

1 INTRODUCTION

The Philippines, through RBCO-DENR had defined 20 major river basins spread all over the country. These basins are defined as major because of their importance, serving as lifeblood and driver of the economy of communities inside and outside the basins. One of these river basins is the Marikina River Basin (Figure 1).

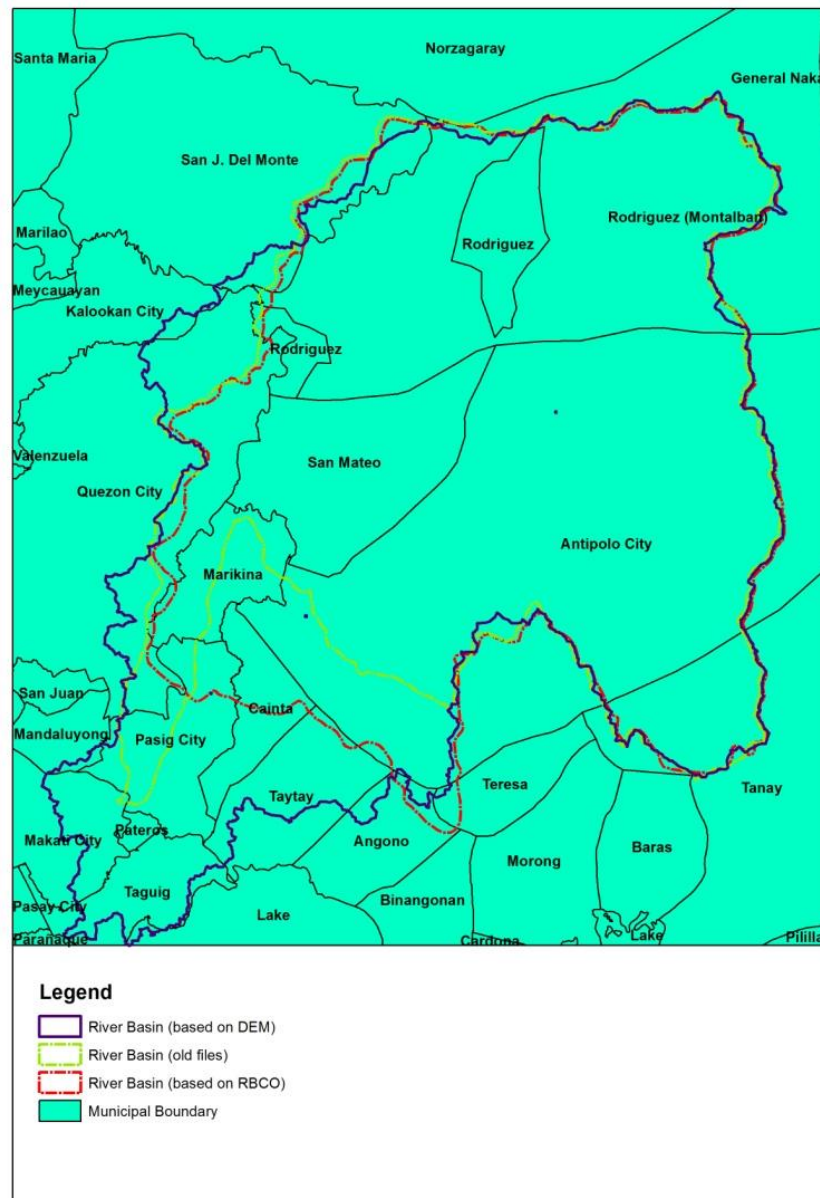


Figure 1 Marikina River Basin Map

Marikina River Basin is currently not in its best of condition. Just like other river basins of the Philippines, MRB is faced with problems. These include: a) rapid urban development and rapid increase in population and the consequent excessive and indiscriminate discharge of pollutants and wastes which are; b) Improper land use management and increase in conflicts

over land uses and allocation; c) Rapidly depleting water resources and consequent conflicts over water use and allocation; and e) lack of capacity and resources of stakeholders and responsible organizations to pursue appropriate developmental solutions.

The consequence of the confluence of the above problems is the decline in the ability of the river basin to provide the goods and services it should ideally provide if it were in desirable state or condition. This is further specifically manifested in its lack of ability to provide the service of preventing or reducing floods in the lower catchments of the basin. There is rising trend in occurrence of floods, water pollution and water induced disasters within and in the lower catchments of the basin.

The rivers that overflowed and resulted to exceptionally high and extensive flooding during the TS Ketsana event are the rivers that drain Marikina River Basin. These rivers contributed huge volumes of stormwater to the main Marikina River that cut across through densely populated areas of Rizal Province, Quezon City, Marikina City and Pasig City. As a result, flooding due to overflowing of the river tremendously damaged human lives and properties. Consequently, the floodings that occurred and any other flooding that will happen were and will be attributed to the poor management of the river basin.

Solving the problems faced by the MRB is not an easy task. Different resources, various stakeholders and numerous concerns in the different sectors that are present in a basin make the sustainable management of a basin complicated. Sustainable management of river basins requires careful planning following concepts and principles of an integrated river basin management (IRBM).

Integrated River Basin Management (IRBM) considers the various resources and ecosystems inside a basin. IRBM considers the interaction among the following components, namely: forests, water, aquatic/marine resources, mineral resources, nutrients, plants/animals/micro-organisms, wetland, lands and man/communities/indigenous people.

The development of an Integrated River Basin Master Plan for various river basins including the Marikina River Basins is consonant with the plans and programs of the River Basin Control Office.

2 PRINCIPLES

The Philippines adopts an integrated and community-based ecosystems approach to environment and natural resources management, precautionary approach to environment and natural resources, sound environmental impact assessment (EIA) coupled with cost-benefit analysis. These are all anchored on the principles of shared responsibility, good governance, participation, social and environmental justice, intergenerational space and gender equity, with people at the core of conservation, protection and rehabilitation, and developmental initiatives (Philippine Development Plan 2011-2016).

This Project aimed to formulate an Integrated River Basin Management and Development Plan toward sustainable management of the Marikina River Basin. The Strategy and Master Plan prepared addressed concerns on:

- a) flood control and hazard management
- b) water resources management
- c) watershed management and restoration
- d) creation of an institutional framework and physical structure for management
- e) wetland and river management
- f) community participation

The “Formulation of an Integrated River Basin Management and Development Master Plan for Marikina River Basin” consisted of Review of Water Policy and Basin Development Strategy (Phase 1) and Formulation of Master Plan (Phase 2).

The specific objectives of Phase 1 were:

- a) to formulate a Marikina River Basin Management and Development Strategy;
- b) to distill lessons in integrated water resources management, integrated watershed management, and other sector management experiences;
- c) to harmonize existing programs and approaches into an integrated river basin management and development strategy.

The specific objectives of Phase 2 were:

- a. to assess trends in the conditions of natural and socio-economic resources; and,
- b. to prepare an integrated Marikina River Basin Management and Development Master Plan

3 CONDITION OF THE RIVER BASIN

Almost half of the river basin and located in the eastern part of the basin is the Upper Marikina Watershed Protected Landscape, a protected area 27,000 ha in size, under the jurisdiction of the DENR Region 4A. The rest of the basin is mostly private lands located in the lower portion of the basin, and can be aptly called Lower Marikina Watershed. The Marikina River Basin is a huge basin comprising of 69,826.60 hectares that contribute significantly to the flooding of Metro Manila.

The highest elevations (above 1000 but less than 1,500 m.a.s.l.) of the Marikina River Basin can be found in the ridges of the basin where the headwaters are located and in the portions of Sierra Madre Mountains. The lower elevations are in the downstream near the confluence of Marikina River and Pasig River and in the urban areas of the basin.

Land cover, consisted mostly of the forested land cover in the upper basin where the protected area of UMWPL is located, and non-forest cover and built up areas in the lower basin.

The climate within the Marikina River basin belongs to Type I based on the Modified Coronas Classification. Type I climate is characterized by two pronounced seasons, which is dry season from November to April and wet season during the rest of the year. It is also characterized by occurrence of high rainfall during the months of June to September.

The average annual temperature is 27.7°C. May is the hottest month with monthly average of 29.7°C. The coldest month is January with an average of 25.7°C. The current trend of temperature shows an increasing number of hot days but significantly decreasing number of cool nights.

The average annual rainfall is 2574.4 mm with August as the highest with mean rainfall of 504.2 mm. The dry months (November to April) showed a monthly average of 14.6 mm to 148.8 mm with the lowest mean monthly rainfall of 14.6 mm occurring in February. In general, there is a decreasing occurrence of extreme intensity of rainfall but increasing extreme frequency of rainfall in the area.

Two pronounced winds prevailed in the area: (a) from the northeast during northeast monsoon and (b) from southwest during southwest monsoon. The annual average wind speed is 1 meters per second (mps).

The mean percentage frequency of tropical cyclone passage at some parts of Luzon including the Marikina River basin ranged from 11 to about 30%. This translates to about 6 tropical cyclones passage within a year based on an average tropical cyclone passage of 20 per year. There is no indication on the increase in frequency of tropical cyclone passages in the Philippine Area of Responsibility (PAR), however, there is increase in sustained winds greater than 150 kilometers per hour (kph) as noted in the baseline years (1970 to 2000).

