0
	Total	1	1	0	1
Provincial Total	Public Market	11	23	4	27
	Bus/Jeep Terminal	1	3	7	10
	Total	12	26	11	37

the population in the area/s is to be served by the sewerage systems. Table 8.5.5 shows the population to be served in Phase II.

Table 8.5.5 Population to be Served by Urban Sewerage in Phase II

Municipality	Urban Population in 2010	Level III Water Supply Coverage	Population to be Served
Aritao	13,897	13,202	6,949
Bagabag	18,533	17,606	9,267
Bambang	16,360	15,542	8,180
Bayombong	31,184	29,625	15,592
Solano	34,101	32,396	17,051
Provincial Total	136,212	129,401	57,039

8.5.4 Solid Waste

Future requirements in the sub-sector are studied giving priority to urban area for the Phase I. Staged improvement for the rural area shall be studied in the future.

Service coverage in Phase I is assumed to be 50% with reference to the current service coverage of 35%. Additional service coverage in Phase I is calculated as a shortfall of target coverage in Phase I comparing with existing service coverage. Table 8.5.6 presents additional service coverage for Phase I in the urban area.

Table 8.5.6 Add'l. No. of Urban Households to be Served by Municipal Solid Waste System in Phase I

Municipality	No. of Urban Households Served in the Base Year	Phase I Coverage (2000)		
		No. of Urban Households	Urban Household Coverage	Add'l. No. of Urban Households to be Served
Alfonso Castaneda	0	0	0	0
Ambaguio	0	0	0	0
Aritao	490	2,360	1,180	690
Bagabag	115	3,088	1,544	1,429
Bambang	823	2,890	1,445	622
Bayombong (Capital)	1,126	4,918	2,459	1,333
Diadi	0	399	200	200
Dupax del Norte	247	1,307	654	407
Dupax del Sur	452	694	452	0
Kasibu	0	0	0	0
Kayapa	0	154	77	77
Quezon	0	0	0	0
Santa Fe	0	262	131	131
Solano	4,035	6,024	4,035	0
Villaverde	0	856	428	428
Provincial Total	7,288	22,952	12,605	5,317

8.6 Facilities, Equipment and Rehabilitation to Meet the Target Services

8.6.1 Water Supply

(1) Required facilities

Water supply facilities required by service level were estimated by urban and rural area by municipality based on the additional service coverage by target year and summarized in Table 8.6.1 (details are referred to Supporting Report).

Urban water supply:

Physical requirements of Level III systems are estimated as the number of required house connections. Mode of project indicates whether future urban water supply will be implemented as expansion of existing system or construction of a new system. Number of deep wells was also estimated based on the water source evaluation results in Chapter 7.

Rural water supply:

Physical requirements of Level II systems are estimated as the number of systems and number of communal faucets, while that of Level I wells are estimated as the number of wells with classification of deep and shallow wells. Deep wells are further subdivided in terms of three different standard depths based on the water source evaluation results.

(2) Rehabilitation

Rehabilitation requirements are estimated as 10% of the total number of deep wells to be constructed under PW4SP. Rehabilitation work is mainly redevelopment of wells by means of air surging, while minor repair of concrete apron and handpump was considered to be undertaken by respective beneficiary organizations.

(3) Equipment

Logistic support:

For rural water supply development, 1 unit each or set of the following equipment was considered necessary for the provincial government to conduct various activities of PW4SP implementation;

Transportation- service vehicle.

Office equipment- computer with printer, typewriter, mimeo machine, scanning machine and copier.

Field equipment- water testing kit, sound system, tape recorder and tools for maintenance.

