Part – I

ENVIRONMENTAL ASPECTS

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I1 General

Environmental aspects were studied by the environmental expert of the JICA Study Team and his counterpart personnel of the NWRB (hereinafter referred to as the environmental survey group). In the initial investigation stage, the environmental aspects were studied with a focus on the following items:

- Collection of data/information and field reconnaissance (Section I2)
- Examination of planning factors required for the water resources management (Section I3)
- Examination of the maintenance flow estimation methods (Section I4)
- Investigation of the environmental legal system in the Republic of the Philippines (Section I5)

Based on the information and findings obtained through the study, the subjects shown below were selected for the second stage study of environmental aspects:

- A study for the demand management (Section I6)
- An environmental study for each dam projects (Section I7)
- Proposal to make ECO-DAMs (Section I8)

Based on these studies, planning formula of the water resources management (development) currently employed in this project is thought to be somewhat unsuitable from the environmental conservation standpoints. An alternative planning formula is proposed in Section I9.

I2 Data/Information Collection and Field Reconnaissance

I2.1 Data/Information Collection

I2.1.1 Data Collection at Environmental Management Bureau (EMB)

The following information was collected from the Project Management Office, the Environmental Quality Division, Management Information System and Environmental Impact Assessment Division of the EMB:

- Procedure for environmental impact assessment of water resources development Plan
- Situation of water quality problems in the Philippines, i.e. eutrophication
- List of rivers nationwide and their classification as to water quality and usage

A book entitled the Philippine Environmental Quality Report (1990- 1995) published by the EMB and the DENR was procured to obtain information regarding the situation of water quality problems in the Philippines. The list of rivers nationwide and their classification as to water quality and usage are included in the book, but the available information therein is limited to that up to 1995. On the other hand, an updated list of classified water bodies as of March 1997 was provided by the EMB staff to the Study Team. The "Procedural Manual for DAO 96-37 (Initial Version)" was also provided, which includes the procedure for Environmental Impact Assessment of Water Development Plan. The water quality data of river systems in the Philippines are available at the Management Information System of EBM. The regional water quality data were obtained therefrom.

I2.1.2 Data Collection at the Mines and Geo-Science Bureau (MGB) and the Bureau of Soils and Water Management (BSWM)

The following information were gathered from the MGB:

- Guidelines/measures in the protection of groundwater and mining environment (both qualitative and quantitative).
- Specific locations/sites wherein groundwater and mining environment is greatly affected qualitatively and quantitatively.
- Effects of landslide, erosion and deforestation.

The volume I & II of the "Geology and Mineral Resources of the Philippines" was collected from the MGB. These contain information and maps of the groundwater and mining environment of the Philippines and the guidelines/measures in the protection of the groundwater and mining environment qualitatively and quantitatively. The data and information on the effects of landslide, erosion and deforestation were collected from the Bureau of Soils and Water Management (BSWM).

Technical papers on soil erosion were gathered at the Agricultural Land and Management Evaluation Division. After a review of the technical papers, the Study Team procured the Land/Use Vegetation Map and Hydro-Ecological Conditions Zoning Map from the Soil Conservation and Management Division

I2.1.3 Protected Areas and Wildlife Bureau (PAWB)

The following information was gathered from the PAWB:

- Available information/publications concerning national situation of natural environment (flora, fauna, habitat, cultural parks, wetlands, biodiversity, NIPAS).
- Laws/guidelines on conservation/protection of the natural environment (flora, fauna, habitat, cultural parks, wetlands, biodiversity, NIPAS).
- Specific locations/sites where the natural environment is critical.
- Effect of deforestation to natural environment.
- Some views/suggestions so as to mitigate the adverse effect on scarce living species and beautiful landscapes when a water resources development is undertaken.

At the PAWB office, the Study Team collected a copy of the "Compilation of Policy Issuances (1987-1993)" as well as the list of the policies/guidelines as of 1994-1995 and "SAGIP Wildlife Program" which aims to promote the protection of flora and fauna in the country. It also contains a list of the priority species of Philippine wild birds, mammals and reptiles and their status of existence in the country (see Table I-1). In addition, the Study Team succeeded in gathering the list of protected areas (1997) in the country which also included the location of the areas, the special features of the areas and examples of flora and fauna which exist in the areas.

I2.2 Field Reconnaissance

I2.2.1 Field Reconnaissance to Laguna de Bay

The environmental survey group conducted a field reconnaissance of Laguna de Bay on June 10-11, 1997. The group members visited Pritil, Binangonan, Rizal along Laguna de Bay using a guided boat. The field reconnaissance of Laguna de Bay covered the following places and municipalities:

- North-Binangonan, Cardona
- Northwest-Muntinlupa, San Pedro, Sta. Rosa, Cabuyao
- Central-Talim Island
- Northeast-Tanay, Pililla, Jala-Jala
- South-Los Banos

In the course of the field reconnaissance, the environmental survey group was informed by the staff of the Laguna Lake Development Authority (LLDA) that the eastern part of Laguna de Bay is not much affected by pollution or sediment load, since no extensive development in terms of urbanization and industrialization takes place in the area. The following are the information and findings obtained during the site reconnaissance:

<u>On 1st day: Northern, northwestern, central and southern places of Laguna de Bay</u>

- A large part of the Laguna de Bay is filled with fishpens, specifically in areas of Binangonan, Muntinlupa, and along the coast of Talim Island
- Several water lily tulips were found between Talim Island and the municipalities of Calamba and Los Banos.
- A color change of the lake water from green to brown was observed between Binan

and Sta. Rosa; however, it then turned to green at Sta. Rosa.
- Suspended oil-like (greenish) materials were observed nearby Cabuyao.
- Several industrial plants were identified near Laguna de Bay, which include the Rizal cement factory located at Binangonan, Rizal.

On 2nd day: Northeastern and southern places of Laguna de Bay

- The boat passed through the Navotas Channel (separating mainland of Binangonan and Talim Island) to have a closer look at the northeast portion of Laguna de Bay.
- Small-scale fishpens were found at Cardona.
- A petrol refinery is located at Jala-Jala, and the bay is used as a transport route by oil products from Jala-Jala to Manila.
- Noticeable large-scale fishpens were built at Jala-Jala.
- The brown colored water of Laguna de Bay was observed at the southern-most site visited.

The environmental survey group discussed with the aforesaid staff of the LLDA about Laguna Lake water quality conservation and its water resources development. It was confirmed through the field reconnaissance that it would be very difficult to mitigate the Laguna de Bay eutrophication problem, since the lake is shallow and human activity on the shore discharges huge amount of wastes into the lake. On the hand, the staff suggested that water resources development of the Laguna de Bay might be possible, if water from the eastern part of the lake, or the inflow from the Pagasanjan River is taken through a pipeline to Metro Manila. However, it seems that there are two (2) drawbacks with respect to this suggestion. One is that the intake of fresh water from inflow to the Laguna lake will lead to a further worsening of the water quality of the lake and the occurrence of adverse effect on the fishing industry in the lake. The other is that a costly pumping system is required to send water to Metro Manila, since the level of the intake is relatively low

I2.2.2 Field Reconnaissance to Davao River Basin

A field reconnaissance of Davao city was conducted in the latter part of July, during which the environmental survey group visited the regional office of the Department of Environmental and Natural Resources (DENR) to gather the information on water quality of the Davao River, NIPAS restrictions, the soil erosion situation, deforestation, and endangered plant and animal species. The environmental survey group also performed a field reconnaissance at the Davao River.

Upon arrival at Davao, the environmental study team visited the regional office of the DENR and collected useful information/data. According to the information obtained therefrom, the various mapping for the area of Region XI, including data/information on topography, land cover, watershed, drainage, infrastructure, land-use, and soil erosion, which are considered very useful for the Study, are now under preparation. In addition, it was disclosed that those maps are going to be made available at the end of June 1997. The Environmental and Water Quality Division of the regional DENR office provided the Study Team with the "Proposed River Classification of Davao River", which includes the general description of Davao River, the uses of the river, the present condition of the river, the eight (8) monitoring stations along the stretch of Davao River and its water quality. The team was informed by the staff of the Protected Areas and Wildlife Division of the regional DENR office that there are no protected

areas or under NIPAS law along the Davao River. The other information obtained during the field reconnaissance was the list of rare and endangered species of wildlife (flora and fauna) and the NIPAS ACT (RA#7586) with implementing rules and regulations.

The environmental survey team conducted a field reconnaissance of the Davao River at the following locations:

- (Brgy. Gumagalang): The Davao River, approximately 50 km distant from the city proper, and 20 m upstream from the confluence with the Tamogan River and Gumalang Creek. The Tamogan River, approximately 50 km upstream of the confluence with the Davao River.

- (Brgy. Kibangay)
  Suawan Bridge: The Suawan River, approximately 7 km upstream of the above location or 5 km distant from the confluence with the Davao River.

- (Brgy. Tigatto)
  Davao Bridge: The Davao River, approximately 5 km upstream from the mouth of the Davao River.

- (City Proper)
  Bustolan Bridge: The Davao River, approximately 500 m upstream of the mouth of the Davao River

After the site visit, the environmental survey group discussed with the staff of the regional office about the water resources management of the Davao River basin. It was suggested through the discussion that taking water from upstream of the Davao River and sending it through a pipeline to Davao City is advisable, because the slope along the Davao River enables water conveyance via gravity and without pumping. The water contamination caused by agricultural chemicals is also avoidable in this case.

13 Planning Factors for the Water Resource Management

The planning factors required for the water resources management are examined with reference to the Water Resources Development Project Final Report and Guidelines on Water and Sustainable Development: Principles and Policy Options - Water Resources Series.

13.1 Water Conservation and Wastage Prevention through Demand Management

Economic measures (appropriate water pricing)

Water pricing plays an important role in the management of urban and rural water supply systems, because realistic water prices, when properly introduced and administered, can help ensure efficient use of water, meet operations and maintenance costs, recover capital investments, generate funds for extension of water supply services to other areas and protect the environment by reducing the quantity of wastewater. Concerning irrigation water use, water pricing for agricultural water also could significantly reduce the wastage of resources.

Non-economic measures (improvement of the water distribution system)

As the non-economic measures, the following ones are conceivable:

- Improvement of irrigation efficiency
- Prohibition of illegal connections
- Recycled water use
- Use of lower grade water
- Water saving devices

The improvement of water distribution systems includes leak detection, repair and maintenance of city water mains, and changes in plumbing codes and incentives that promotes water-saving devices such as low-volume flush toilettes and showers. The improvement of irrigation efficiency can be achieved through concrete channel lining, time-scheduling of water supply, and irrigation pond system setups. Institutional reforms such as the transfer of irrigation systems to user organizations should also be implemented. Vigorous detection and prosecution of illegal connections is needed to secure the water pricing measures' effectiveness, and the proper maintenance of city water mains. The recycling of water is a powerful measure to reduce water demand. Especially, the use of lower-grade water for non-potable uses such as industrial, sanitary purposes, irrigation of public parks and farmland is most desirable.