According to the 2010 NSO Census on Population, the cities/ municipalities affected by the formulation of the Marikina River Integrated Basin Management and Development (IRBMD) Master Plan has a total population of 7.5 million. This is 8.1% of the total national population for the same year. The population density in all the cities and municipalities within the Marikina River Basin is higher than the average national figure. The average annual population growth rate from 2000-2010 for the affected area is 3.25 per cent, which is much higher than the national average of 1.90 per cent. The male-female sex ratio is 96.6 meaning there are 97 males per 100 females.

Population belonging to the age group 1-14 comprises 31.5% of the total population. Productive population or persons belonging to the age bracket 15-64 comprise 65.3% and the elderly comprise 3.2%. Total dependency ratio is high at 53.0 which means that for every 100 productive persons, there are 53 individuals depending on them for support. Young dependency ratio is 48.2 and old dependency is 4.9. This means that there are more young dependents than the elderly dependents. Both young and old dependents have distinct need for health services and other social support. This partly explains why many households are living below the poverty threshold level.

Marikina River Basin catchment area has undergone rapid urbanization and industrialization since the turn of the century.

Available land use data generally showed declining agricultural areas and forest lands in many of the previously green municipalities, specifically those outside of Metro Manila. Cities and municipalities in Metro Manila have practically no agricultural and forestry sectors for at least 40 years now. So it is clear that the percentage of built-up areas has increased.

Within the built-up areas, land usage has also shifted, with generally increasing areas for residential and commercial use, and decreasing vacant and open spaces. In Metro Manila, there is a declining percentage of land use for industrial purposes, but in Rizal industrial land use is broadly rising. Residential areas have increased only modestly especially in Metro Manila, but usage has intensified due to high-density developments like high rise projects. Institutional areas have almost remained constant, but usage has also intensified.

Population data provides the basic indicator of urbanization, with the size of population being a major determinant of an urban area. Based on population size at the barangay level, the National Statistics Office (NSO) is able to extrapolate the percentage of urban and rural population in a municipality.

As far as Metro Manila cities and municipalities are concerned, they are already 100% urban in 2000 or even much earlier. In a number of Rizal towns in the study area, urban population was below 100% just before the turn of the century but is presently 100%. Nonetheless, there are still some municipalities outside Metro Manila which have less than 100% urban population as of the 2010 census.

Population density had been rising gradually during the past 10 years, i.e., from 2000 to 2010. In the Rizal cities and municipalities, population density had risen much faster during the same period. Despite the relatively slower growth in population, density in Metro Manila's

cities and municipalities is nevertheless among the highest in the world, making them highly urbanized areas. Population density in the selected municipalities and cities in Rizal province is also well above the national average of 269 persons per square kilometer in 2010, indicating its steady urbanization.

Metro Manila is increasingly becoming service sector-oriented based on land use data, as reflected in the significant expansion of commercial areas; type of businesses being registered; and gross regional domestic product (GRDP). Surprisingly also, the GRDP data appears to suggest that there is a small pocket of agricultural activity within the Metropolis. The 6 of the cities and municipalities within the scope of the river basin master plan account for 44% of Metro Manila's population.

Rizal cities and municipalities are, on the other hand, being transformed into residential, commercial and industrial areas at the expense of agriculture. Rizal is part of Calabarzon, which is probably the most industrialized region in the country. Rizal is the 2nd most populated province in the region (20% of total) and has the highest population density. The cities and municipalities within the Marikina River Basin catchment area account for almost 80% of Rizal's total population. The major industrial establishments in the selected towns of Rizal are mostly resource-based (e.g., agri-business, food and beverages manufacturing, mineral products, etc.)

Prominent industrial areas in Metro Manila can be found in many of the cities included in the Marikina river basin development framework, notably in Marikina, Pasig, Quezon City and Taguig. But industrial land usage has remained constant at best, and generally declining, due to the dispersal of industries outside of Metro Manila and the development of central business districts (CBD's) and micro-cities within each of these towns.

In Quezon City, for example, what was once a formidable industrial zone in Libis is gradually giving way to such projects as Eastwood Cyber City, commercial complexes and high-rise residential enclaves. Only the Balintawak and Novaliches areas still hold a significant number of factories. In Taguig, Bonifacio Global City is emerging as the country's premier CBD, while the industrial complex in the Food Terminal area will soon be transformed by the Ayala Group into a mixed-use property development. Some 200 medium to large manufacturing establishments operate in Pasig City, but the so-called Greenfield area is fast becoming a commercial-residential center. Nonetheless, in Marikina major manufacturing establishments, including Philip Morris Fortune Tobacco Corp. (PMFTC) Inc., JT International, Arms Corp. of the Philippines, food manufacturers and shoe-makers, still maintain significant operations.

In the Rizal cities and municipalities, the industrialized areas are Antipolo, Cainta and Taytay. Antipolo has about 400 manufacturing establishments, but the largest companies operating in the city are into agri-business, especially Universal Robina, Foremost and GMC poultry and piggery farms. Cainta hosts Mitsubishi Motors, Monde M. Y. San Corp., BF Corporation and a number of mostly small-scale processed food producers. It is the 2nd richest municipality in the country in terms of LGU revenue generation. Taytay is known as the "woodworks" and "garments capital of the Philippines," boasting about 7,000 commercial

and industrial firms, many of which are small businesses specializing in the production of RTW clothes; doors, furniture and other woodworks; curtains; and other garment products.

Although the other Rizal towns (Angono, Rodriguez and San Mateo) are industrializing, the activities are mostly small-scale and micro, poultry and piggery, and in certain areas quarrying. But there is collective aspiration, as gleaned in their development plans, for the preservation of forest resources and greeneries, and the development of cultural (art centers and museums, etc.) and eco-tourism.

4 FINDINGS AND IMPLICATIONS FOR RIVER BASIN STRATEGY

The analysis and planning for the social sector took into consideration the rapid demographic changes in the cities and municipalities affected by the formulation of the Marikina River Basin Master Plan. These population changes have serious social implications such as increase demand for housing, a growing homeless population and the spread of informal settlers. Without appropriate measures in place, this situation can lead to distinct challenges in health and sanitation, peace and order, access to basic utilities like safe water supply, sewerage and drainage, circulation patterns, and environmental integrity of the Marikina River and its attributes. Further, in developing the master plan, data on population increase and increasing urbanization had spatial implications. For instance, the data presented potential conflicts between the need to preserve protected areas vis-à-vis demand of increasing population, in the midst of a growing heterogeneous population which includes indigenous peoples and mixed cultural groups. At the end of the day, the ultimate beneficiaries of any river basin development plan are the people living in the basin.

The population not only holds the knowledge of the resources but also is both the influencing factor and direct impact group of resource use and management. Empowered people and their participation in the development process ensure an accurate understanding of the development challenges and the definition of appropriate solutions.

Developments in the Marikina River Basin catchment area suggest increasing pressure on physical resources resulting from rapid urbanization and industrialization. Demand for water is steadily shifting from agricultural to domestic and industrial uses. But more importantly, rapid population growth within the river basin area is creating priority concerns that need to be addressed, specifically:

- Environmental degradation as a result of competition for land use, such as for settlements and subsistence.
- River pollution resulting from effluents of households, commercial and industrial establishments and improper waste disposal.
- Flooding resulting from declining forest cover/natural absorbent of run-off water from heavy rains, heavy siltation of river channels, and indiscriminate disposal of garbage and solid waste in water systems.

These concerns appear to take precedence over water supply within the Marikina River Basin. Except for Laiban in Tanay, the basin area is not being envisaged as a key potable water source. There is another potential water source in the Rizal province, but this is beyond the boundaries of the river basin area. The greater value of the river basin is its role in flood control and mitigation in Metro Manila and Rizal province, and in improving water quality for sanitation, livelihood, recreational and aesthetic purposes.

5 VISION FOR THE BASIN

Clean, safe and productive watersheds, managed by a competent, dynamic and well coordinated institution, for an inclusive social, environmental and economic development

The goals for the management of the river basins include:

1. Marikina River in unison with the environment: providing beneficial use notwithstanding the informal role as cleanser of the surroundings.
2. Restored and sustained watershed responsive to the needs of the different stakeholders promoting socio economic development.
3. Protected environment and maintained ecological balance to ensure environmental and social sustainability of development activities in the MRB. The healthy environment will dictate the type of livelihood and prosperity of the population of MRB.
4. Operation of appropriate and adequate flood control systems that prevent flooding according to the flood prevention plan.
5. A dynamic and well represented river basin organization is in place to effectively implement the strategies, programs and projects in the various components to put in place the principles and concepts of Integrated River Basin Management
6. Marikina River is a natural waterway that collects and conveys surface runoff with marginal change in its bathymetry and the floodplain.
7. Invigorated civil society and private sector in managing and developing the MRB.
8. Management of water resources and watershed that balances the need for conservation, maintaining environmental integrity and economic development; and Creation of more livelihood opportunities

6 PROJECTS FOR THE VARIOUS COMPONENTS

6.1 WATER RESOURCES: CONDITION AND MANAGEMENT

Marikina River is a tributary of Pasig River with headwaters located in the Sierra Madre Mountains in Rodriguez, Rizal. The river is located east of the Metro Manila region with an approximate length of 31 km. that drains the 582 km² Marikina River Basin (MRB) towards the Pasig River (Abon et. al., 2011). The Marikina River has a number of tributaries in the form of creeks and rivers. These tributaries drain four municipalities and one city in the Province of Rizal, and three cities in the National Capital Region. The biggest of these tributaries are upstream in the mountainous areas of Rodriguez. This includes the Tayabasan River, Montalban River, Boso Boso River, and the Wawa River, which meets the Marikina River just upstream of Wawa Dam. Downstream of the dam, but still in the town of Rodriguez are the Puray River and the Manga River (Abon et. al., 2011).