Table 8.6.1 Water Supply Facilities Required by Target Year

Municipality	Phase I (2000) Requirements											Phase II (2010) Requirements							
	Urban Water Supply (Level III)			Rural Water Supply								Urban Water Supply (Level III)		Rural Water Supply (Level I)					
				Level II		Level I													
	Mode of Project	No. of Additional Deep Wells	Number of House Connections	Number of System	No. of Communal Faucets	Number of Deep Wells				Number of Shallow Wells	Total No. of Wells	No. of Additional Deep Wells	Number of House Connections	Number of Deep Wells				Number of Shallow Wells	Total No. of Wells
						30 m	50 m	70 m	Sub-total					30 m	50 m	70 m	Sub-total		
Alfonso Castaneda	New	0	0	0	0	20	0	0	20	0	20	0	0	14	0	0	14	0	14
Ambaguio	New	0	0	0	0	0	90	0	90	0	90	0	0	0	29	0	29	0	29
Aritao	Expansion	1	206	0	0	47	0	0	47	0	47	1	2,626	54	0	0	54	0	54
Bagabag	Expansion	1	317	0	0	25	0	0	25	0	25	2	3,473	46	0	0	46	0	46
Bambang	New	1	414	0	0	47	0	0	47	0	47	2	3,368	81	0	0	81	0	81
Bayombong (Capital)	Expansion	1	494	0	0	0	20	0	20	0	20	2	5,064	0	74	0	74	0	74
Diadi	New	1	35	4	80	25	0	0	25	0	25	1	522	35	0	0	35	0	35
Dupax del Norte	New	1	226	2	40	101	0	0	101	0	101	1	1,504	56	0	0	56	0	56
Dupax del Sur	New	1	89	0	0	77	0	0	77	0	77	1	889	32	0	0	32	0	32
Kasibu	New	0	0	0	0	244	0	0	244	0	244	0	0	81	0	0	81	0	81
Kayapa	New	1	13	0	0	82	0	0	82	0	82	1	203	61	0	0	61	0	61
Quezon	New	0	0	0	0	100	0	0	100	0	100	0	0	44	0	0	44	0	44
Santa Fe	New	1	54	0	0	64	0	0	64	0	64	1	326	36	0	0	36	0	36
Solano	Expansion	1	688	0	0	0	0	39	39	0	39	3	5,997	0	0	70	70	0	70
Villaverde	New	1	124	0	0	24	0	0	24	0	24	1	1,096	34	0	0	34	0	34
Provincial Total	New——11 Expansion-4	11	2,660	6	120	856	110	39	1,005	0	1,005	16	25,068	574	103	70	747	0	747

For urban water supply, no hardware was considered.

Well drilling and rehabilitation equipment:

As a reference information, necessary types and number of well drilling and rehabilitation equipment were studied considering the existing equipment of sector agencies in the province.

During the Phase I period, a total of 1,005 Level I deep wells shall be newly constructed and 10% of these deep wells shall be rehabilitated annually. Although there are huge requirements, only 1 unit of truck-mounted percussion drilling rig is available at DPWH-DEO in the province, while no air compressor for well rehabilitation equipment is available neither at provincial government nor sector agencies.

Therefore, a total of 19 sets of drilling rigs (8 sets of medium size rotary type and 11 sets of medium size percussion type) together with 3 sets of well rehabilitation equipment, 3 units of support vehicles for well rehabilitation and 19 units of service trucks for deep well construction shall be mobilized/procured either by private sector or LGUs (details are referred to Supporting Report).

8.6.2 Sanitation

This sub-section refers to physical requirements by target year covering household, school and public toilet facilities. Table 8.6.2 presents the required sanitation facilities by target year. Rehabilitation for the sanitation facilities is considered as part of recurrent cost.

(1) Household toilets

Future requirements in the number of household toilets by different type for urban and rural areas are estimated based on the additional households to be served by type of facility both for urban and rural areas by target year (details are referred to Supporting Report).

(2) School toilets

The future requirements in the number of toilet facilities are estimated based on the standard number of students to be served by a 5-unit standard facility and the additional students to be served by target year (details are referred to Supporting Report).