Water-saving devices are an essential element for managing water demand and are part of a larger water conservation strategy. Then, governments may intervene directly by installing water-saving devices or by offering a variety of subsidies to domestic and commercial users to encourage the rapid adoption of water-saving technologies. Where realistic water pricing is in effect, the use of water-saving devices is directly linked to the economic benefit of the users, and strong incentives are expected to work on water conservation. Because western and Japanese water distribution systems are accustomed to luxurious water consumption, innovative water-saving devices and strategies may be advisable.

I3.2 Water Quality Protection

The following measures are conceivable for the purpose of the water quality protection:

- Clean technology in industry
- Point source countermeasures such as municipal and industrial wastewater or sewage
- Non-point source countermeasures including sustainable agriculture, erosion control, and reforestation

The water quality protection should be a part of any water resources management plan, since available water resources can be increased with the improvement of water quality, and increased water consumption may cause the pollution of water resources and diminish the available water resources. There are several measures for water quality protection, and these are shown below. Clean technology in industry is a generic term that applies to any improvement in the industrial process, either in the manufacturing process or the handling of wastes, which achieves a net environmental benefit. This may include substitution of raw materials with recycle or less polluting materials, changes in manufacturing processes that reduce wastes or enhance energy efficiency, recycling of water and other fluids used in manufacturing processes, recovery of thermal energy and other by-products that can be reused or sold, integration of industrial activities where one manufacturing process can use another's by-products, and more efficient handling of wastes.

Point source counter-measures includes municipal and industrial wastewater handling. Usually, it is said that point source countermeasures are easier than the non-point source countermeasures to monitor and manage. A swifter improvement can be attained with point source countermeasures. Therefore, application of point source countermeasures is strongly advisable. However, because many municipalities in the Philippines lack proper sewerage pipelines, the construction of sewerage systems may be acute subject. The reduction of pollutants from non-point sources has not effectively been tackled until now, not only in the developing countries but also in western countries and Japan. This is because such non-point source countermeasures demand the cooperation of the common people. The mobilization of these people with regard to pollutant reduction is usually more difficult. However, water quality protection cannot be attained with only point-source countermeasures and such non-point source countermeasures as sustainable agriculture for nutrients and agricultural chemical control, erosion control and reforestation to reduce the turbidity of water should be emphasized.

I3.3 Groundwater Management

The following measures are conceivable for the groundwater management:

i) Control of the groundwater exploitation through drilling and water abstraction permit/license, levy charge, monitoring
ii) Conjunctive use of surface and groundwater which enables recharging of groundwater
iii) Land zoning and land use restriction
iv) Reforestation

Groundwater management should be conducted from the standpoint of quantity and quality conservation. First, the control of groundwater exploitation with such measures as drilling and water abstraction permit/licenses, levy charges and monitoring. These measures are, basically, to take the balance of water rights and its duty, and restrict the free-rider usage of groundwater. Recharging of groundwater is also advisable if proper clean surface water can be secured. Levied charges for groundwater exploitation can be used to meet the recharging costs. Land zoning and land use restrictions in groundwater recharge areas are advisable to maintain quantity and quality conservation. Reforestation may be effective for the recharge of the groundwater, and its implementation is also recommended.

I4 Maintenance Flow Estimation

I4.1 Concept of Maintenance Flow

In determining the river maintenance flow, such factors as navigation, fishing, picturesque scenery, salt water intrusion, clogging of the river mouth, riparian structures, groundwater tables, flora and fauna, river water quality need to be considered to maintain the normal function of the river. In the case of the Master Plan Study on the Cagayan River Basin Water Resources Development, which was carried out under JICA in 1987, a specific discharge of 0.0046 $m^3/sec/km^2$ is applied to the respective reference points selected for the water balance study in consideration of the aforesaid aspects.

In the present investigation stage, the methods to estimate the river maintenance flow are examine with reference to those practiced in Japan and other countries. In the Philippines, at least 10 % of the dependable flow of the river are assumed as the required minimum maintenance flow. However, no detailed study has been performed yet to further refine such assumption. What the NWRB has done so far is the recommendation of tentative criteria for the minimum stream flow of rivers and streams and/or minimum water levels of lakes to be considered in the allocation and appropriation of waters for purpose of fish conservation, water quality control and environmental protection. The basic idea and framework of maintenance flow is given in the Guidebook on Maintenance and Water Supply Flow Study proposed by the Japanese Ministry of Construction (MOC), River Bureau, in 1992.

This guidebook says that the maintenance flow is set from the standpoints of navigation, fisheries, scenery view of flow, control of the salt water intrusion, prevention of river-mouth clogging, safety of equipment and facilities in flow, maintaining the groundwater level, preservation of flora and fauna, and making the flow water clean. From the engineering standpoints, three (3) of these items, fisheries, scenery view of stream flow, and preservation of flora and fauna are the most difficult to be quantified, but they suffer a severe impact from the decreased flow after the implementation of the water resources development projects, and must be regarded as essential water environment factors. As the maintenance flow concerning fisheries and the preservation of flora and fauna are lumped as the one for the ecosystem preservation, the following two items were studied:

i) Maintenance flow for the scenic view of flow (SVMF),
ii) Maintenance flow for ecosystem preservation (EPMF).

The estimation method of SVMF is explained in detail in the Guidebook of the Japanese MOC, the River Bureau, and its brief explanation is given herein. EPMF is also explained in this guidebook. The maintenance flow will be set at the reference points on the river that represent each sections with similar flow characteristics along a river. Usually, the locations of the existing stream gauging stations and water quality monitoring places are chosen for the purpose.

I4.2 Maintenance Flow for Scenic View of Flow (SVMF)

The necessary steps for the setting of SVMF are as follows:

- Choose the reference points along the river,

- Set the criteria to judge the scenic view of flow,
- Set the SVMF at the reference points.

I4.2.1 Selection of the Reference Points along a River

The reference points for SVMF, which satisfy the following three items are selected;

- Representative scenic viewpoints of the river and/or noted places.
- Points that are viewed by many people, while walking, sightseeing, or other recreational activities.
- Points where scenery view changes drastically as the flow rate changes, such as waterfalls, thin depth flow where the riverbed tends to be exposed as the flow rate changes, and gently sloped cross section such as sandbar where the width of water surface changes greatly as the flow changes.

I4.2.2 Criteria to Judge the Scenic View of Flow

The criteria to judge the scenic view of flow are set so that the observer watch the river downward along the river flow and takes a photo of this. The angle of depression is less than 5 degree. The value of "W/B" is equal or more than 0.2, where "W" is water surface width in meter and "B" is the river width in meter. For smaller rivers, the value of "W/B" can be derived from the river cross-sectional diagram, as the layout of these rivers is easy to see. The relationship between the contentment degree of people concerning the flow and "W/B" values is obtained from the psychological experiment performed in Japan. Discontentment is proved to be negligible if the value of "W/B" is equal or more than 0.2.

I4.2.3 Setting the SVMF at Each Reference Point

For each of the SVMF reference points, the equation showing the relationship between the flow rate and water width is established. The value of the water width (W) is given using the criterion explained in (b) above, and the SVMF will be obtained with the equation and "W" value.

I4.3 Maintenance Flow for Ecosystem Preservation (EPMF)

The EPMF setting is applied to the case of fishes' preservation. In the method, fish are selected as the object of study for ecosystem preservation for the following reasons:

i) Fish are relatively large and occupy the upper level in the food chain pyramid. They are indispensable actors in the river recreational activities of people and are regarded as an important resource of fishery.
ii) Hydrodynamic data or information of habitation condition is obtained, at present, only from fish.
iii) Birds also utilize the rivers for feeding, nesting, resting, and so on. However, these activities are regarded not to be in close relationship with the flow rate.
iv) Many small animals such as waterborne insects are in close relationship with fishes. Study on fish may cover the conditions of these small animals.
v) Preservation of other scarce and valuable living species can be dealt with the

planning of the river configuration, and not the flow augmentation, in most circumstances.

The necessary steps for the use of EPMF are as follows:

- Set the fish species for study
- Set the criteria to judge the ecosystem preservation
- Choose the reference points along a river
- Set the EPMF at the reference points

I4.3.1 Setting the Fish Species for Study

The study by means of the EPMF is carried out for the fishes, which are reported to exist in the river. The fish species, which have a close relationship with the shoals of river are recommended to be selected, since the living conditions of fishes change most drastically as the river flow changes in these shoals.

In Japan, some fish chosen from 12 species are usually set as the object of study, and scarce species are also included. Although as a matter of course the fish in the Philippines are different from those in Japan, it is strongly recommended that fish species that can serve as the representative indicator are selected. The procedures applied to twelve (12) fish in Japan are presented to show the EPMF setting method. The setting of EPMF is performed for each of reference points along a river. Choosing of the reference points will be explained hereinafter. The 12 species usually selected for EPMF study in Japan are *Salvelinus leucomaenis f. pluvius, Salvelinus leucomaenis, Salmo (Parasalmo) masou masou, Salmo (Parasalmo) masou macrostomus, Salmo (Oncorhynchus) keta, Plecoglossus altivelis altivelis, Leuciscus (Tribolodon) hakonensis, Zacco platypus, Zacco temminckii, Cottus pollux, Cottus nozawae, and Sicyoplerus japonicus.*

I4.3.2 Criteria to Judge the Preservation of 12 Fishes

The criteria to judge the preservation of the 12 fish species are given in Table I-2. Setting of the values in the criteria may be made on a whole year basis, when the values for the most severe conditions during a year (in short, the maximum flow rate) is set for all the year round, or on the seasonal basis, where values are set depending on the growth steps of fish. These two setting modes are selected depending on the flow condition of the rivers. Table I-3 shows an example of the EPMF setting on the seasonal basis. This example also considers the 5 sections (reference points) along a river. This example explains how to set the criterion values out of the very limited and sometimes duplicated information on the living conditions of the fish. The values are based on the data given in Table I-2. The value setting principle is as follows;

i) When a flow condition is shown as a span of water depth (cm) or water velocity (cm/sec), usually the lower limit value is chosen. If only the maximum value is shown for the span, values on other growth steps of the fish may be used for setting.
ii) When more than two values are given in each data source, more severe values (in short, larger value) will be chosen.
iii) When no data is given for a fish species, the data for other fish with similar

characteristics is used. When no data is given for some growth steps of a fish species, data on other growth steps of the fish may be used.

I4.3.3 Selection of Reference Points along a River

The EPMF setting points are chosen on more than two shoals of each section of a river. The principle of the selection is as follows:

- Choose the shoals where the fishes on study utilize as the main living site (fishing ground),
- Choose the shoals where the fishes on study utilize as the spawning site,
- Typical shoals during the section, and
- Recreational site where activities of the fishes are observed.