The Marikina River's depth ranges from 3–21 meters and spans from 70–120 meters. The riverbank has an elevation of 8 meters above sea level (m.a.s.l.) at the boundary of San Mateo and Marikina. This slowly goes down at an elevation of 4 m.a.s.l. before the Brgy. Malanday and Brgy. Santo Niño boundary in Marikina City. The lowest elevation is along Brgy. Calumpang, Marikina City which is 2.0 m above sea level.

The two (2) water level stations (WL Station) namely: the San Jose WL Station in Brgy. San Jose, Rodriguez, Rizal and Sto. Niño WL Station in Brgy. Sto. Niño, Marikina City provide water level/streamflow measurements at Marikina River since 1991. The record from San Jose WL Station from 1991 – 2006 shows that Marikina River has an average annual flow of about 30,000 liters per second (Lps) (**Table 1**). Low flows are observed from January to May with the lowest baseflow occurring during the month of April. The high flows correspond with the rainy season in the area with the highest mean flow expected during the month of August. A minimum flow of only 210 Lps occurred in January while a maximum flow of up to 714,210 Lps is recorded during the month of November which could be brought about by a typhoon during that period.

Table 1 Mean Monthly Discharge at San Jose WL Station in Rodriguez, Rizal from 1991 to 2006.

Month	Discharge (Liters/sec)		
	Mean	Minimum	Maximum
January	11,070	210	120,210
February	10,384	560	184,110
March	4,370	560	88,310
April	2,449	350	11,110
May	10,775	410	432,010
June	16,532	950	191,810

Month	Discharge (Liters/sec)		
	Mean	Minimum	Maximum
July	58,216	950	469,810
August	71,211	5,360	599,410
September	66,639	6,910	365,610
October	45,905	1,610	619,410
November	36,797	650	714,210
December	25,853	1,270	306,600
Annual	30,017	210	714,210

The Sto. Niño WL Station is located about 11.6 km downstream of San Jose WL Station. The monitoring records at this station are recent but at shorter period as compared to the San Jose WL Station. Based on overlapping records from 2005 to 2006, the recorded flow at Sto Niño WL Station is about 40% higher than that at San Jose WL Station due to contribution from the drainage area between the two stations.

The recorded annual mean flow at Sto Niño WL Station is 36,794 Lps (**Table 2**). The record shows that relatively low flow of less than 10,000 Lps is now occurring at shorter period from February to May. High mean flow of more than 94,000 Lps is expected during the month of September with the highest flow of 1,838,260 Lps recorded in September 26, 2009 during Typhoon Ondoy.

Table 2 Mean Monthly Flow at Sto. Niño WL Station in Marikina City from 2005 to 2010.

Month	Discharge (Liters/sec)		
	Mean	Minimum	Maximum
January	16,973	2,700	77,950
February	8,098	1,250	84,050
March	4,604	1,800	10,050
April	7,820	1,350	44,750
May	9,587	1,900	114,550
June	24,647	1,375	350,050
July	49,768	3,700	690,650
August	73,518	4,800	561,550
September	94,164	3,050	1,838,260
October	69,878	16,550	497,450
November	48,702	6,250	175,150
December	33,765	6,250	97,150
Annual	36,794	1,250	1,838,260

Land use changes in hills and mountains in the MRB influence flooding pattern in the area. The watershed was classified as 28,000 has. of forestlands in 1904 (HOFCA, 1993). However, the forestlands have been transformed into paddies, grasslands, fruit orchards or dry fields, villages, residential subdivisions and, extensive poultry & pig farms. According to NWRB, 25 to 50 percent of the topsoil in the watershed has already been eroded (JOFCA, 1993). The eroded topsoil has silted the Marikina River and its tributaries, has decreased the loading capacity and has led to faster overbanking during periods of high water level.

On the other hand, rapid urbanization in the low-lying areas resulted to increase in impervious ground surface effecting intensification of the rate and volume of runoff. Occupancy of river easement and vicinity of drainage systems or estero restricted the available passageway for runoff. This limited carrying capacity is compounded by indiscriminate dumping of solid wastes directly to the river systems and esteros.

Generally, the province of Rizal is underlain by volcanic rocks chiefly dacite and andesite flows with pyroclastics and/or volcanic debris. These formations are not good aquifers, thus the chances of finding shallow wells are very slim. Recent formations composed of consolidated sand, gravel and clay constitute about 135 km² or 10% of the total land area and this is where shallow well areas are mostly found. These areas are situated on the western part of Rizal particularly in the towns of San Mateo, Taytay, Cainta and portions of Angono. Deep well areas are scattered all over the province, majority of which are concentrated on the eastern portion encompassing the towns of Rodriguez, Antipolo and Tanay. About 260 km² or 20% of the total land area are considered deepwell areas. The remaining 70% or 914 km² fall under the category of difficult areas. This area covers most of the towns in the southern part of Rizal specifically the mountainous areas of Binangonan, Talim Island, Jala-Jala, Pililia, Tanay, Baras and Morong. Thus, most of the cities/municipalities within the MRB are considered deepwell areas with a few shallow well areas at the upstream of the basin.

The upstream of Marikina River is classified as Class A *Public Water Supply Class II*. Based on **DAO 90-34**, this classification is intended for sources of water supply that will require complete treatment (coagulation, sedimentation, filtration and disinfection) in order to meet the NSDW or National Standards for Drinking Water. The downstream section of Marikina River is classified as Class C or at lower classification than the upstream section. For this **DAO 90-34** classification, the intended beneficial uses downstream of Marikina River are for Fishery Water (*propagation and growth of fish and other aquatic resources*), Recreation Water Class II (*non-contact such as boating, etc.*), and Industrial Water Supply Class I (*for manufacturing processes after treatment*).

Industrialization at the upstream portion of Marikina River Basin is concentrated on agri-business sector. Major poultry and piggery farms of Universal Robina, Foremost and GMC are located in Antipolo. At this section, these livestock farms are the primary source of wastewater going to Marikina River. Deforestation and subsequent erosion of the mountainous area at the headwaters of Marikina River is another source of pollution at this section of the basin.

Due to a relatively flat valley and easy accessibility, particularly within the NCR, several large industrial establishments are located in the vicinity of the Marikina River system (**MWSS MP, 2012**). Thus, it serves as a principal drainage system. Domestic and industrial wastewater are discharged into open and/or covered canals and ultimately drains into tributary creeks or directly to Marikina River.

Only water lilies and janitor fish could be found in murky water of Marikina River in 2003 and hardly any life forms are able to survive, thus it was formally declared by the DENR as biologically dead (**Gorme, et.al., 2010**). In 2008, the two (2) water quality monitoring stations in the river exhibited nonconformance on parameters such as BOD, DO, and pH for Class C water quality standards (**MWSS MP, 2012**). There were also several peaks in the BOD during summer months. The high rate of precipitation during the 2008 summer months may have contributed to high organic loading in the river (**MWSS MP, 2012**).

The National Water Resources Council, currently the National Water Resources Board (NWRB), is the primary governing body for the management of water resources in the country.

The Marikina River Basin is still a major source of water, either as freshwater or feeding groundwater, despite its current condition. In particular, the National Water Resources Board (NWRB) has issued water permits for tapping some tributaries of Marikina River at the upstream portion in Rodriguez, San Mateo down to Antipolo City. The tributaries that are being used as source of water include the Tayabasan, BosoBoso, Wawa, Nangka and Puray rivers. However, majority of the water permits in the basin are for the use of groundwater especially at the areas within the NCR. This is primarily due to the poor water quality downstream of Marikina River. On the other hand, the water from the Marikina River could be partially filtered as it percolates to the groundwater aquifer, thus making the groundwater suitable for some beneficial usage.

As of December 2012, NWRB issued Water Permit to 859 users of groundwater and 81 users of surface water accounting for a total volume 37,150.38 Liters per second (lps) (**Table 3**). In case of Tanay, the reflected source of surface water is the Kaliwa River which is a different river system from Marikina River. Despite the use of Kaliwa River in Tanay, the surface water is still the major source of water in the MRB particularly at the upstream section.

Table 3 NWRB Permittees within Marikina River Basin as of December 2012

City/Municipality	Groundwater		Surface Water	
	No. of Permittees	Capacity (lps)	No. of Permittees	Capacity (lps)
Angono	13	49.28	3	101.00
Antipolo City	160	448.55	24	1,757.14
Cainta	47	212.86	3	36.00
Makati City	103	382.28	0	0.00

City/Municipality	Groundwater		Surface Water	
	No. of Permittees	Capacity (lps)	No. of Permittees	Capacity (lps)
Marikina City	59	317.93	2	40.00
Pasig City	50	294.11	0	0.00
Pateros	0	-	0	-
Quezon City	224	1,034.20	3	1,182.44
Montalban / Rodriguez	24	175.58	16	5,203.80
Sa Jose del Monte City	58	353.60	11	311.95
San Mateo	27	132.04	5	144.19
Taguig	61	130.42	3	982.00
Tanay	33	269.82	11	23,591.20
Subtotal (Tanay not included)	826	3530.85	69	8608.81
Total	859	3,800.67	81	33,349.71

6.2 DESIRED CONDITION FOR THE WATER RESOURCES

Marikina River is a water resource that could still be put into beneficial usage. To optimize its water resource potential, establishment of possible beneficial usage will have to be adapted with the current water quantity and quality at the different sections of the river and its tributaries. For example, river segments that could be possibly tapped for water supply are limited at mountainous region with minimal human interventions. Downstream of this section, could be designated for fishery, recreation and industrial use.