Table 8.6.2 Sanitation Facilities Required by Target Year

Municipality	Phase I (2000) Requirements												Phase II (2010) Requirements											
	Urban Sanitation							Rural Sanitation					Urban Sanitation							Rural Sanitation				
	Number of Household Toilets				Number of Public School Toilets	No. of Public Toilets		Number of Household Toilets				Number of Public School Toilets	Number of Household Toilets				Number of Public School Toilets	No. of Public Toilets		Number of Household Toilets				Number of Public School Toilets
	Flush	Pour Flush	VIP Latrine	Total		Public Markets	Bus Terminal	Flush	Pour Flush	VIP Latrine	Total		Flush	Pour Flush	VIP Latrine	Total		Public Markets	Bus Terminals	Flush	Pour Flush	VIP Latrine	Total	
Alfonso Castañeda	0	0	0	0	0	0	0	0	342	0	342	1	0	0	0	0	0	0	1	0	563	0	563	1
Ambaguio	0	0	0	0	0	1	0	0	1,293	0	1,293	2	0	0	0	0	0	0	0	0	1,372	0	1,372	1
Aritao	155	170	0	325	0	0	0	131	412	311	854	0	1,428	0	0	1,428	3	0	0	41	2,105	0	2,146	5
Bagabag	211	169	0	380	0	0	0	0	422	75	497	0	1,909	0	0	1,909	4	0	0	0	1,764	0	1,764	3
Bambang	193	134	0	327	0	1	0	0	762	109	871	1	1,671	0	0	1,671	5	0	1	0	3,079	0	3,079	8
Bayombong (Capital)	275	19	0	294	6	1	0	187	1,000	282	1,469	5	3,236	0	0	3,236	8	0	1	354	1,543	0	1,897	6
Diadi	35	168	0	203	0	0	0	0	995	0	995	1	247	0	0	247	0	0	0	0	1,405	0	1,405	3
Dupax del Norte	114	0	0	114	2	2	0	0	0	324	324	7	773	0	0	773	2	0	0	0	2,135	0	2,135	6
Dupax del Sur	54	0	0	54	1	0	0	0	777	100	877	4	439	0	0	439	0	0	0	0	1,393	0	1,393	4
Kasibu	0	0	0	0	0	0	0	0	1,958	0	1,958	12	0	0	0	0	0	0	1	0	3,238	0	3,238	6
Kayapa	9	0	0	9	0	2	0	0	1,858	0	1,858	3	96	0	0	96	0	1	1	0	2,670	0	2,670	6
Quezon	0	0	0	0	0	0	0	0	993	0	993	0	0	0	0	0	0	1	0	0	1,686	0	1,686	3
Santa Fe	0	48	0	48	0	3	0	0	913	16	929	2	174	0	0	174	0	1	0	0	1,419	0	1,419	2
Solano	166	879	0	1,045	6	0	1	0	228	42	270	4	3,483	0	0	3,483	8	1	2	0	2,553	0	2,553	7
Villaverde	49	21	0	70	0	1	0	0	798	0	798	3	553	0	0	553	1	0	0	0	1,434	0	1,434	4
Provincial Total	1,261	1,608	0	2,869	15	11	1	318	12,751	1,259	14,328	45	14,009	0	0	14,009	31	4	7	395	28,359	0	28,754	65

Total required facilities are further broken down into urban and rural areas by applying the percentage share of urban and rural population.

(3) Public toilets

Future requirements in the number of toilet facilities are estimated based on the additional number of toilets for public markets and bus/jeepney terminals located in urban areas (details are referred to Supporting Report).

8.6.3 Urban Sewerage and Solid Waste

Physical requirements for the sewerage facilities are not discussed in this sub-section. Further study shall be conducted in the future.

As reference information, the number of refuse collection trucks is estimated for the urban area in Phase I. Nine (9) additional units of truck are required to meet assumed service coverage as reflected in Table 8.6.3.

Table 8.6.3 Number of Refuse Collection Trucks Required in Phase I

Municipality	Additional Urban Households to be Served	Estimated Daily Amount of Refuse to be Generated (Kg)	Number of Collection Trucks Required
Alfonso Castaneda	0	0	0
Ambaguio	0	0	0
Aritao	690	288	1
Bagabag	1,429	597	1
Bambang	622	260	1
Bayombong (Capital)	1,333	557	1
Diadi	200	84	1
Dupax del Norte	407	170	1
Dupax del Sur	0	0	0
Kasibu	0	0	0
Kayapa	77	32	1
Quezon	0	0	0
Santa Fe	131	55	1
Solano	0	0	0
Villaverde	428	179	1
Provincial Total	5,317	2,222	9

8.7 Identification of Priority Projects for Medium-Term Development Plan

In general, the present service coverage by municipality with reference to the target coverage indicates the direction of development effort for implementing PW4SP with municipal priorities.

Specific projects shall be selected subject to detailed studies and rather not discussed in provincial master plan. In addition, pertinent information to identify priority projects is not available both at provincial and municipal level during this PW4SP preparation, except some WDs for future expansion work.

The general criteria for identifying priority projects as guide for implementing the PW4SP are summarized below.

The first level of priority should be given to projects with positive feasibility studies and identified funding. Next level of priority would be given to projects with positive feasibility studies, although no funding source has been identified. The third level should be those for which feasibility study has been conducted. Within each level, if funds were insufficient, a ranking could be carried out in application of some factors such as willingness to pay, water-related diseases status and per capita cost. Under the above mentioned conditions, a list of projects shall be prepared by the implementors.

Due attention shall be paid on the importance of integrated development of relevant sub-sectors to maximize the effects and benefits through simultaneous implementation of water supply and sanitation projects. On a municipal level priority, synthetic evaluation of sector components for concerned municipalities (which is studied in the financial arrangements, Chapter 11) may be used for implementation arrangements.