The flow rate of the EPMF is set for each point of a river using the flow-velocity and flow-depth equation, where the velocity and depth of the river is already known as explained in (b) above. In case the values obtained from the flow-velocity and flow-depth equation are different, the larger one for EPMF is selected. In Table I-3, the river flow derived by multiplying the velocity by mean water depth is shown on the bottom line. The values ranging between 0.03W and 0.18W may be used as the first estimation of the EPMF. Sometimes, the velocity (0.1-0.5 m/sec) x depth (0.5-0.1 m) x width (W (m)) is assumed to be approximately an EPMF of 0.05 * W (m^3/sec) in the smaller streams to enable the prompt estimation method. Needless to say, it is important to maintain the exact river hydraulic condition and high dissolved oxygen level, recover the series of shoals and depths configuration, present the hiding spaces for fishes, and re-grow the plants along the river edge.

I4.3.4 Other EPMF Setting Method on the Reconnaissance Planning Stage

Amended Tennant Method

Select the points important for the fish at each live step such as shoals. Observe the living conditions of the fish at various depth, velocity, and width. Tabulate the results of living conditions with the percentage value of the mean yearly flow.

Wet Length Method

Figure I-1 shows the relationship between the wet length (m) of a river cross section and the flow rate (m^3/s). The wet length method (Nelson 1980) tells that flow rate at the curvature changing point may be used for the EPMF. This method assumes that the habitation area is proportional to the wet length. Because increase of flow rate over the curvature changing point does not yield a significant increase in wet length, this curvature changing point may point out the minimum value for the fish sound living. For this method, usually shoals of rectangular cross section are chosen for setting point.

The aforementioned EPMF setting method is only for the reconnaissance planning purposes in the first stage, and does not present sufficient information for solid negotiation. The method, which can show the relationship between the flow rate and the quantity of living site of the fish, is necessary to cope with the solid negotiations. There are two types of methodology for this purpose. One type is the statistical method, which analyzes the statistical relationship of flow rate change with the mass of living fish. Another type studies

the relationship of flow with some river fluid indicators that have the close relation to the fish ecology.

Habitat Quality Index Method (HQI method) (Binns, 1982) is one example of the statistical method, which presents the statistical correlation equation of fish number with many factors in the state of Wyoming, USA. This method can be applied for a river with sufficient data, and it is valid in the flow range where the equation is gained.

Physical Habitat Simulation System (PHABSIM) (Boove and Milhous, 1978) is one example of the model that presents the relationship of flow with some river fluid indicators and their close relation to fish ecology.

PHABISIM is a calculation model of available quantity of microhabitats for various living species of each life step, at each flow level. A cross section and other observed data for the characteristics of the fishes living sites, fluid indicator value for the state of the living sites, and the Suitable Index which calculate the quantity of the available living sites for each flow rates, are necessary for this method. Figure I-2 is an example of the output of this method, which shows how the increase or decrease of flow will effect the quantity of living sites (available living site area per unit river length).

This method is thought to be the best method before the IFIM method, however there exist some difficult points:

First, sometimes it is difficult to make consensus on these Suitability Index or curve. This method has also been criticized for omitting the interference effects between species.

PHABISM is an incremental method, because it relates the change of the living site quantity with the change of the flow rate. However, it negates the dynamic characteristics of the living sites, which change time to time.

Instream Flow Incremental Methodology (IFIM Method)
The IFIM method makes a time series output of the available living sites area as shown in Figure I-3, with the computer aided calculation using the macroscopic living sites data, microscopic living sites data and the time series flow data. In the macroscopic living site calculation, such data as water quality, river way configuration, flow rate, and water temperature are treated. In the microscopic living sites calculation, water depth, water velocity, river bottom materials, and covering materials which are used in the PHABSIM method are also used.

Figure I-3 also shows the observed change of the number of living fish. The number of living fish follows each minimum values of the available living sites area, and not the time series of the available living sites area itself.

This method can be applied for the past flow data to gain the change of the available living sites area. With these output, such question can be answered with a clear value, as the available living sites area for 90% of the period, statistical median of the living sites area, the decrease of the living sites area with the 20% decrease of flow rate during the wet season, and so on. Alternatively, duration of the living sites available can also be obtained with this method. Figure I-4 shows one of these examples, which shows that at the baseline condition at least 15.5 units living sites are available for 90% duration, while after the proposed water

taking plan implementation this level living sites units are available for only 15% duration.

The estimation of the number of the living fishes with this method is currently on study, and is said to be possible near future.

The IMIF method requests a very long period of fish activity observation. Sometimes more than 20 years are demanded, and therefore this method is not suitable for the reconnaissance planning study on the first stage.

I5. Environmental Legal System in the Philippines

With regard to the environmental legal systems in the Philippines, the following five (5) items were studied in the present study stage:

i) Environmental Impact Statement (EIS) System
ii) Water Quality Classification of Fresh Surface Waters
iii) Soil Erosion
iv) Deforestation
v) National Integrated Protected Areas System (NIPAS)

I5.1 Environmental Impact Statement (EIS) System

I5.1.1 Environmental Critical Projects (ECPs) and Environmental Critical Area (ECA)

The Philippines Environmental Impact Statement (EIS) System was established by virtue of Presidential Decree (PD) No.1586, 1979. The Department of Environment and Natural Resources (DENR) is the government organization responsible for the execution of the system.

The basic DENR policy governing the implementation of the Philippine EIS system is to attain and maintain a rational and orderly balance between socioeconomic growth and environmental protection. The policy objective is to be achieved through the sustainable use, development, management, renewal and conservation of the country's natural resources, including the protection and enhancement of the quality of the environment, not only for the present but for the future generations as well. In consonance with this basic policy, the objectives of DAO 96-37 are set as follows:

i) Ensure that environmental considerations are incorporated at the earliest possible stage of project development.
ii) Further streamline the current procedures in the conduct of the Environmental Impact Assessment (EIA) in order to improve its effectiveness as a planning, regulatory and management tool.
iii) Enhance maximum public participation in the EIA process to validate the social acceptability of the project or undertaking so as to ensure the fullest consideration of the environmental impact of such project or undertaking.

The EIS system covers projects and undertakings categorized as Environmentally Critical Projects (ECPs) and projects located in Environmentally Critical Areas (ECAs). An ECP covers projects that have a high potential for negative environmental impacts.

Under the DAO 96-37, the projects and undertakings shown in Table I-4 are defined as ECPs. An ECA is an area that is considered ecologically sensitive. An area is subject to ECA if it exhibits any of the characteristics shown in Table I-5.

I5.1.2 Environmental Compliance Certificate (ECC)

All projects or undertakings falling within the category of ECP or projects sited within ECAs

are required to first secure an Environmental Compliance Certificate (ECC) prior to construction and operation. An ECC is a document issued by the DENR Secretary or the Regional Executive Director certifying that, based on the representations of the proponent (of the project) or prepares (of the necessary documents), as reviewed and validated by the Environmental Impact Assessment Review Committee (EIARC), the proposed project or undertaking will not cause significant negative environmental impacts, and that the proponent has complied with the requirements of the IS system.

The proponents who wish to undertake a project that is within the definition of ECPs, regardless of their location, must prepare an Environmental Impact Statement (EIS). This document will be submitted to the Environmental Management Bureau (EMB) of DENR, as the basis for the review and eventual issuance or denial of an ECC by the DENR Secretary. For ECPs, it is the EMB that is responsible for implementing the EIS system.

The proponents whose projects are located within ECAs will be required to submit an Initial Environmental Examination (IEE) to the concerned DENR Regional Office (DENR-RO), without prejudice to the decision of the Regional Executive Director (RED) to further require the proponent to submit an EIS. In accordance with the aforesaid DAO 96-37, however, the proponent of a project within an ECA may immediately opt to prepare and submit an EIS to the DENR-RO in place of an IEE. This is advisable in cases when the nature of the project will cause significant environmental impacts or has a scale and magnitude that already requires an EIA, but is not listed as an ECP. The IEE or EIS will be the basis for the review and issuance or denial of ECC by the RED.

I5.1.3 Eligible Preparers of EIS and IEE

The EIS/IEE is allowed to be prepared by the proponent's technical staff or a professional group commissioned by the proponent, provided that they are duly accredited by the EMB. The participation of any DENR personnel, in any manner whatsoever, directly or indirectly, in the preparation of the EIS or IEE, is strongly prohibited. At the minimum, any individual who has attained a Bachelor's degree in engineering, natural, physical or social sciences can apply for accreditation

I5.1.4 EIS for ECP and Scoping

All projects that meet the definition of an ECP, regardless of all their location, must prepare an EIS. The EMB of DENR shall be responsible for the review and processing of EISs for ECPs. The aforesaid DAO defines scoping as the stage in the EIS system where information and assessment requirements are established to provide the proponent with the scope of work for the EIS. It is the first and most critical step in the EIS process since this is where most of the key issues and concerns in the EIS are discussed, clarified and agreed upon among the key actors concerned.

More importantly, it prepares the proponent in handling the issue of social acceptability, which is a critical requirement in the ECC application. It is here where a proponent can already determine whether his or her project will experience "rough sailing" or difficulty in getting the approval and support of the local community.

Because of the characteristics of the scoping, social preparation activity by the proponent, prior to the scoping session, is advisable in cases when the project is controversial, large-scale, covering a huge area and will cause significant environmental impacts, if not properly mitigated. This social preparation activity basically involves awareness building about the project or program in terms of its goals, rationale, objectives, components and activities by means of public information campaigns, barangay fora and consultations, informal dialogues with community leaders, and others. It aims to inform and consult the concerned public about their participation, role and responsibilities in the proposed program or project. During social preparation activity, information about the project can be disseminated through the following:

i) Conduct of an information campaign to let people know about the project, the proponent, the scoping process and the expected outputs. The communication expert leads in the design and delivery of the information education program.

ii) Information dissemination program may consist of field visits to the project site, meetings with traditional and political leaders, informal dialogues with community members and community meetings or "talakayang barangay".

iii) Actual visits should be complemented with a selection of information and education campaign materials such as film or video showing, printed media or local radio. Other forms of information dissemination include streamers, exhibits and leaflets/flyers.

The scoping report forms part of the final EIS and serves as the primary reference of the EIA and the review process. At the minimum, it should cover the issues and impacts outlined in the scoping guidelines prepared by EMB for ECPs. The guideline for impact assessment of major dams is not presented until now.

I5.1.5 IEE of Projects within Environmentally Critical Area

An Initial Environmental Examination (IEE) has to be carried out for the projects or undertakings cited in Environmentally Critical Areas (ECAs). In addition, Republic Act 7586, referred to as the National Integrated Protect Areas System Act of 1992 (NIPAS), provides for a comprehensive system of protected areas within the category of national park encompassing the following:

- Strict nature reserve
- Natural park
- Natural monument
- Wildlife sanctuary
- Protected landscape & seascape
- Resource reserve
- Natural biotic areas
- Other categories established by law, conventions or international agreements which the Philippine Government is a signatory

Since many of the defined ECAs have not been spatially identified and delineated on the map,

the proponent is advised to undertake the following, in order to determine whether a project/undertakings falls within an ECA:

i) Prepare a project location map/sketch map showing the site relative to the political boundaries (barangay/municipality/province) including important natural features and landmarks of surrounding/adjacent areas such as rivers/lakes and other water bodies, road network, known buildings and others.
ii) Inquire/check with the CENRO covering the municipality whether the project falls within an ECA. The same inquiry can also be done with the Municipal Planning and Development Officer (MPDO) of the concerned municipality where most proponents would first visit to inquire about local permits required for a project or undertaking. The MPDO can refer the proponent to the CENRO or DENR-RO for verification of the project site.
iii) A certification may be obtained from the CENRO confirming that the project site is indeed within an ECA, in order to facilitate project screening at the DENR-RO.
iv) At the DENR-RO, project screening shall be done for projects whose proponents are not certain of their location in an ECA. If project is considered not covered by the EIS system, the certificate of non-coverage will be issued upon request by the DENR RED/EMB.