There is a need to identify the designated water usage for each part of the river system to ensure its sustainability. Thus, it is necessary to conduct a water body reclassification to adapt it with the existing conditions and beneficial usage. This will also help in monitoring and maintaining the water quality of each river segment based on its water body classification.

Since the intended use such as water supply and hydropower generation will need good water quality, these projects are feasible upstream of Marikina River and its tributaries. This will give limitation on the project capacity considering that the river discharge is directly proportional to the drainage area contributing at identified river section. Depending on the available discharge for the project, no major dam or project structure will be constructed. Thus, the project could be more socially acceptable and technically feasible.

6.3 PROBLEMS AND ISSUES IN THE WATER RESOURCES SECTOR

In general, Marikina River has a degrading water quality as it goes downstream due to increasing number of domestic, commercial, and industrial wastewater being discharged to the river system. This is compounded by sedimentation as contributed by denuded forest and open areas during rainy season, together with the unabated throwing of garbage directly to the river.

A study showed that construction of a high dam structure will present a negative perception to people living downstream of the Marikina River, including cities and towns along Pasig River. This is reinforced by their presumption that the massive flooding from typhoon *Ondoy* was due to the release of floodwaters from nearby dams. Based on the MWSS study, the Montalban Gorge wherein the Wawa Dam is located is within the seismic fault zone. Thus, the DENR will not allow the construction of a large capacity dam in the area.

The re-opening of Wawa Dam and tapping raw water up to 50 million liters per day (MLD) is being considered due to the inadequate water supply in Metro Manila. Its re-opening may not encounter strong opposition compared to construction of a new high dam.. On the other hand, its re-opening could be considered as beneficial since this will include renovation and subsequent maintenance which will hinder the deterioration of the dam. Opposition to the use of Wawa Dam for water supply could be coming from the sprawling communities adjacent to the reservoir since they will be the ones that will be directly affected.

It is a general impression that Wawa Dam is characterized by poor water quality due to major agri-based industries and sanitary landfills in the headways of the Boso Boso River which are located upstream of the reservoir. In addition, there are sprawling communities adjacent to the reservoir and the Wawa Dam is now being used as swimming area. A water quality sampling at the tributaries and reservoir of Wawa Dam indicated that most of the parameters are still in conformance with DENR Standard for Fresh Waters *Class A* or Public Water Supply *Class II*, but not for the bacteriological organisms (**Table 4**). The high fecal and total coliforms at the tributaries and the reservoir could be partly attributed to the communities sprawling alongside the reservoir. During the sampling, the combined discharge at the two (2) tributaries is below 1.0 m³/s.

Table 4 Water Quality Analysis

Parameters	Water Quality Criteria for Class A	Karugo River	Wawa River	Reservoir
Temperature (°C)	-	29.5	29.0	29.5
Dissolved Oxygen (% sat'n)	70	30.0	50.0	50.0
pH	6.5 - 8.5	6.9	7.2	7.0
TSS (mg/L)	50	7.0	14.3	19.0
TDS (mg/L)	1000	205.0	297.5	197.5
5-Day BOD (mg/L)	5	4.0	11.0	4.0
COD (mg/L)	-	70.0	65.0	65.0
Fecal Coliform	100	230	1,100	7,000
Total Coliform	1000	13,000	4,900	22,000

In case of groundwater, it is not considered as reliable source of domestic water since there are several factories using high capacity pumps for groundwater extraction resulting in overdraft. Besides, the NWRB has issued an order in 2008 on deep well construction ban all

over Metro Manila and Rizal towns. This implies that the development of feasible source of water in the area will be limited to surface water.

6.4 POTENTIAL WATER RESOURCES PROGRAMS/PROJECTS

6.4.1 PROJECTS IN HYDROPOWER GENERATION

The Renewable Energy Law being implemented by the Department of Energy (DOE) is providing incentives to the private sector for the development of renewable energy sources which include the hydropower. On the other hand, the Calabarzon Regional Development Plan 2011-2016 identifies the construction of Micro-Hydropower Projects in Marikina City and San Mateo, Rizal as possible projects to enhance the region’s competitiveness as a global business hub.

In response by the private sector, the Hydrotec Renewables Inc. has pending application for renewable energy service contracts which will allow the company to pursue the feasibility study for its proposed hydropower projects. Most of the proposed hydropower projects will be using the Marikina River or its tributaries.

6.4.2 PROJECTS FOR WATER SUPPLY FOR DOMESTIC AND INDUSTRIAL USE

The Wawa Dam used to be the source of water supply for Metro Manila. Thus, its revival as water source to augment the inadequate water supply in Metro Manila is inevitable. The MWSS Master Plan indicates utilizing Wawa Dam to supply potable water up to 50 MLD. Based from the impression out of the ocular inspection and water quality assessment conducted, an in-depth study may be required to determine the suitability and sustainability of re-opening Wawa Dam as source of water supply.

The small water supply system could be a more feasible option to undertake considering that most of the feasible sources are located upstream or still considered as tributaries of Marikina River. The MWSS concessionaires, the Maynilad and MWC, could conduct feasibility study to determine the potential of the major tributaries of Marikina River as source of water supply.

Table 5 List of Proposed Plans, Projects and Programs for Water Resources

Plan/ Projects/Programs	Lead Agency	Budgetary Requirements	Remarks
Water Resources			
a) General			
- Updating of Water Body Classification of Marikina River	DENR	~ PhP 2M / segment or a total of PhP 20M for the 6 major tributaries and Marikina River	The budget will depend on the number of segments that will be classified based on the result of initial water quality monitoring

Plan/ Projects/Programs	Lead Agency	Budgetary Requirements	Remarks
b) Hydropower	Private Sector	-	Hydrotec Renewables, Inc. having pending applications
c) Water Supply	Private Sector	-	MWSS Concessionaires (Maynilad & MWCI)

7 WATERSHED RESOURCES MANAGEMENT AND CONSERVATION

7.1 DESCRIPTION OF WATERSHED AREAS AND WATERSHED MANAGEMENT

The Marikina River Basin is part of the Laguna Lake Watershed Region and thus one of the 24 sub-watersheds of the Region whose development had been the subject of the 2020 Spatial Development Master Plan for Laguna de Bay basin formulated in 2011 and in the Laguna de Bay Region Master Plan of 1995.

Marikina River Basin consists of various ecosystem types from forest, agroforest, agro-industrial areas, flood plains and water bodies. Within the basin is the Upper Marikina River Basin Protected Landscape (UMRBPL) whose management and development undertaken by DENR R4A are being guided by the UMRBPL Management Plan formulated in 2012. Today the implementation of the management plan is overseen by a PAMB. There are vast areas reforested through the National Greening Program as well as construction of infrastructures to reduce impacts of flooding and heavy runoff. However, the management of the Protected Landscape (PL) is still marred by issues and problems, foremost of which are illegal land titling, forest degradation and the practice of very destructive charcoal making.

As part of the Laguna Lake Basin, the Marikina River Basin is regarded as one of the most important and critical sub-watersheds of the lake basin because of its water resources as the Typhoon Ondoy floods showed that not being able to manage the water resources of the basin can result to vast damage to properties and lives in the lower lying areas of the basin. Marikina River basin is also seen as a sustainable source of economic assets. The Marikina River Basin, if managed properly, is envisioned to be a healthy ecosystem to sustain life and host complementary uses.

The scope of the 2020 Spatial Development Plan includes protection and conservation of the remaining forest cover and rehabilitation of denuded watersheds. Marikina River Basin is a target of this strategy (LLDA, 2011).

Further, since the Marikina River basin is seen as the source of vast rainwater that flooded Metro Manila during Typhoon Ondoy, infrastructure development plans which are in the Laguna Lake Spatial Plan can be implemented in the Marikina River Basin. MRB is also identified for reforestation, bamboo agroforestry and production forestry. In the same plan, Wawa Dam is proposed to be rehabilitated for flood control. Additional Sabo dams may be constructed in appropriate locations. Other dams eyed for construction or rehabilitation are the Boso-boso dam and Upper Rodriguez Dam.

Marikina River Basin Master Plan can also align plans related to non-infrastructure plans such as: a) creation of Sub-WQMA, b) formation institutional arrangements like an integrated watershed management council; c) IEC on waste management, and enhanced water quality

monitoring system, Disaster Risk Reduction Capacity building for sustainable agriculture and other alternative livelihood.

7.2 DEVELOPMENT TRENDS, PLANS, AND CURRENT PROGRAMS RELATED TO SOCIAL ASPECTS

The stakeholders identified during the workshop a number of current endeavors that somehow address the social concerns of the Marikina river basin. These concerns maybe classified into the following:

- Integrated efforts of LGUs within MRB, e.g. creation of special bodies to address the issues of the MRB like MRB councils and committees; review and update of the member A-7 Resilience Alliance of their respective CLUPs to identify sharing and lending protocols
- Environmental protection programs that address the pollution problem, e.g. Solid Waste Management Program, waste segregation program, regular river ways clean-up, greening project, EcoSavers Program etc.,
- Projects that address the physical attributes of the basin like the Upper Marikina Protected Landscape Rehabilitation Program, Marikina Watershed Initiative (forestation, sustainable livelihood and capacity building).
- Disaster risk reduction and management projects like Relocation of informal settlers along the river banks, Risk Mapping/ geo-hazard mapping, Community based early warning system.
- Comprehensive programs and plans like the Flood Risk Master Plan for Metro Manila and surrounding areas, Pasig Marikina river improvement project, and the comprehensive UMRB protected landscape management plan
- Studies and research projects like the Inventory of water users of the Marikina river basin; documentation/ study on the indigenous people's structures and culture mapping; documentation of the indigenous knowledge systems and procedures of Dumagat/ Rementado tribe implementation of sustainable livelihood; survey and delineation of ancestral domain in Antipolo; and Segregation of titled areas within CADT/IP of Tanay and Rodriguez.
- IEC activities

LGUs and even communities nowadays have become more aware of the environmental impact of degraded natural resources especially after series of disasters that beset the basin. However, most projects and plans are still more physical infrastructure in nature. The long list above has not specifically targeted the social concerns but has made them either

part of the whole project/ program. For instance, the environmental initiatives listed are still more reactive to actual disasters than preventive.

With the rapid population growth within the basin and the onset of disasters caused by climate change, development plans and programs of local governments need to be adapted to the changing trend of analyzing not only the need and forecasts for a rapidly-growing population but to also factor-in the adverse impact of climate change into the development and management of the basin.

7.3 DESIRED CONDITION FOR WATERSHEDS AND WATERSHED MANAGEMENT

The overall goal of watershed management is: Restored and sustained watershed responsive to the needs of the different stakeholders promoting socio economic development.

Watersheds in the MRB are naturally present to protect and improve the conditions of water and to reduce sedimentation. If the Upper and Lower Marikina Watersheds are in naturally productive condition, they should be able to provide the local and off-site communities with the f goods and services.

7.4 PROBLEMS AND ISSUES IN THE WATERSHED MANAGEMENT

Except for the Upper Marikina River Watershed Protected Landscape (UMRWPL), the rest of the Marikina River Basin is under a very poor to lack of deliberate management resulting to improper land uses and zoning. Most parts of the lower basin are experiencing fast growth of settlement areas. However even in some portions of the protected landscape where patches of forests grow, small scale charcoal making and kaingin resulting to forest degradation and deforestation are occurring. At the same time, urban development slowly creeps into the slopes of the protected area.

There are also institutional problems prevailing in the area. There are conflicting proclamations of the area, and there is lack of coordination in various programs and projects being implemented by the different stakeholders inside the basin. Government agencies, local government units and non-government organizations have overlapping jurisdictions and uses of land are sometimes conflicting.

There is also poor law enforcement in the watershed and there are also conflicting laws and policies. Inside the basin there is increasing number of people who are illegally settling and squatting in areas like easement of rivers and other precarious areas. Because of poor solid waste and waste water management of communities, waters in rivers are polluted and water quality and quantity are deteriorating. Poor water quality and extreme amount of runoffs, e.g. very low volume during dry season and floods during rainy season had also been affected by developments inside the basin, like small scale mining, poor solid waste management, improper land uses like livestock raising as well as lack of flood control structures and water

impounding structures. Other poor land use practices are illegal logging, cutting trees for charcoal making, slash and burn to open up areas for agriculture.

Although UMRWPL is a protected area, there are issuances of titles inside the area. There 500 hectares that is subjected to titling, according to NIA and Quezon City. According to another LGU, there are 20 quarrying activities in Rodriguez and 1 in San Mateo. Guidelines in the granting of quarrying permits are not properly being implemented by the LGUs.

Based on the consultations the following are the perceived problems in watershed management:

- Fast growing settlement structure
- Too much number of small scale charcoal
- Degraded forest cover upstream
- Poor Management on watershed
- Conflicting proclamations on land use
- Land used sustainability
- Deforestation/Kaingin charcoal making by the locals
- Improper land-use zoning
- Watersheds used a resettlement area

The families living inside the MRB derive income from planting agricultural crop, selling small household item needs in small tindahan or mini-stores, tricycle driving and employment in the private and government sector.

Households derive income from livelihood activities based on lands of the basin and using forest products as major sources of raw materials. Because of insufficiency of sustainable livelihood opportunities and increasing cost of living, increasing cost of fuel for cooking and consequent increase in demand for charcoal, charcoal making is rampant and becoming major means for livelihood.

Communities are currently engaged in farming or agriculture. With current work and experience in farming, it is expected that these people can also develop and tend agroforestry and forest plantations. The government can give these opportunities through National Greening Program (NGP).

The problem of charcoal making directly and very significantly contributes to forest degradation and is related to the problem of lack of livelihood. The problem is thus aggravated by the lack of will among law enforcers to stop the practice, mainly for consideration of the need of the poor upland people to earn and live, albeit, through a means that sacrifices the forest. Without addressing the problem squarely, the watershed will continue to be destroyed and the problems of flooding will continue to be experienced in the lower portions of the basin. There is urgent need to formulate a program to properly manage charcoal making if this cannot be stopped. This can be addressed by establishing and managing fuel wood plantations in appropriate areas, e.g. backyard, grasslands, brushlands.

This will save the natural forests as well as the areas not really intended for charcoal making. Charcoal making with reduced or without significant CO₂ emissions should also be practiced.

7.5 POTENTIAL WATERSHED MANAGEMENT STRATEGIES AND PROJECTS

There are two strategies that will address the concerns and problems related to watershed management in the Marikina River Basin. They are enumerated below together with the specific intervention strategies.

1. Build capabilities of stakeholders to manage and conserve the watersheds
 - a) Implement information, education and communication strategies to sensitize the stakeholders on the importance of the river basins.
 - b) Policy and institutional reforms which will involve the study of policies and organizations that directly affect the effective management of the basins.
 - c) Improve capacities of institutions and communities in watershed management will involve conduct of trainings and other capability building activities that will provide the stakeholders with skills to properly manage the watershed in the context of multi-resource management by multi-stakeholders.
 - d) Harmonization of tenurial instruments and provide security of tenure to qualified upland occupants. Because various instruments exist that are used to transfer rights over some resource in the watersheds, such instruments need to be made consistent.
 - e) Harness public private partnership (PPP). Mobilize private sector support to watershed development and management. Watershed management and watershed interventions are expensive. Stakeholders should contribute shares in the financing of projects within the river basins.
 - f) Provide alternative sources of income for the members of communities within the watersheds, because when there is no long term livelihood program, and people turn hungry because of lack of money to buy their basic needs, they resort to illegal activities including destroying existing forest stands.

2. Improve the ecological/protective and socio-economic and productive values of the watersheds
 - a) restore natural characteristics
 - b) protect and conserve critical habitats
 - c) Improve and manage biodiversity
 - d) Improve water supply
 - e) Promote development and utilization consistent with government sustainable reform
 - f) Protect the remaining old growth/closed canopy forests
 - g) Retain and protect the biodiversity of the watersheds
 - h) Rehabilitate and reforest open and denuded areas

- i) Improve the productivity of the upland, sloping lands, and water resources

7.5.1 PROPOSED PROJECTS

Focusing on the core issues and problems and in consultation with the stakeholders, big ticket projects were identified that will truly address the problems of the basin as far as watershed management is concerned. The projects are:

a. Community Forest Management Project

When the Commission proposed to oversee the management of the river basin is formed, it will need the participation of other stakeholders in undertaking the various tasks related to bringing back the productive condition of the watersheds. The task of managing the watersheds cannot be done by one organization alone. The component activities under this project are: a) Preparation of Community Forest Management Plans; b) Establishment of Agroforestry model farms and Livelihood Programs; c) Identification and preparation of Plans for Community Infrastructures; d) Establishment of Community Forest Parks.

b. Integrated Watershed Protection and Rehabilitation Project

Rehabilitation and protection have been in the forefront of strategies of the country to accelerate the improvement of the country's forest cover. Reforestation and protection of watersheds of the MRBs is aimed at securing sustainability of water for the communities within and outside the river basin. The component activities will include: a) Organization of Multi-stakeholders Forest Protection, Monitoring Teams; b) Forest Officers Deputation and Training on Enforcement of Regulations on Natural Resources Extraction and Utilization and Other Concerns; c) Multi-stakeholders Participatory Community Development Approach to Reforestation / Rainforestation; d) Soil and Water Conservation and Bio-engineering Measures along Marikina River; e) LGU Land Use Zoning and Formulation of Ordinances.

c. Livelihood Generation Project

The socio-economic surveys conducted in the project study sites showed that the capability of local communities to participate effectively in the proper management and protection is hampered by poverty and lack of opportunities to earn a living. Livelihood projects can help achieve effectiveness in participation. Livelihood projects to wean the communities away from destructive activities are very useful to conserve the environment. The component activities are: a) Community organizing and development in communities in the watersheds; b) Formulation and installation of a livelihood micro-financing facility; c) Livelihood Feasibility Studies; d) Provision of technical assistance; e) Provision of financial assistance.

d. Forest Production and Development Project

This project aims to provide alternative source of income and raw material for charcoal production. It is assumed that private sector will participate in making the watersheds

productive and help provide local communities with employment opportunities. The component activities are: a) Forest Plantation for Fuel; b) Forest Products and Processing and Marketing Project.