An IEE is a document required of proponents describing the environmental impacts of, and mitigation and enhancement measures for, projects or undertakings located in an ECA. Pursuant to Section 18, Article III of DAO 37, only accredited consultant/firms can prepare the IEE.

Because the IEE is not a full-scale assessment, information may come primarily from existing reports/studies supplemented by some field data and consultations with affected stakeholders.

I5.2 Water Quality Classification of Fresh Surface Water

Human settlement, industry and agriculture are thought to have considerably polluted both inland and coastal waters. Domestic sewage contributes approximately 52% of the pollution load while industry contributes the remaining 48% (DENR). This continuing pollution could seriously compromise the country's water resources' potential for domestic, agriculture and industrial uses.

The Philippines government has performed vigorous monitoring on the rivers in Metro Manila, such as the Pasig River, the Markina River, the Sun Juan River, the Paranaque River and the Tullahan-Tinajeros River. This monitoring result shows very high BOD values and low DO values, both indicate the non –treated municipal sewage flowing in. And some monitoring has performed on the rivers in Luzon outside Metro Manila, and on other rivers in Visayas and Mindanao, at the downstream of these rivers. These results also show the contamination with domestic, industrial and agricultural effluents.

However, the water quality data at the upstream of rivers are very limited. These data are, indeed, acutely necessary to judge the water quality of rivers at the proposed dam sites. Two (2) methods are employed to judge the water quality of rivers at the proposed dam sites, in such a situation of scarce water quality data.

i) The Philippines government designated the list of classified rivers outside Metro Manila, and this information may be utilized to judge the water quality, especially when the water is developed for municipal and industrial purposes.
ii) Population and land usage at the upstream of the dam sites. Many populations means much domestic effluent, and this effluent must cause the water quality deterioration.

The quality classification of waters is shown in Table I-6. The list of officially classified rivers, excluding those of Metro Manila, as of 1997, is tabulated in Table I-7, in which the rivers rated at class-AA and class-A are judged to be suitable for municipal water supply. As a result, almost half of the river shown in Table I-7 could still be tapped for drinking water, requiring only approved disinfection to meet the National Standards for Drinking Water (NSDW).

I5.3 Soil Erosion

In the 1993 study of the Bureau of Soils and Water Management, approximately 5.2 million ha or 17.3% of the country are classified as severely eroded, 8.5 million ha or 28.3% as moderately eroded and 8.8 million ha or 29.3% are slightly eroded area as shown in Table I-8. The total eroded area (5.2+8.5+8.8) is 22.5 million ha, or 75% of the total land area of the Philippines (30 million ha). The land areas with no apparent erosion cover only 7.1 million ha or 23.7%, while 0.4 million ha or 1.3% are unclassified. Of the severely eroded areas, Mindanao Island has the biggest share of 2.4 million ha or 46.1%. In Luzon Island most of eroded areas are categorized into the moderately and slightly eroded areas.

I5.4 Deforestation

In the Philippines, forests are among the most diverse in the world. However, they are also among the most endangered. The county's forests have been steadily shrinking, at an average rate of 2% per annum, resulting in adverse impacts to the environment and shortage in raw materials supply for the wood-based industries. The 27.5 million ha of virgin forests in 1575 has been reduced to 0.8 million ha in 1994. Of the country's total land area of 30 million ha, about 15.8 million ha are considered forest lands. About 15.0 million ha or 94.4% have been classified as of 1995, while the remaining 881,157 ha or 5.6% remain unclassified as shown in Table I-9. The classified forest lands are further categorized into forest reserves (21.8%), timberlands (66.76%), national parks (8.94%), military and naval reservations (1.11%), and fishponds (0.5%).

Table I-10 shows the trend of the commercial forests area and the forest type composition. It shows the average forest-decreasing rate of 2% between 1990 and 1994. In 1989, the Philippines had 6.3 million ha of natural forest or 21% of the total land area of 30 million hectares. As Table I-11 shows, only 5.6 million ha or 19% of the total land area remain under forest cover, or it decreased at an annual ratio of 2% after 1989 as shown in the Table I-10.

Over the years, the forests in the Philippines have been subjected to unabated destruction as

shown in Table I-11. The principal causes have been illegal logging, shifting cultivation, forest fires, natural calamities, as well as, conversion to agricultural lands, human settlements, and other land uses brought about by urbanization and increasing population pressure. From 1989 up to 1995, the annual average rate of deforestation has been estimated at 0.13 million ha. In contrast, reforestation efforts have hardly kept pace with deforestation. In 1990, reforestation efforts by the Government and private institutions totaled 0.1 million ha. In the subsequent years, figures have diminished. However, reforestation statistics picked up significantly in 1995.

The Government utilized a combination of permitting, socio-economic interventions, reforestation efforts and conservation measures to manage the remaining forest resources as well as rehabilitate degraded forestlands for the period under review. The Forest Management Bureau still took the initiative in the monitoring and evaluation of all regional projects under the forestry sector, as well as, operations of forest users to ensure more effective conservation of the forest resources and to determine strict compliance to forestry laws, rules and regulations and conducted inventory/evaluation of timber resources within areas under expiring Timber License Agreements (TLAs). The number of TLAs, which have been issued since 1920s has been steadily declining over the years. In 1990, the Forestlands Management Agreement (FLMA) was instituted to ultimately supplant/ eliminate all TLAs as the latter have become controversial. Illegal logging is being claimed to stem from them.

The FLMA is a new scheme of lease agreement granted primarily to local communities whose reforestation contracts have expired, as well as, upland dwellers who would qualify as reforestation contractors. It is meant to better manage and protect areas under contract reforestation. The FLMA is a 25-year contract renewable for another 25 years. Under this scheme, the beneficiary also acts as a full-time forest manager, whose duty is to manage the tree farm and care for the young trees until they mature. In the interim, FLMA holders are allowed to plant cash crops or short gestation fruit trees. Products from such inter-cropping accrue to them.

Reforestation still remained one of the major programs of the forestry sector. A total of 39 foundations/community-based groups have availed of and were awarded Community Forest Stewardship Agreements in 1994 under the Community Forestry Program (CFP) covering 94,916 ha and involving 18,140 beneficiaries. The CFP is envisaged to be a mechanism for joint management of the forest with the communities. Program components include community organizing and training, contract reforestation, upland development through Integrated Social Forestry (ISF), sustainable forest resources utilization, timber stand improvement (TSI), assisted-natural regeneration (ANR), forest protection and conservation, and development of alternative livelihood schemes for the upland communities.

Based on preliminary data of the Forest Management Bureau as of June 1996, it is estimated that for 1995 the Government sector has reforested a total of 21,841 ha, while the private sector has reforested a total of 43,392 ha. Forest plantation and tree farm development also showed positive growth. In December 1994, there exist 227 Industrial Forest Plantation Management Agreements (IFMAs) and Industrial Tree Plantation Lease Agreements (ITPLAs) covering a total of 516,000 ha. Agroforestry farm leases numbered 86 covering 99,000 ha while tree farm lease agreements totaled 120 covering 17,000 ha. The Integrated Social Forestry Program (ISFP) allows farmer-residents of upland communities to utilize,

process and sell forest products within residual forests through a 25-year Community Forest Management Agreement (CFMA), renewable for another 25 years. The program hopes to gradually transfer the protection and management of residual forests to organized communities.

Nine (9) watershed forest reserves covering a total area of 88,082 ha were proclaimed in 1994. These proclamations brought to 108 in the total number of watershed forest reservations with an aggregate area of 1.355 million ha at the close of 1994. The DENR is expected to delineate around 40% of the total land area of the country to constitute the final forest line. The remaining 800,000 ha of old-growth forests of the country will have to be identified and delineated/demarcated on the ground within a period of 3 years. This is in line with the provisions of the NIPAS Law ,which classifies old-growth forests as part of the protected areas of the country.

I5.5 National Integrated Protected Areas System (NIPAS)

I5.5.1 An Outline of National Integrated Protected Areas System (NIPAS)

The passage of Republic Act No. 7586 or the National Integrated Protected Areas System (NIPAS) Act of 1992 is an explicit recognition of the need to protect and maintain what remains of the country's biodiversity. It declares to secure the perpetual existence of all native plants and animals through the establishment of a comprehensive system of integrated protected areas within the classification of national park as provided for in the Constitution. The National Integrated Protected Areas System (NIPAS) encompasses outstandingly remarkable areas and biologically important public lands that are habitats of rare and endangered species of plants and animals, biogeographic zones and related ecosystems, whether terrestrial, wetland or marine, all of which shall be designated as "protected areas".

In the NIPAS, the following areas are categorized into the protected areas:

i) Strict nature reserve,
ii) Natural park,
iii) Natural monument,
iv) Wildlife sanctuary,
v) Protected landscape and seascape,
vi) Resource reserve,
vii) Natural biotic areas, and
viii) Other categories established by law, conventions or international agreements which the Philippine Government is a signatory.

The aforesaid protected areas are defined in the NIPAS as follows:

- "Protected Area" refers to identified portions of land and water set aside by reason of their unique physical and biological significance, managed to enhance biological diversity and protected against destructive human exploitation
- "Buffer zones" are identified areas outside the boundaries of and immediately adjacent to designated protected areas that need special development control in order to avoid or minimize harm to the protected area

- "National park" refers to a forest reservation essentially of natural wilderness character which has been withdrawn from settlement, occupation or any form of exploitation except in conformity with approved management plan and set aside as such exclusively to conserve the area or preserve the scenery, the natural and historic objects, wild animals and plants therein and to provide enjoyment of these features in such areas
- "Natural monuments" is a relatively small area focused on protection of small features to protect or preserve nationally significant natural features on account of their special interest or unique characteristics
- "Natural biotic area" is an area set aside to allow the way of life of societies living in harmony with the environment to adapt to modern technology at their pace
- "Natural park" is a relatively large area not materially altered by human activity where extractive resources resource uses are not allowed and maintained to protect outstanding natural and scenic areas of national or international significance for scientific, educational and recreational use
- "Protected landscape/seascapes" are areas of national significance which are characterized by the harmonic interaction of man and land while providing opportunities for public enjoyment through the recreation and tourism within the normal lifestyle and economic activity of these areas
- "Resource reserve" is an extensive and relatively isolated and uninhabited area normally with difficult access designated as such to protect natural resources of the area for future use and prevent or contain development activities that could affect the resource pending the establishment of objectives which are based upon appropriate knowledge and planning
- "Strict nature reserve" is an area possessing some outstanding ecosystem, features and/or species of flora and fauna of national scientific importance maintained to protect nature and maintain processes in an undisturbed state in order to have ecologically representative examples of the natural environment available for scientific study, environmental monitoring, education, and for the maintenance of genetic resources in a dynamic and evolutionary state
- "Wildlife sanctuary" comprises an area which assures the natural conditions necessary to protect nationally significant species, group of species, biotic communities or physical features of the environment where these may require specific human manipulations for their perpetuation.