e. Watershed Management Planning Project

Detailed management plans are need for the watersheds to be managed properly so that they will continue to provide the goods and services they should provide. The activities proposed are: a) Management Planning including Adoption and institutionalization of community-based river basin management; b) Capacity building of LGUs on river basin management.

f. Policy and Institutional Reforms Study

Responsive policies that are harmonized, accepted by stakeholders are important for the management of the watersheds. a) Policy studies and conduct of public consultation and institutional coordination; b) Conflict resolution to resolve issues affecting the watershed

g. Harmonization of Tenorial Instruments Study

Tenorial instruments have to be harmonized to avoid confusions in the management of watershed resources. a) Delineation and demarcation of boundaries including policy study on tenure and occupancy; b) Formulate a unified process for adoption by concerned agencies (DENR, DA and DAR) to avert overlapping conflicts.

h. Watershed Management Capability Enhancement Project

Capability of concerned agencies and organizations should be enhanced so that they can effectively contribute to the development and management. a) Capability building for the existing PAMB of Upper Marikina Protected Landscape; b) Capability building for the proposed RBO of the Marikina River Basin; c) Design, installation and operationalization of GIS-based database

i. Climate Resilience and Green Growth for Marikina River Basin

Five upper basin LGUs had been recipient of a CCC project on climate resilience and green growth and are able to undertake activities like vulnerability assessment, natural resource accounting, greenhouse gas inventory and other activities related to ecotown management. Three other lower basin LGUs, Quezon City, Marikina City, and Cainta Rizal are also able to undertake similarly mentioned activities.

8 WETLANDS AND RIVER

Most of the LGUs have programs to control influx of informal settlers and help the latter to live in formal settlements. For example, Marikina City has successfully contained the influx of new squatters since its creation of the Marikina Settlements Office in 1993 (2013-2020 CDP). To date, there are only 421 households living within the three meter easement of the creeks. These informal settlers are already due for relocation to safer grounds in coordination with the National Housing Authority. (2013-2020 CDP).

Pasig City has an estimated 10,000 squatter families mostly concentrated on rivers and creeks (Pasig CLUP). Large concentration of squatters is on the banks of Manggahan Floodway and on the unfinished embankments. One solution of the LGU is the Community Mortgage Program or CMP wherein squatter families organize themselves into an association to establish a personality to negotiate with the government and the landowners for the acquisition and eventually, subdividing the lot they will occupy regardless of the housing standards.

8.1 DESIRED CONDITION FOR WETLANDS AND RIVER MANAGEMENT

In general, the river system should have waterways and floodplains that are free of obstruction and/or manmade structures. However, the development within the watershed necessitates installation of flood control structures to minimize damage to human life and to the built-up structures and facilities within the basin. To ensure the operation of these hydraulic control structures as designed, the facilities and its support systems should be properly maintained and inaccessible to unauthorized persons to prevent installation of any structures that will cause obstruction or flow restriction during its operation.

8.2 PROBLEMS AND ISSUES

It is a common sight particularly at the urbanized area that Marikina River has no easement since it is already occupied by structures which are sometimes extending up to the riverbanks. Even the floodway for the flood control structures and its buffer zone is being occupied by informal settlers. In some cases, small streams or creeks that are tributaries to Marikina River are even reclaimed for conversion as built-up area.

Occupancy of the river easements and small tributaries are directly putting these occupants to flooding hazards since these are the part of the river system that will initially receive the excess flow from the waterways. Encroachment will even complicate the problem since the LGUs will now have social responsibility to protect the lives of these informal settlers once they are settled in this area.

8.3 POTENTIAL WETLANDS AND RIVER MANAGEMENT PROGRAMS/PROJECTS

Other LGUs having problems with encroachment but with no definite program could consider the abovementioned programs of Marikina City and Pasig City for their possible implementation. The concerned LGUs could implement the same program or could make some modifications based on the locational conditions, their capabilities and budgetary requirements to implement the program, among others.

8.4 PROPOSED WETLANDS AND RIVER MANAGEMENT PLAN

A multi-sectoral approach is required to solve the problems of encroachment of the river easements and its small tributaries. The NWRB, DPWH, LGUs and other concerned agencies should coordinate and design a program to maintain the easement of public use. To date, it seems that there is no definite process for the control and maintenance of the easement. The NWRB is responsible in the implementation of the PD 1067 *Water Code* wherein the provision for easement of public use is defined. However, the NWRB has limited manpower resulting to its policing power for maintenance of easement to be set aside in order to focus on other more important functions. The DPWH will get involved in case a road alignment will be crossing or running parallel adjacent to a river, and in installation of flood control facilities or hydraulic structures along the river. Lastly, the concerned LGUs have direct and easy access to the area aside from supervision of the enforcement group. The LGU is also developing a land use plan and/or zoning plan wherein the easement of public use could be incorporated.

The abovementioned agencies, together with Land Management Bureau and NAMRIA, could define a program regarding the encroachment of waterways. This multi-sectoral group should prepare a plan that will define the functions and responsibilities of each agency. The plan should identify the following:

- The easements of public use along the entire stretch of the Marikina River system
- Development and/or facilities that will be allowed adjacent to the easements and established buffer zone for installed flood control structures
- The agency/ies that will check and approved the proposed development adjacent to the easements and/or established buffer zones
- The agency/ies responsible for the maintenance of the easements and established buffer zones
- The agency/ies that have police power to apprehend the violators
- Relocation plan for the existing informal settlers and the implementing agencies

9 WATER QUALITY PROTECTION AND MONITORING

9.1 CURRENT CONDITIONS

From the headwater of Marikina River in San Jose del Monte up to upstream section in San Mateo, Rizal, the major sources of water pollution are agri-based industries such as poultry, piggery and agricultural farms; quarrying / mining; highly urbanized communities; and, presence of sanitary landfills. These are primarily sources of physical and biological pollutants. Downstream of the river from Marikina City, the sources are mostly service-oriented business establishments, highly urbanized communities, and manufacturing industries particularly leather goods manufactures. The same clusters of pollutant sources in Marikina City could be identified further downstream up to its confluence with Pasig River although the industrial cluster already include some major multi-national manufacturing and processing industries. At the downstream section, the expected pollutants are more chemical and biological in nature.

9.2 DESIRED CONDITIONS

Initiatives are underway for the operation of sewage treatment plant (STP) in Metro Manila. Before 2011, the Manila Water Company Inc. (MWCI) is already operating 27 STPs within its concession area covering the cities of Makati, Pasig, Mandaluyong, Marikina, San Juan, Taguig, and most parts of Quezon City, some parts of Manila, Pateros, and some cities and municipalities of Rizal. In 2011, the MWCI has started the operation of the Olandes STP. The Olandes STP is designed to process up to 10 million liters per day (MLD) of domestic wastewater from 40,000 residents of Cinco Hermanos, Industrial Valley, and Sitio Olandes in Marikina City, as well as some parts of Quezon City.

For the domestic solid waste management, Marikina City is setting a good example with a garbage collection efficiency rate of 98% (Marikina CLUP, 2000). It established a system that prevents direct or indirect dumping of solid wastes on waterways.

The Laguna Lake Development Authority (LLDA) is the government agency responsible in ensuring the compliance of industrial establishments with the RA 9275 or *Clean Water Act* for the MRB.

9.3 PROBLEMS AND ISSUES

For the communities and establishments along the waterways, the latter could serve as the final outlet of their generated solid and liquid wastes. Solid and liquid wastes from households find its way to the river system via the drainage systems. In general, urban communities are still using the traditional household disposal system for domestic wastewater management due to the absence of sewer lines.

Industrial establishments located along the riverbanks are discharging liquid waste directly to the river with or without any treatment. The LLDA is responsible in monitoring and ensuring compliance of the establishments in the discharge of wastewater. However, the LLDA has

difficulty of monitoring the numerous industries within the Laguna Lake Basin wherein the MRB is included partly due to limited manpower. With these lapses in implementation of environmental regulations, some industries prefer not to register with the LLDA. Consequently, they do not install and operate wastewater treatment facility (WWTF) due to its prohibitive cost from the capital outlay up to its operation and maintenance.

9.4 POTENTIAL PROJECTS FOR WATER QUALITY PROTECTION AND MONITORING

The LLDA could implement a complete survey of establishments within the MRB to determine the facilities not in compliance with environmental regulations and consequently, contributing to the pollution of Marikina River. Based on the survey, the LLDA could already regulate all the establishments and require them to comply with the applicable environmental regulations. The LLDA could coordinate with the LGUs for the initial list of establishments since almost all of the establishments are applying for a business permit prior to its operation.

The LLDA will require additional manpower and budget to implement this project. The LLDA may employ some temporary personnel to facilitate the conduct of the initial survey. Upon completion of the initial survey, some of the survey personnel could be permanently employed to continue the regular conduct of this activity, aside from being part of the technical team that are doing the monitoring of the establishment.

10 FLOOD CONTROL AND HAZARD MANAGEMENT

10.1 CURRENT CONDITIONS

Flooding is aggravated by damaged, cut or clogged drainage systems. In Pasig, absence of dikes/embankment or closure of Rosario floodgates of the Manggahan Floodway inundates low-lying areas (Pasig CLUP, 2007). Lastly, encroachment of the natural waterways is blocking the flow resulting to water stagnation or flooding for days.

10.2 PROGRAMS AND PROJECTS

10.2.1 STRUCTURAL

10.2.1.1 PASIG-MARIKINA RIVER CHANNEL IMPROVEMENT PROJECT (PMRCIP)

To cope with flooding problems in Metro Manila, the Department of Public Works and Highways (DPWH) conducted an updated Master Plan for flood control and drainage improvement in Metro Manila and a Feasibility (F/S) Study on the channel improvement of the Pasig-Marikina River System from January 1988 to March 1990 (**DPWH, 2011**). Based on the review of the F/S for the river channel improvement project, the "Pasig-Marikina River Channel Improvement Project (PMRCIP)" is proposed for implementation in the following four (4) phases:

- (1) Phase I : Detailed Design for the Overall Project from Delpan Bridge to Marikina Bridge; 29.7 km
- (2) Phase II : Channel Improvement Works for Pasig River (Delpan Bridge to Napindan River); 6.4 km
- (3) Phase III : Channel Improvement Works for Lower Marikina River including Construction of Marikina Control Gate Structure (MCGS) (Junction with Napindan River to Manggahan Floodway); 7.2 km
- (4) Phase IV: Channel Improvement Works for Upper Marikina River (Manggahan Floodway to Marikina Bridge); 6.1 km

Presently, the PMRCIP (*Phase III*) is now undergoing the bidding process prior to its implementation. The construction of Marikina Control Gate Structure (MCGS) is no longer included in the PMRCIP (*Phase III*). The project coverage area is located in the cities of Manila, Mandaluyong, Makati and Pasig. The major scope of the proposed PMRCIP (*Phase III*) are the following:

1. Construction of revetment with reinforced concrete river wall supported by the steel sheet piles along the Pasig River (*total length = approx. 9.90 km on both banks: revetment with river wall = 7.50 km, river wall only = 2.40 km*);
2. Dredging of Lower Marikina River (*total length = 5.40 km; total volume = approx. 612,000 m³*); and

3. Construction of dike/revetment, river wall and boundary banks along Lower Marikina River (*dike/revetment = 1.70 km, river wall = 0.34 km, boundary bank = 7.06 km*).

10.2.1.2 MANGGAHAN FLOODWAY

The Manggahan floodway in Pasig City is, a controlled waterway used to prevent flooding in Manila. This is achieved by diverting the peak water flows of the Marikina River to the Laguna de Bay which serves as a temporary reservoir. . In case the water level on Laguna de bay is higher than the Marikina River, the floodway can also reverse the flow. The confluence of Marikina and Pasig Rivers is located about 6.75 km downstream of Manggahan floodway. The Manggahan by design is capable of handling 2,400 cubic meters per second (m^3/s) of water flow based on 100 year return flood, although the actual flow is about 2,000 m^3/s . It is 9.0 km long and has an average width of 220 m.

10.2.1.3 NAPINDAN HYDRAULIC CONTROL STRUCTURE (NHCS)

To prevent or lessen the increase of salinity from Manila Bay and pollution from the Pasig River from entering Laguna de Bay during times of reverse flow or higher water level in Manila Bay compared to Laguna de Bay, the Napindan Hydraulic Control Structure (NHCS) was constructed in 1983. The NHCS is found on the confluence of Marikina River and Pateros-Taguig River with Pasig River. This confluence is also the downstream endpoint of the Napindan Channel, which is the upper part of Pasig River that connects to Laguna de Bay.

Apart from preventing the reverse flow of Pasig River, the NHCS is also used for flood control. During the rainy season, most of the flooding along the Pasig River area is due to the increased water flow coming from Marikina River. The Manggahan Floodway in Pasig City was constructed to divert much of the water from Marikina River directly into Laguna de Bay. By also closing the NHCS during times of rain, the water is effectively dammed in Laguna de Bay preventing it from flooding the downstream portions of Pasig River.

The NHCS has a fully gated diversion dam at its head and was designed with a width of 260 m. Over 40,000 households are situated along the floodway's banks and these shoreline informal settlers have reduced the NHCS effective width to 220 meters.

10.2.2 NON-STRUCTURAL

10.2.2.1 PROJECT NOAH

The Nationwide Operational Assessment of Hazards (NOAH) was launched by the Department of Science and Technology to put in place a responsive program for disaster prevention and mitigation. The Project NOAH is envisioned to enable the warning agencies to provide a 6 hour lead-time warning to vulnerable communities against impending floods and to use advanced technology to enhance current geo-hazard vulnerability maps.

NOAH's mission is to undertake disaster science research and development, advance the use of cutting edge technologies and recommend innovative information services in government's disaster prevention and mitigation efforts. Through the use of science and technology and in partnership with the academe and other stakeholders, the DOST through Program NOAH is taking a multi-disciplinary approach in developing systems, tools, and other technologies that could be operationalized by government to help prevent and mitigate disasters.

The initial output of Project NOAH is focused on the Marikina Watershed. As of July 6, 2012, the following information are accessible online: streaming data from the automated rain gauges and water level sensors; flood hazard maps overlain on Google Maps; graphical satellite radar and Doppler data forecasts; and, translated rain intensity and volume measurements in terms of warning and evacuation level alarms, hours or days ahead of the flood event.

10.2.2.2 EFCOS PROJECT

The DPWH implemented the Effective Flood Control Operation System including Telemetering and Flood Warning System in the Pasig-Marikina-Laguna Lake Complex or the EFCOS Project. The EFCOS was a project under the leadership of the Department of Public Works and Highways (DPWH) in collaboration with the Japan International Cooperation Agency (JICA), and was later transferred to the Metro Manila Development Authority (MMDA). The project aimed to achieve effective flood control through water gauging systems and utilizing warning systems to mitigate flood damage (**Azarias, 2010**). The initial phase of the project composed of the establishment of hydrologic gauge stations, flood warning equipment, and telecommunication facilities for the linkage and control of these various equipment and facilities. The second phase of the project involved installation of five (5) rainfall gauges, installation of nine (9) warning posts along the Manggahan Floodway, and setting-up of additional water level stations and telecommunication systems in different LGUs in Metro Manila for efficient coordination (**Azarias, 2010**).

10.2.3 COMBINED SYSTEM

10.2.3.1 SAVE THE MARIKINA RIVER

In 1992, the "Save the Marikina River" project was initiated by then Mayor Bayani Fernando of Marikina (**ADB, 2008**). The project involved massive drainage improvement by unclogging the network of canals, creeks and other waterways to drain straight into the Marikina River. Roads were paved to improve storm drains and river dredging became more regular. In 1994, a new law declared 'no-build zones' along both sides of the river. All factories on the riverbanks were removed, or they were forced to set up their own waste and wastewater management facilities while affected households were relocated (**ADB, 2008**).

10.3 DESIRED CONDITION FOR FLOOD CONTROL AND HAZARD MANAGEMENT

During the consultative workshop, the stakeholders formulated a vision of *Zero Flooding in 2028*. This condition could be partly attained, if not totally, with the presence of adequate structural and non-structural facilities for flood control, adequate and unclogged drainage systems, non-encroachment of river easements and small tributaries, watershed rehabilitation and protection, and no solid wastes and/or floating debris along the waterways.

There are already different structural and non-structural facilities for flood control operating at MRB. The DPWH is even currently implementing the Phase III of the Pasig-Marikina River Channel Improvement Project (PMRCIP). However, the design of the facilities has its limitation which is primarily determined by the financial allocation thru cost-benefit analysis. Thus, extreme conditions beyond the design capacity of the facilities are still expected to cause flooding. However, flooding will be minimal if the other abovementioned conditions within the control of the concerned agencies are in place together with the consensus and active participation of the stakeholders.

10.4 PROBLEMS AND ISSUES

It is perceived that the lack of flood control structures is a major factor resulting to flooding in the area. The major flood control structures along the Marikina River are the Manggahan Floodway which is capable of diverting up to 2,400 m³/s although its present optimum operational capacity is only 2,000 m³/s; and, the Napindan Hydraulic Control Structure (NHCS) which is being closed during rainy season to prevent flooding at the downstream of Pasig River after its confluence with Marikina River. In addition, some small water impounding projects (SWIP) are constructed and/or for construction on narrow depression or valley upstream of Marikina River to hold back water and develop a reservoir that will store rainfall and runoff during the rainy season.

By diverting floodwaters to Laguna de Bay, the Manggahan Floodway lessens flood conditions in Metro Manila but contributes to flooding of the coastal areas along Laguna Lake such as Taguig, Taytay, and other towns / cities in Laguna and Rizal. It is believed that severe flood becomes more frequent and lasts longer in these areas since the construction of Manggahan Floodway.

The NHCS is designed with a floodway width of 260 meters but encroachment of over 40,000 households within the floodway reduced its effective width to 220 m. This constriction of the floodway width reduces the NHCS flow capacity resulting to immediate flooding of the households within the designed floodway and its vicinity upon reaching full capacity. Moreover, proliferation of aquatic plants like water lily in the floodway further reduces the flow capacity in NHCS.

10.5 POTENTIAL FLOOD CONTROL AND HAZARD MANAGEMENT PROGRAMS/PROJECTS

The national government, thru the DPWH, has a flood control program for the MRB. The Phase III of the program is now on its initial implementation with the final stage or Phase IV still for implementation in the future. This is a major program for flood control and prevention within the MRB. The operation of this flood control facility will require maintenance of its technical components and support structures along the floodway. Specifically, the floodway and its established buffer zone should be inaccessible to unauthorized persons and always kept free of obstruction.