I5.5.2 Establishment and Extent of the System

The establishment and implementation of the system shall involve the following:

i) All areas of islands in the Philippines proclaimed, designated or set aside, pursuant to a law, presidential decree, presidential proclamation or executive order as national park, game refuge, bird and wildlife sanctuary, wilderness area, strict nature reserve, watershed, mangrove reserve, fish sanctuary, natural and historical landmark, protected and managed landscape/seascape as well as identified virgin forests before the effectivity of this Act are hereby designated initial components of the System. The initial components of the System shall be governed by existing laws, rules and regulations, not inconsistent with this Act (The list of the initial components are in Table I-12);

ii) Within 1 year from the effectivity of this Act, the DENR shall submit to the Senate and the House of Representatives a map and legal descriptions or natural boundaries of each protected area initially comprising the System.

iii) -

iv) Within 3 years from the effectivity of this Act, the DENR shall study and review each area tentatively composing the System as to its suitability or non-suitability for preservation as protected area and inclusion in the System according to the categories established in Section 3 hereof and report its findings to the President as soon as each study is completed. (This study has not completed yet)

I5.5.3 Buffer Zones

The NIPAS specifies that, for each protected area, the peripheral buffer zone has to be established when necessary, to protect the same from activities that will directly and indirectly harm it. Such buffer zones shall be included in the individual protected area management plan mentioned below that shall prepared for each protected area.

I5.5.4 Management Plan

The NIAPS set up a general management planning strategy to serve as guide in formulating individual plans for each protected area. The management planning strategy aims, at the *minimum*, promote the adoption and implementation of innovative management techniques including if necessary, the concept of zoning, buffer zone management for multiple use and protection, habitat conservation and rehabilitation, diversity management, community organizing, socioeconomic and scientific researches, site-specific policy development, pest management, and fire control.

The management planning strategy have to also provide guidelines for the protection of indigenous cultural communities, other tenured migrant communities and sites for close connection between and among local agencies of the Government as well as the private sector.

i) Strict Protection Zone: Areas with high biodiversity value which shall be closed to all human activity except for scientific studies and/or ceremonial or religious use by indigenous communities.

ii) Sustainable Use Zone: Natural areas where habitat and its associated biodiversity shall be conserved but where, consistent with the management plan and with PAMB approval:

- Indigenous community members and/or tenured migrants and/or buffer zones residents may be allowed to collect and utilize natural resources using traditional sustainable methods that are not in conflict with biodiversity conservation requirements;
- Research, including the reintroduction of indigenous species, may be undertaken; and
- Park visitors may be allowed limited use. Provided, no clearing, farming, settlement, commercial utilization or other activities detrimental to biodiversity conservation shall be undertaken. The level of allowable activity can be expected to vary from one situation to another.

iii) Restoration Zone: Areas of degraded habitat where the long term goal will be

restore natural habitat with its associated biodiversity and to rezone the area to a more strict protection level.

iv) Habitat Management Zones: Areas with significant habitat and species values where management practices are required periodically to maintain specific non-climax habitat types or conditions required by rare, threatened or endangered species. Examples would be forest openings for the Tamara or brushy forest.

v) Multiple-Use Zones: Areas where settlement, traditional and/or sustainable land use, including agriculture, agro-forestry, extraction activities and other income generating or livelihood activities, may be allowed to the extent prescribed in the management plan. Land tenure may be granted to tenure residents, whether indigenous cultural community members or migrants.

vi) Buffer Zone: Areas outside the protected area but adjoining it that are established by law and under the control of the DENR through the Park Area Management Board. These are effectively multiple-use zones that are to be managed to provide a social fence to prevent encroachment into the protected area by outsiders. Land tenure may be granted to occupants who qualify. Buffer zones should be treated as an integral part of the protected area in management planning.

vii) Cultural Zones: Areas with significant cultural, religious, spiritual or anthropological values where traditional rights exist and ceremonies and/or cultural practices take place.

viii) Recreational zones: Areas of high recreational tourism, educational, or environmental awareness values where sustainable eco-tourism, recreational, conservation education or public awareness activities may be allowed as prescribed in the management plan.

ix) Special Use Zone: Areas containing existing installations of national significance, such as telecommunication facilities, irrigation canals or electric power lines. Such installations may be retained subject to mutual agreements among the concerned parties, provided such installations will not violate any of the prohibitions contained in Section 20 of the law.

x) Other management zones as may be used in the management plan and approved by the Secretary.

I5.5.5 Environmental Impact Assessment

Proposals for activities which are outside the scope of the management plan for protected areas shall be subject to an environmental impact assessment as required by law before they are adopted, and the results thereof shall be taken into consideration in the decision-making process. No actual implementation of such activities shall be allowed without the required Environmental Compliance Certificate (ECC) under the Philippine Environmental Impact Assessment (EIA) system. In instances where such activities are allowed to be undertaken, the proponent shall plan and carry them out in such manner as will minimize any adverse effects and take preventive and remedial action when appropriate. The proponent shall be

liable for any damage due to lack of caution or indiscretion.

I5.5.6 Prohibited Acts

Except as may be allowed by the nature of their categories and pursuant to rules and regulations governing the same, the following acts are prohibited within protected areas:

i) Hunting, destroying, disturbing, or mere possession of any plants or animals or products derived therefrom without a permit from the Management Board.
ii) Dumping of any waste products detrimental to the protected area, or to the plants and animals or inhabitants therein,
iii) Use of any motorized equipment without a permit from the Management Board,
iv) Mutilating, defacing or destroying objects of natural beauty, or objects of interest to cultural communities (of scenic value),
v) Damaging and leaving roads and trails in a damaged condition,
vi) Squatting, mineral locating, or otherwise occupying any land,
vii) Construction or maintaining any kind of structure, fence or enclosures, conducting any business enterprise without a permit,
viii) Leaving in exposed of unsanitary conditions refuse or debris, or depositing in ground or in bodies of water, and
ix) Altering, removing, destroying or defacing boundary marks or signs.

I6 Water Conservation through Demand Management

Water conservation through demand management will contribute a lot to alleviate environmental impact due to the water resources development, as mentioned in I3.1. The conceivable water saving measures are listed as follows:

- (For municipal and industrial water usage)
  - Improvement of the efficiency of piped water conveyance
  - Prohibition of illegal connection
  - Recycling of water
  - Use of the lower grade water
  - Water saving devices

- (For irrigation water usage)
  - Reducing the seepage from the unlined irrigation canals
  - Change of the irrigation types to such as the micro-irrigation
  - Change of the crop types to less water consumption crops
  - Appropriate maintenance of the irrigation system

Demand management in the irrigation activity is presented in Part F. For the environmental study, evaluation of the maintenance flow remained in the rivers after the application of the water development schemes will be necessary.

For the demand management of the municipal water usage, special consideration should be given to two (2) sites concerning the demand management, that is:

- Metro Manila – Metropolitan Waterworks and Sewerage System (MWSS)
- Metro Cebu

As shown in Table I-13, unit water consumption (domestic + commercial + industrial) of MWSS is 159 (Lpcd) in 1995 and estimated to be 258 (Lpcd) in 2025. On the other hand, total unit water consumption is 361 (Lpcd) in 1995 and 368 (Lpcd) in 2025, and non-revenue water (NRW) percentage is set to be decreased from 56% in 1995 to 30% in 2025. Accordingly, it is clear that drastic demand management measure should be implemented to attain this reduction of the non-revenue water percentage, and further reduction of this percentage is strongly recommended. Without these demand management efforts, water consumption in Metro Manila will increase over the estimated level of this plan, causing significant environmental damage due to water resource exploitation.

Superannuated pipes can contaminate the flowing water in these pipes, and may cause an epidemic during water shortage. Improvement of the existing water pipes is also needed from this sanitation standpoint. Therefore, suggestion for the improvement of pipes is shown in this section, I6.1.

The present water demand of Metro Cebu, 1.7 m^3/sec, has already exceeded the exploitable amount of groundwater in the area, and is forecast to sharply increase to 7.8 m^3/sec after 2,000 A.D. However, planned production amount is only 2.1 m^3/sec, and this value is much smaller than the estimated demand, as shown in Table I-14. Four (4) projects, Mananga Phase II Dam Project, Lusaran Dam Project, heightening of existing Malubog Dam and

Bohol-Cebu Water Supply Project including Tipolo Dam Project are proposed to supply for Cebu city. However, realization of Bohol-Cebu Water Supply Project is questioned because of the anticipated social conflict in relation to water conveyance between the different two islands. Most of the proposed sites have water quality problems, and are located in the Protected Area of the NIPAS system. Then considerable difficulty of acquiring the approval of Protected Areas and Wildlife Bureau (PAWB)-DENR is anticipated for these projects to be realized. As a last measure, installation of desalination plants is thought to be one alternative thereto.

Here, water demand management measures may be implemented, especially for the resort facilities. Resort facilities are thought to be one of the largest water consumers in this region. Suggestion for the demand management of resort facilities and also for the available measures for the whole Metro Cebu region will be shown in this section, I6.2.

The vision of the sustainable water resources management and the plan for its realization is thought to be necessary to implement the water conservation and wastage prevention through demand management. This section, I6.3 presents the image of this vision and planning.

I6.1 Suggestion for the Improvement of Pipes in Metro Manila (MWSS)

I6.1.1 Current Situation of Pipes in Metro Manila

(1) Situation of Non-Revenue Water (NRW) in Metro Manila

Table I-15 presents the details of distributed water in 1993. The current NRW, which MWSS defines as a ratio of unbilled water against the total distributed water amount, hit 57.43%, composed of 22.34% of effectively used NRW and 35.09% of lost water, further specified as leaks, unauthorized use and metering errors. (Study on Water Supply and Sewerage Master Plan of Metro Manila in the Republic of the Philippines, Final Report Volume II Main Report, JICA, February/1996.)

From Table I-15, the following measures are suggested to be undertaken to reduce the NRW.

- Controlling unauthorized use of water
- Improving metering efficiency
- Reducing leakage
- Improving institutional aspects

(2) Water Supply Conditions by Each Service Areas

Table I-16 presents the MWSS service area's water supply conditions by each city/ municipalities. In this Table I-16, the category of water supply conditions is as shown below (Study on Water Supply and Sewerage Master Plan of Metro Manila in the Republic of the Philippines, Final Report Volume III Supporting Report, JICA, Feb./1996.):

Category of Conditions

1) No water in daytime

2) Intermittent/Low pressure
3) Low pressure: 0-5 psi (0-0.35 kg/cm^2)
4) Moderate pressure: 6-15 psi (0.4-1.06 kg/cm^2)
5) High pressure: more than 16 psi (1.13 kg/cm^2)

Water supply is relatively good in wide areas in Quezon City, Caloocan, and Manila. Still, many areas receive water intermittently. Because of inadequate water pressure, many consumers forcibly withdraw water from the system by installing pumps at their premises. Others draw water directly from the water mains. These practices create a vacuum in the water mains increasing the possibility of drawing polluted water from outside the pipe. Improving the water pressure within the system thus becomes imperative.

The rehabilitation of old pipelines, together with sufficient pipe network expansion are therefore very important activities to reduce leakage and increase the supply of water within the system.

I6.1.2 Non Revenue Water Reduction

(1) Controlling Unauthorized Use of Water

Although it is suspected that violations are rampant in the poverty depressed areas, many cases of violations were also noted in commercial establishments and in residential places. Thus, suitable programs for the remedy of the violations, not only for the poverty-depressed areas but covering every type regions should be formulated. And punitive measures/actions must be available to MWSS.

After the privatization of Manila waterworks, efforts for the controlling of unauthorized use of water is continued. (Figure I-5)

(2) Improving Metering Efficiency

Much of the water, 8.24%, is lost through measurement error or deficiencies, and much revenue of MWSS is also lost. These measurement error or deficiencies are due mainly to un-metered services, defective or tampered meters, obstructed or inaccessible meters and under registration of working meters.

The installation of new meters and the replacement of old and defective meters will solve part of the NRW problem. However, more important is the provision of reliable equipment and tools, as well as the improvement of the methods and techniques in meter testing and repair. And a new organization that focuses in the maintenance of water meters should be created.

Some points that should be concerned is:

- Monitoring system should be installed to make immediate and periodic inspection of all meters possible.
- Standardized water meter should be installed, and only the accepted type meter is warranted to be set.
- MWSS should adopt a policy to own all meters installed. The current practice of owning of meters by customers makes quality control of meters difficult.

After privatization of Manila waterworks, efforts for improving the meter efficiency is

continued. (Figure I-5)

(3) Reducing Leakage

Leakage is the most substantial contributor (35%) to Non Revenue Water. However, leakage control is regarded as the most tedious and difficult activity of MWSS, and losses attributed to leaks have increased despite the leak repair program, of which 50,000 leaks were repaired over 10 years. (Study on Water Supply and Sewerage Master Plan of Metro Manila in the Republic of the Philippines, Final Report Volume II Main Report, JICA, February/1996.)

From the experience in major cities in Japan, leakage decreased at the rate of one (1) percent per year, and in Bangkok, Thailand, the Metropolitan Waterworks Authority has decreased its water loss from 44% to 29% in 26 years or 1.7% annually. Because most water resources development program takes 20 to 30 years to be realized, these numbers of leakage reduction rate should not be underestimated.

A lesson from the Japanese and Thailand experience is the importance of the proactive measures such as pipeline renewal. These proactive measures seem to be more effective in reducing the leakage than the reactive countermeasures such as the leak repair.

The pipes that require replacement are:

- Old pipes mostly found in Quezon City, Manila and Makati where water supply system was installed in earlier ages. Water supply in these areas is relatively good (as shown in Table I16), however water leakage is also assumed to be large.
- Relatively weak pipes, mainly Asbestos Concrete pipes. The existing distribution pipes of MWSS have a total length of about 4,300-km, of which 910-km is reported to be AC pipes. And most part of the pipes of the unverified materials, which has 1,317 km length, are guessed to be AC pipes, and should be replaced.

Thus, total length of pipes to be replaced is estimated as follows:

All AC pipes		=908 km
50% of all pipes of unverified materials	= 1,317 * 0.5	=659 km
50% of pipes in Quezon City, Manila and Makati (excluding AC and pipes of unverified materials)	= (297 + 545 + 131)/2	=487 km
	Total	=2,054 km

And, experience shows that metering the water flows on the way of the distribution pipe networks and implementing the on-line information system to monitor the flow rate and leakage is desirable to find the leakage points of the pipelines. Installing such information system is also recommended to leakage reduction in addition to the pipe replacement. Furthermore, the reaction time from the receipt of the leak report to the final completion of the repair work should be shortened.

Permanent organization should be created which assumes the responsibility to reduce the leakage and NRW. However, efforts for this direction seems almost ceased after the privatization of Manila waterworks. (Figure I-5) Because one of the main driving forces of the privatization is the expectation that it will facilitate the improvement of facilities, efforts for the superannuated pipe replacement should be reinforced promptly.

(4) Improving Institutional Arrangement

MWSS established the NRW Task Force in January 1995. The Task Force has developed an action plan in January 1995.

The reduction of NRW requires also the legislative and Presidential/Executive actions other than the massive internal effort of MWSS. The following actions of legislature and President/Executive are proposed by the NRW Task Force of MWSS.

- Amendment of Anti-Pilferage Law
- Exemption from COMELEC Ban on bidding, award and implementation of NRW and expansion projects
- Amendment of Lina Law authorizes MWSS to eject squatters within its ROW and property
- Exemption from RA 6768 (Salary & Standardization Law)
- Exemption from Attrition Law
- Authorization for MWSS to write-off bad accounts that passed 10 years and longer
- Increase of MWSS capitalization
- Tax exemption for MWSS

After privatization of Manila waterworks, such institutional improvement should also be pursued.

I6.2 Suggestion for the Available Water Management Measures of Metro Cebu Region

I6.2.1 Characteristics of the Water Usage in Resort Facilities in Cebu

Table I-17 presents the current condition of the water usage in the resort facilities in Cebu. There are seven (7) hotels studied, and four of them are the beach resort type hotels. And two (2) are the city hotels, which do not have the seacoast along their lot area. One (1) hotel is the condominium type facility, and locates along the sea. Survey was performed on June/1998.

Findings obtained from the survey are as follows:

(1) Per guest (in the guestroom) water consumption in the resort hotels of sufficient water supply capacity is around 2.0 m^3/#, without regarding of the existence of beach along the lot area. (SL, MB, CP hotels) However, for the hotels of insufficient water. Supply capacity, per guest consumption is 0.5 m3/#. From the Japanese experience, per guest water consumption in beach resorts is 0.9-1.6 m3/#, and for the usage only in the guestroom and restaurant, per guest water consumption is around 0.5 m3/#. (J. Mizutani et. al., Water consumption in the resort facilities in Okinawa prefecture, Journal of Japan Water Works Association vol. 62, No. 6, June 1993.) Comparing these numbers, it is said that per guest water consumption in Philippines' resort hotels (2.0 m3/#) of sufficient water supply capacity is twice the value for Japanese resort hotels (0.9-1.6 m3/#). However, for the usage only in the guest room and restaurant, per guest water consumption in both countries is nearly equal to 0.5 m3/#, as assuming the water consumption in the Philippines' resort hotels of insufficient water supply capacity is mainly for the usage in the guestroom and restaurant. Judging also from the findings in

(2), the difference in the per guest water consumption value between these two countries is thought to be attributed to the change of water consumption for plants irrigation. Philippines' resort hotels may have wider lot area.

(2) Per lot area water consumption in the resort hotels of sufficient water supply capacity is around 8 liter/day/m^2. However, this value is only 1.3 for the hotel of insufficient water supply capacity. Average water consumption for various crops is said to be as follows: for rice 1.5 (liter/sec/ha) = 13.0 (liter/day/m^2), for vegetables 0.41 (liter/sec/ha) = 3.5 (liter/day/m^2), for garlic 0.78 (liter/sec/ha) = 6.7 (liter/day/m^2), for onion 0.66 (liter/sec/ha) = 5.7 (liter/day/m^2), and in Japan, this value for rice is said to be 15.0 (liter/day/m^2). Per lot area water consumption in the resort hotels of 8 liter/day/m^2 is thought to be under the reasonable limit, and the value in both countries is not so much different. It is guessed that managing the plants in the garden is difficult in the resort facilities of limited water supply capacity.

(3) Total of water consumed in the surveyed hotels gained from Metro Cebu Water District (MDWD) is only 186,542 (m^3/yr) = 511 (m3/day) = 0.006 (m^3/sec) (23%). On the other hand, water gained with desalination during the same period is 428,263 (m^3/yr) = 1173 (m3/day) = 0.014 (m^3/sec) (54%),and water gained from the deep well is192,500 (m^3/yr) = 527 (m^3/day) = 0.006 (m^3/sec) (23%). Total is 0.026 (m^3/sec). Most of the prominent resort hotels seem not to rely on the water supply from the MCWD water works, and produce the necessary water by themselves. Because number of guests visited these hotels in CY1997 is 416,956 (#/year) = 1,142 (#/day). Number of guests visited at Cebu resort hotels is as follows:

at CY1995: Domestic 273,158, International 227,329, Total 500,487,
at CY1996: Domestic 334,628, International 248,311, Total 582,939,
at CY1997 Jan.-Jun.: Domestic 190,865, International 141,266, Total 332,131,
estimated for whole year: Total 2*332,131 = 664,262.

Then number of guests for these surveyed hotels occupies 63% of the whole number of guests visited at Cebu, these hotels may represent the whole resort hotels in Cebu. And, whole of water used in the Cebu resort hotels is estimated to be 0.026 * (1/0.63) = 0.04 (m^3/sec).

(4) One hotel (SL hotel) has the sufficient wastewater treatment facility and the effluent reuse system for the plants in the garden irrigation. Most of other hotels do not install the sufficient wastewater treatment system, and also recycling of the effluent. Because wastewater treatment and effluent recycle for the plants irrigation contribute both for the coastal water environment conservation and the save water consumption, practice of these measures is strongly recommended. And, the study of the sludge treatment and disposal, which is produced from the wastewater treatment, should be started. Currently, sludge is disposed at the dumping site of Cebu City, however some recycling measures such as the composting for the agricultural fertilizer may be proposed thereto.

(5) Nevertheless, recycling the effluent produced in each resort hotels may be insufficient to supply fully the water demand of the plants in the garden. Because per guest water consumption used in the guest room and the restaurant is only 0.5 m^3/# shown in (1),

which is one fourth of the total per guest consumption of 2.0 m^3/#. If recycling of effluent is really employed to replace and reduce the water consumption of resort hotels, the effluent from Cebu City should be used. However, most of the water gained by the resort hotels is the desalinated water and the self-owned well water (see (3)), resort hotels may not be interested in using the recycled water of such type.

I6.2.2 Available Water Management Measures of Metro Cebu Region

Currently municipal and industrial water consumed in MCWD is 1.7 m^3/sec. It is estimated to become 7.8 m^3/sec in 2025 A.D. Water used in the resort hotels is only 0.04 m^3/sec (see I6.2.1 (3)), more or less. Then, water consumption in the resort hotels is not the predominant one in the whole water consumption in Metro Cebu region. Then it is difficult to solve the water shortage problem in Metro Cebu region with the improvement of the water usage only in the resort hotels. It is reported that "in region VII, Cebu & Bohol, most proposed sites have water quality problem, because of the high population density in the catchment area. Besides, most of these sites are planned to be located in the Protected Area of the NIPAS system. In this region, further innovative water development method should be studied. Or, restriction of the regional development such as resort facilities may be desirable."

This statement can still be applicable. Or, demand management measures such as the pipe replacement, similar to the one as shown in I6.1 for Metro Manila, also should be applied for Metro Cebu District (MCWD).

I6.3 Vision of the Sustainable Water Resources Management and the Plan for Its Realization

I6.3.1 Vision of the Sustainable Water Resources Management

"Pacific institute for studies in development, environment, and security" presents California Water 2020: A Sustainable Vision in1995. This paper may show the vision of sustainable water resources management, as outlined herein. Of course, it seems to be improper to directly apply the experience of California on the land of Philippines, because California and the U.S.A. have already constructed a lot of water development facilities, whereas Philippines have very limited water storage capacity. And California is a very dry state, and conveys a great deal of water from the remote Colorado River as its water resources. Nevertheless, studying this California's vision will make important contribution to the planning of Water Resources Management of Philippines, because this vision contains most of the measures that should be employed in the Water Resources Management Plan concisely. Lots of anticipated adverse effects incident to the water resources development program can be evaded with the lesson of this study.

(1) Vision of the Sustainable Water Environment for Each Sector in 2020

1) Urban Area

Various technology developments will be implemented to reduce the waste of water. Superannuated infrastructures that waste the water in the residential, business and the public buildings will be replaced with the less water wastage ones. New buildings and

watering the plants growing in the private houses' garden, and the plants of the less water consumption variety are grown. Pipelines for the reclaimed water are constructed, and the households will be able to use it. Then, per capita water consumption in the residential area is estimated to decrease to 54% of the 1990 level. Even if population is estimated to increase by 60% from 1990 to 2020, the water consumption volume in the whole state is estimated to be reduced by more than 10 % compared with the 1990 level. Figure I-6 shows the change of the water usage in the private houses from the current 1990 to 2020 in vision.

2) Agriculture

Crops of low economic value that consume large quantity of water, such as the grass, the alfalfa, the cotton and the rice is planed to be replaced with the crops of high economic value that consume less water, such as the almond, the grape, the walnut, the olive, the apricot, the pear and the artichoke. And the more effective irrigation technique will be employed. The ratio of the irrigated cultivated land of the crops of the high water consumption, 40%, is estimated to be reduced to 26% in 2020 A.D., and the water consumption quantity of 26,120 million m^3 per year in 1990 is expected to be reduced to 23,040 million m^3 in 2020 A.D.. At the same time, revenue gained from the agriculture will increase 12%.

3) Industry

The percentage of the high water consumption industry, such as the chemical, the metal, the paper making and the oil refinery is expected to be reduced, and the low water consumption industry, such as the computer, electronics, automobiles and other service industry is expected to increase until 2020 A.D.. Process water of these industries will be partly supplied with the reclaimed water.

4) Natural environment

Conservation of specific natural environment, such as the fresh water environment for the circulating fishes, the shoreline and the wetland for the water birds, is on. And the integrated management to protect water for the environment is applied to reconstruct the nature system, to attract the native fishes until 2020 A.D.

5) Information dissemination

The data concerning the water resources including the groundwater (water quantity and quality) are gathered, and are made available through the independent water related institutions, state scientific academy and NGO.

(2) Subjects for Sustainable Water Resources Management

The minimum water needed for humans to sustain their health and to cook their food is said to be only 20 liters per capita per day. In addition, humans consume approximately 76 liters for their sanitation and washing in the daily life. Multiplying this number with the population, the minimum water needed annually is estimated at 1,360 million m^3 in the whole country. The average available water is estimated at 70 times of this value. However, no system to guaranty this volume exists nowadays. And no agreement concerning the minimum flow for ecosystem conservation is reach.

Water quality standards for each purposes of reclaimed water usage are necessary. The

standard for the water used for the drinking should be more strict, however, more tolerant value may be applied for other purposes. Without such revision, usage of the reclaimed water is hindered.

(3) Vision of the Sustainable Water Resources Management

1) Urban Area

Furnishing with water saving devices on newly constructed and rehabilitated houses is very effective even from the long-run standpoint. This is provided in the National Energy Policy Act of 1992, and will be effective in the future. Water usage volume with the old water supply facilities, the shower and the toilet facilities set before 1980 A.D. is said to be reduced by 62% with the newly installed ones, and 39% reduction may be possible for the facilities set during 1980 and 1992. By replacing the inefficient water supply, shower and toilet facilities, water consumption in the domestic households can be reduced by 10% compared with the 1990 level. The critical hindrance in using water saving devices is not the cost of the replacement, but the detailed information concerning the equipment purchasing sites, fixing procedure, etc.

Various methods to improve the outdoor water usage, such as the improvement of the irrigation efficiency, change of the turf to the native grasses, application of the desiccation tolerant plants, usage of the reclaimed water are applied. With these methods, outdoor water consumption can be reduced easily by 50 to 80%. There is the problem of the water wastage due to the discounted water rates. Effective outdoor water usage also reduces the fertilizer, agricultural chemicals, fuel and the labor force. Videos and pamphlets should be disseminated and seminars should be held to give the accurate information to the people.

2) Agricultural sector

The groundwater used for the agricultural activities in the state of the California in 1990 reached 1,600 million m^3. It is necessary to reduce the high water consuming crops to cut the water demand and also to avoid the adverse effect on the agricultural activities. Concretely speaking, reducing the cultivated acreage of the rice, the cotton, the alfalfa, the grass that consumes large quantity of water and earns less profit, and increase the area of the tomato, the almond, the grape that consumes less water and earns more profit is demanded. One of the main reasons for the low efficient water usage in the agricultural section is the discounted water pricing system, and the economical measures introduced in 5) should be examined. On the technical aspect, irrigation method with the large quantity of water usage should be reexamined. Excessive water usage facilitates the washing away of the applied fertilizer etc., causes the contamination of the groundwater and the river water, and give the serious environmental effects on the ecosystem. There are improved irrigation methods such as the improved sprinkler, drop irrigation system and the water content monitoring. It is also important to implement thoroughly the management of the irrigating time, the system design, etc.. And save water measures based on the Reclamation Reform Act of 1982 (Water Conservation Plan) should also be actively pursued.

3) Other Industrial Sectors

Water consumption in other industrial sectors can be reduced 20% with the improvement of the water usage efficiency in each sector. Besides, more than 20% can be cut with the

structural change of the industry. With these measures, water consumption of the industrial sectors in California was reduced by 33% during 1980 and 1990. And 40% more reduction can be attained in coming 25 years with facilitation of these measures. It is well recognized that reclamation water can be used for many processes, however, it is still a big challenge to know how to facilitate its usage. Synthetic evaluation of the reclaimed water, water quality standard for each purposes, and the cost of the treatment and the conveyance of the water is necessary, to facilitate the reclaimed water usage hereafter. 250 million m^3-reclaimed water is assumed to be used annually in the Central California Regional Water Project currently on practice.

4) Natural Environment

It is very difficult to estimate the necessary water for the natural environment conservation. The function of the natural ecosystem is not elucidated well until now, and this is one of the main reasons for this difficulty. Unrecoverable damage on natural environment such as the extinction of the species and the destruction of the living sites of the endangered living creatures should be avoided, when formulating the environmental policy under these conditions. Various measures are applied for the natural environment conservation until now. For example, Wild and Scenic Rivers Acts demands the minimum maintenance flow in several rivers, conservation of the wetland and the endangered wild animals, and the restoration of the living sites for the circulating fishes. Ecosystem monitoring system that is cooperatively run by the governments and the environmental NGOs should be formulated other than the policies shown here for the restoration of the natural ecosystem, of which previous water development schemes damaged before. And land usage planning should be synchronized with the water resources management plan. Current land usage planning first set the facilities, and then the water sources for these facilities are searched. The desirable planning should first estimate the water consumption of the facilities, and show the possibility of water supply without the adverse effects on the natural ecosystem at the primary design and planning stage. Besides, it is strongly recommended that the large scale undeveloped land is reserved for the future generations.

5) Economic Measures

The water price has not covered the whole costs of its production, including the social cost of the environmental damage caused by the water development facilities and also the cost of its plants and equipment, until recently. The water pricing structure should be revised. Floating price rating, such as the seasonal rates and the tiered-block rates should be tried for more efficient water usage. Seasonal rates is applied during the high water demand period, and for the filling up of the expense incurred by the water supply increase and for the restriction of the water usage. Tiered-block rates set water price according to the water usage quantity. The price elasticity of the water demand during summer period is usually larger than the one in the winter. Especially, this trend is remarkable for the outdoor water usage than the one for the indoor usage. It is important hereafter to set the water price that can facilitate the effective usage of the water.

6) Regulation by Law

Various regulations were applied before for the restriction of the water demand. For example, efficient flush toilet, 13.3 liter/time, is obligated to be set in all the newly constructed houses in California. National energy policy act currently set a provision to

restrict the water usage with the save water toilet and shower. (Figure I-7) Water Conservation Landscaping Act of 1991 demands the restriction of the acreage of the turf and the efficient watering with using the native plants. Such law regulations are regarded much effective for the attainment of the 2020 vision shown in this report.

I6.3.2 The Plan for the Sustainable Water Resources Management

The main duty of the Development Bureau, the Department of the Interior of U.S.A is said to be changed from the water resources development to the water resources management. This bureau is currently pushing the save water through the Water Conservation Plan of the Water Districts based on the Reclamation Reform Act of 1982. Outline of the Water Conservation Plan is shown hereinafter.

(1) Explanation of the Water Conservation Plan

The Reclamation Reform Act of 1982 obligates the Water Districts that make the water receive contract with the Developing Bureau, to make the Water Conservation Plan of the sufficient level acceptable for the Bureau, and to practice it surely.

The intention of the Water Conservation Plan is to inspect the current water usage mode, studies the more rational water usage that will substitute the current one and urges the Water Districts to apply the appropriate save water measures. Various measures concerning the water demand reduction, cutting off of the water wastage, efficient usage of water, water recycling and reduction of the water intake are studied here.

The Water Conservation Plan is looked over every five years, and is obliged to submit to the Development Bureau. The Development Bureau examines the submitted plan by them based on the guidelines. And notice of the approval is appeared on the Federal Register before the final approval is made, and opinions about the plan from the people are heard for forty-five (45) days. The Development Bureau examines these opinions, and issues the final approval afterwards.

The aim of the Water Conservation Plan is to reduce the social pressure for the new water development with the implementation of the measures of this plan, to calm in advance the social effects of the drought, to proceed to the sustainable society, and to restore the river ecosystem with the water that is produced through the saving efforts.

A guideline for the Water Conservation Plan is presented in 1985 by the Development Bureau. This guideline is the textbook for the Water District to make their plan and also the basis for the Development Bureau to judge the approval.

Revised guideline is presented in Jan./1995. The items that should be included in the Water Conservation Plan presented in this new guideline is shown in the following section.

(2) Items that Should be Included in the Water Conservation Plan

1) Outline of the Water District

Information of the outline of the Water District is given. Such information as the location of the Water District, area, contents of the contract with the Development Bureau, water usage situation, water shortage information (including the water appropriation criterion

during the water shortage period), water distribution facility in the Water District, and the water rating system, is indispensable in this section.

2) Water usage situation
Study and describe where, when and what purpose the water is utilized in the Water District.

3) Subjects on the water usage and targets of the water resources conservation
Elucidate the subjects and the points for improvement of the Water District. And set the target values of the water resources conservation based on the result.

4) Water conservation measures taken until now. Describe the water conservation measures taken by the Water District until now, and also the result of them. Evaluate the result and elucidate the subjects. It is utilized at the target setting.

5) Priority measures for the water resources conservation
Four (4) priority measures are presented in advance by the Development Bureau that are regarded as the key factors for the success of the water resources conservation program. It is indispensable to acquire the permission of the Development Bureau that the action program of the Water District for these four (4) priority measures are well described.

a) Metering and recording system for the whole distributed water to each users through the water distribution system of the Water District
b) Rating system of the Water District that facilitates the effective water usage. It should not violate the related laws and the contents of the contract with the Development Bureau. However rates system without the clear relationship with the water usage quantity, such as the rates per acreage of the agricultural land system, are not accepted and to be amended.
c) Publicity activity and the educational program for the effective water usage
d) Designation of the responsible persons for the water conservation program.

It is necessary to designate the responsible persons if the planning and the practice of the water conservation program is surely conducted.

6) Water conservation measures expected to be introduced in future
Study for the new measures that is suitable for improvement of the water usage efficiency, and that is based on the real conditions of the Water District, including the aspects of the cost.

7) Monitoring survey for the effectiveness of the water conservation measures
The Water Conservation Plan should describe the monitoring results of each measures taken before if the expected targets are attained, and also describe how to monitor the measures that will be introduced in future.

8) Environmental review of the water conservation plan. Review of the Water Conservation Plan from the standpoint of the environmental conservation, in relation to the National Environmental Policy Act. The Development Bureau support the short-term target "NO-NET-LOSS of the Wetland" and the long term target "INCREASE WETLAND AREA", that is officially declared by the U.S.A. government. It should be specified on the map if water conservation measure that incurs adverse effects on the wetland is planned. Permission of the Water Contamination Control Act, Section 404 should be secured if it is needed for the measures planed. Endangered and Threatened Species Act, Section 7 demands that any action in relation to the federal government agencies should not incur the adverse effects on the endangered and threatened species designated by law. The Water District describes the effects on the law-designated species, consulting officially and non-officially with the Fish and Wildlife Bureau. When adverse effects are

anticipated, biological environmental impact statement should be made up.
Describe the schedule, cost and personnel for the implementation of the program.

I7 Environmental Study for Each Dam Site

Environmental study for each dam site is conducted based on the "Guideline of the Environment Impact Study for the Dam Construction Planning, JICA, February/1990".

The Philippines Environmental Impact Statement (EIS) System says that major dams with storage volumes equal to or exceeding 20 million cubic meters are Environmental Critical Projects (ECPs), and are required to first secure an Environmental Compliance Certificate (ECC) prior to construction and operation. Then every dams designated in this project should gain this ECC, and Environmental Impact Assessment is needed for these projects.

Concerning the screening procedure, Environmental Impact Assessment is indispensable and further study is thought to be unnecessary.

Concerning the scoping procedure, three (3) points shown below were studied for forty-nine (49) dams listed in Table I-18. See the details in the database.

- Water Quality Classification designated by the Philippine government,
- Protected Area under the NIPAS system,
- Existence of the mining deposit.

And, description of the natural environment and ecosystem and also of the land use/vegetation and the soil erosion is also presented in the database when it is available.

As water classes of AA and A is regarded suitable for the (drinking) water supply, and B is only for the recreational purpose, Water Quality Classification should first be checked for the water resources management facilities.

And, if dams are located in the Protected Area, Protected Area and Wildlife Bureau (PAWB)-DENR approval is demanded. Because, most of the significant wilderness area and endangered and threatened species exist in the Protected Area, destruction of these natural environments in the Protected Area should be avoided. Then checking from this standpoint is necessary.

Mining deposit sometimes discharges the poisoning effluents that cause the adverse effect on the plants and animals. Careful consideration should be paid when the water containing these effluents is used for the irrigation and municipal purpose.

Natural environment and ecosystem is regarded as the most important factor to judge the viability of the dam projects in the JICA guideline. Then description of these factors is included.

Description of the land use/vegetation and the soil erosion is presented, because rampant deforestation in Philippines may cause the soil erosion and exert the adverse effects on dams.

Table I-18 shows 63% (31 sites) proposed dams have some kind of mining deposits upstream. Of which, San Roque dam on Agno River is regarded most serious, and comments for this dam is given herein. And 31% (15 sites) proposed dams are located in the Protected Area of the NIPAS system, and special consideration should be paid. Comments for these dams are also shown herein.

1) Chico IV

Water quality class; B (1994) Balbalasang-Balbalan Resource Reserve exists in the dam reservoir area. Endangered species; Philippines Deer Cervus Philippines and blue nape Parrot habitat in the dam reservoir area. (JICA, The Cagayan River Basin Water Resources Management, August/1987). Producing/ abandoned gold and copper deposits exist in the upstream, and prospect pyrite and sulfur deposits also exist in the upstream.

2) Mallig #2

No water quality class is designated, however, many municipalities/ barangay exist upstream, and water is thought not to be excellent. Ambuklao-Binga Protected Area exists in the dam reservoir area. High possibility of interruption of the migrating mullets in the stream (JICA, The Cagayan River Basin Water Resources Management, August/ 1987).

3) Siffu #1

No water quality class is designated, however, many municipalities/ barangay exist upstream, and water is thought not to be excellent. Ambuklao-Binga Protected Area exists in the dam reservoir area. High possibility of interruption of the migrating mullets in the stream (JICA, The Cagayan River Basin Water Resources Management, August/ 1987).

4) Matuno

Water quality class; C (1994) Salinas Deer Refuge Natural Park exists in the dam reservoir area. Explored copper deposits exist in the upstream, and prospect pyrite and sulfur deposits also exist in the upstream.

5) Boloc Dam II

Water quality class; A (1993) Mt. Pulog Resource Reserve exists in the dam reservoir area. Pure forests; habitat of unique species of cloud rats (Crateromys schadenbergii); mountain lakes; dwarf bamboo (Arunolinaria nitakayamensis); deep ravines; temperate climate. Producing/ abandoned gold deposits exist in the upstream, and producing/ abandoned and explored copper deposits also exist in the upstream.

6) Tebbo Dam

Water quality class; A (1993) Lower Agno Protected Area exists in the dam reservoir area. Producing/ abandoned gold deposits exist in the upstream, and producing/ abandoned and explored copper deposits also exist in the upstream.

7) San Roque

Water quality class; A (1993) Lower Agno Protected Area exists in the dam reservoir area. Producing/ abandoned gold deposits exist in the upstream, and producing/ abandoned and explored copper deposits also exist in the upstream.

It is projected that the released water from the proposed San Roque dam will have a large amount of very fine suspended solid containing copper to some extent if all of mine tailings are impounded in the reservoir of the proposed dam. This water having such characteristics in quality is provided to the proposed San Roque irrigation development area in the future. As a result, copper will accumulate in paddy soils through the spread of very fine suspended solids to the whole beneficial area. After 120 to 160 years, thus, copper concentration of solids will reach the limits allowed over which copper determines the cause of crop yield reduction. Thus,

some measures such as the sedimentation of the fine particles in the San Roque dam that is on construction is strongly recommended.(JICA, Re-study of the San Roque Multi-Purpose Project Final Report, Sep./ 1985)

8) Abaca

Water quality class; A (1993)Casecnan River Protected Area exists in the dam reservoir area. The Casecnan watershed has an undoubtful environmental value for the still wide coverage of primary forest. The Abaca reservoir area appears to be forested at 90-95%. Endangered species: wild deer (cervus sp.) and Protected species: reticulated phiton (Phiton reticulatus) and the wild cat (Felis sp.). Other species presently inhabiting the area to be defended and possibly protected, are the Philippines monkey (Macaca Philippinensis), the giant trod (Bufo marines), the Philippines woodland frog (Rana magna) and the Philippines common cobra. (the World Bank, Water Resources Development Project, Oct./1994) Prospect iron deposits exist in the upstream.

9) Kanan

No Water Quality Class is designated, however, there seems scarce population upstream, and the water quality is expected to be excellent. National Park, Wildlife Sanctuary and Game Preserve (Natural Park) exist in the reservoir area.

The characteristic of the natural vegetation in Kanan Valley is classified as Dipterocarp forest zone. The area is characterized by the old growth of the Philippine Rain Forest and probably has remained intact for many centuries. This is one of the very few significant wilderness area left on Luzon Island to date.

Besides common bird species, a green parrot which is one of the protected species under the CITES known as "Philippine Hanging Para-Keet" is found in the area. Luzon Deer, Philippine Macaque and Malay Civet Cat which are classified and protected by the CITES are known to inhibit in the area. (National Power Corporation, Implementing Program for Detailed Design of Kanan Hydropower Project, April/1993)

10) Sipocot

Water quality class; A (1993) Bicol Resource Reserve exists in the dam reservoir area. Dipterocarp forest, natural swimming pool, scenic spots, recreational area, Hanging parakeet, cockatoo, cloud rat, palm and Malay civet. Guano and Rock Phosphate deposits exist in the upstream.

11) Panay

Water quality class; A (1993) Panay River Protected Area exists in the dam reservoir area. The upper watershed of the Panay River up to the elevation of 400 to 500 meters is covered with corn, bean and cassava fields or with shrub. Natural vegetation in the watershed is sparse, with forests existing only at elevations of 600 meters and above. Therefore, the watershed is mostly erosion-prone.

12) Bago

Bago River Protected Area exists in the dam reservoir area.

13) Ilog No.1
Water Quality Class: A (1975) Ilog-Hilabangan Protected Area exists in the dam reservoir area.

14) Mananga II
Water quality class; B (1996) Mananga River (Amendment) Protected Area exists in the dam reservoir area. Under the classification of permissible land use of the DENR, 40% of the watershed is "alienable and disposable" land and the reminder is either timberland or National Park. A wide range of pesticides is commonly used on cash crops and mango trees. There are also about 20 small coal mines in the watershed.

In 1990, the total population of barangay wholly or partially located within the watershed amounted to 22,000 people. Population density in the catchment area: 324 #/km^2. (ADB, Cebu Water Supply Project Phase 2, Feb./ 1991) Prospect gold deposits and producing /abandoned and prospect copper mine upstream.

15) Tipolo Dam
Water Quality Class: B (1996) Many municipalities exist upstream. Population density in the catchment area; 25.4 – 110.8 #/km^2.

16) Tumaga
Water Quality Class: A (1995) Pasonanca Protected Area exists in the dam reservoir area.