The MMDA has no manpower that could conduct regular monitoring of the entire facility to control access of unauthorized persons in order to prevent installation of structures and opening up of the area. Considering that the concerned LGUs are the direct beneficiary for the operation of the facility, they could assist in its maintenance and/or monitoring. They could issue ordinances that will regulate access to the facility. The ordinances could support the setting-up of monitoring team at the barangay level who will conduct patrolling to control access to the facility. The concerned LGUs could also consider the presence of the facility in their land use plan so that adjacent structures and/or facilities to be constructed are compatible and will not encroach the restricted area.

10.6 PROPOSED FLOOD CONTROL AND HAZARD MANAGEMENT PLAN AND PROJECT

The Department of Public Works and Highway (DPWH) has the responsibility for the nationwide flood control and protection to which the Marikina River Basin is included. The DPWH prepared Flood Control Master Plans and installed flood control facilities for the Marikina River Basin. After the completion of the flood control facilities for the MRB, it is being turnover to the Metro Manila Development Authority (MMDA) for its operation and maintenance.

The operation of the facilities by the MMDA is an additional responsibility which is not included in its main functions and activities. Thus, the MMDA has limited skilled personnel to operate and maintain the systems unlike the DPWH which has a pool of skilled personnel familiar with the operation and maintenance of such facilities. In addition, the financial requirement for the operation and maintenance of the facilities will depend on the budget of MMDA. On the other hand, the DPWH has a national allocation for the operation of the department handling the operation and maintenance of flood control structure and facilities.

Considering the importance of the facility maintenance to ensure its operation when the need arises, there is a need to review the present set-up of transferring the facility to MMDA for its operation. The assessment will include determination of the adequacy and competency of MMDA manpower handling the facility, and sufficiency of MMDA funds for its operation and maintenance. The following options could be the results of the assessment which could be adopted in the Flood Control and Hazard Management Plan:

- Status Quo, with Enhancement of MMDA Capability
 - Possible increased in personnel and budgetary allocation
 - Upgrading competency thru training/ technology-transfer by facility experts and/or DPWH personnel
 - Involvement of MMDA personnel from the conceptualization, design and construction of new facility
- Partnership between MMDA and DPWH
 - Clearly defined functions and responsibilities for each agency
 - Setting-up of organization structure that will operate the system
- Return of the Operation and Maintenance of the Facility to DPWH

Table 6 List of Proposed Plans, Projects and Programs for Flood Control

Plan/ Projects/Programs	Lead Agency	Budgetary Requirements	Remarks
a) PMRCIP	DPWH	Budget allocation based on the Master Plan prepared by DPWH	Phase III is now ongoing with the last phase (Phase IV) to be implemented in the future
b) Strengthening Capability for the Maintenance of the Flood Control Structures	MMDA and/or DPWH	PhP 1M (The estimate is only for the assessment and does not include cost for possible additional personnel depending on the result of assessment)	Will require assessment of the current system before the implementation of the chosen plan

11 INSTITUTIONAL FRAMEWORK AND PHYSICAL STRUCTURE FOR MANAGEMENT

11.1 ISSUES AND PROBLEMS

There are a lot of efforts among stakeholders to protect and manage the watersheds. However, these efforts need to be organized, to be effective. It is quite disheartening among civil societies that despite of their efforts, albeit scattered, to save the river basins from destruction, these efforts remain unnoticed, as this is made obvious by observations of stakeholders that there is a lack of organized efforts and preparedness to reduce and mitigate flooding and other natural hazards and their disastrous impacts. Other problems related to weak institutional arrangements and were identified during the various consultations include: a) Overlapping of jurisdiction of various government agencies and sometimes local government units; b) Conflicting land uses as many of them are not based on the capabilities of the lands of the basin; c) Overlapping and sometimes conflicting programs; d) Poor law enforcement in the watersheds; and e) Conflicting laws and policies. Our assessment is that there is also Weak institutional capacity of government agencies and LGUs in the management of the basin's resources resulting from Lack of data and information sharing and networking among government agencies and LGUs in the basin. In addition there are conflicting and varied interests among stakeholders in the use of the basin's resources, opposing views of political leaders, conflict of interests among stakeholders and conditional support of stakeholders. Poor enforcement of national laws and regulations at the local level may arise from lack of political will to enforce laws or lack of resources, personnel and fund allocation.

Because of the above cited problems and issues, as well as the created apathy among stakeholders to protect and conserve the river basins, the condition of the river basin continue to deteriorate as destructive practices continue to be undertaken by many uncaring stakeholders. These actions may be because of the following perceived effects of the lack of good management of the basin.

There is lack or none at all, of public pressure to tackle illegal activities leading to their silent acceptance. The risk of being caught and prosecuted is very low, thus indirectly encouraging illegal operations.

11.2 DESIRED CONDITION

A dynamic and well represented river basin organization is in place to effectively implement the strategies, programs and projects in the various components to put in place the principles and concepts of Integrated River Basin Management .

11.3 STRATEGY

Addressing the problems and issues in the management of the river basins require innovative approaches towards the sound management of the river basins and the

watersheds. Command-and-control approaches using rules and regulations that have been instituted to halt the anthropogenic causes of deterioration have not worked even in areas other than the Marikina River Basin. Even development programs that were implemented to rehabilitate watersheds have less than desirable outcomes and less than desired improvement of the condition of the watersheds. Solution requires more than technical considerations because the demands of the different stakeholders are complex. Given the complexity of the problems, involvement of the various sectors in addressing the concerns for watersheds that provide the good and services to satisfy local and national demands, is needed.

11.4 ISSUES AND PROBLEMS

The lack of effective management of the basin resources is rooted to a lot of problems that beset the agencies and organizations that should work together to manage the river basins. Currently there is no organization to oversee and orchestrate basin-wide policy, planning, program and project implementation.

There are a lot of efforts among stakeholders to protect and manage the watersheds. However, these efforts need to be organized, to be effective. It is quite disheartening among civil societies that despite of their efforts, albeit scattered, to save the river basins from destruction, these efforts remain unnoticed, as this is made obvious by observations of stakeholders that there is a lack of organized efforts and preparedness to reduce and mitigate flooding and other natural hazards and their disastrous impacts. Other problems related to weak institutional arrangements and were identified during the various consultations include:

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- b) Conflicting land uses as many of them are not based on the capabilities of the lands of the basin;
- c) Overlapping and sometimes conflicting programs;
- d) Poor law enforcement in the watersheds; and
- e) Conflicting laws and policies.

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Because of the above cited problems and issues, as well as the created apathy among stakeholders to protect and conserve the river basins, the condition of the river basins continue to deteriorate as destructive practices continue to be undertaken by many uncaring stakeholders. These actions may be because of the following perceived effects of the lack of good management of the basin.

There is lack or none at all, of public pressure to tackle illegal activities leading to their silent acceptance.

The risk of being caught and prosecuted is very low, thus indirectly encouraging illegal operations.

For integrated water resources management to succeed in Marikina River Basins, the following should be considered.

Long-term investment is needed. One investment that should be urgently undertaken is the creation of a local river basin organization (RBO) in the river basin.

There should be a clear vision, one that is formulated by stakeholders and an agreement on the values – natural, social, and economic which should be the basis of an integrated, holistic and strategic approach to solve the problems of the basin. These values will also help to identify the areas to be conserved and the sustainable livelihoods needed by the people of the basin.

Effective partnership between the public and private groups must also be built. The strategies and activities identified in this plan while built on strong informational and science base, must be also established as political priorities. One way to strongly support the plans is to formally designate the Marikina River Basin as a vital basin for the long term development and maintenance of the environment of the 14 LGUs inside the basin. It should also be supported by public awareness campaigns to gain the support of the communities.

11.5 INSTITUTIONAL ARRANGEMENT FOR MARIKINA RIVER BASIN

Institutions are important to implement the master plan. Institutional arrangements are important to address the need to coordinate and engage many stakeholders for collective action. It also assumes that stakeholders have different (and often conflicting) visions and perspectives on what needs to be done, relative political weight, and interest. It will set in place an institutional arrangement to get the active participation of the agencies, local government units, private sector, and civil society organizations in implementing the Master Plan and at the same time establish public private partnership in undertaking development projects in the basin.

Institutional arrangements will help address the problems and issues identified by the stakeholders and pave the way to the creation of an organizational set-up to effectively address issues and concerns.

In identifying the ideal institutional arrangements for the implementation of the master plan, water sustainability will be considered central in development plans, with specific measures for urgent needs.

11.6 PROPOSED ORGANIZATIONAL STRUCTURE

Addressing the problems and issues in the management of the river basins require innovative approaches towards the sound management of the river basins and the watersheds.

Command-and-control approaches using rules and regulations that have been instituted to halt the anthropogenic causes of deterioration have not worked even in areas other than MRB. Even development programs that were implemented to rehabilitate watersheds have less than desirable outcomes and less than desired improvement of the condition of the watersheds. Solution requires more than technical considerations because the demands of the different stakeholders are complex. Given the complexity of the problems, involvement of the various sectors in addressing the concerns for watersheds that provide the good and services to satisfy local and national demands, is needed.

Given the strategies identified in the various sectors to solve the problems of the river basins and to implement and put in place the principles and concepts of IRBM, a organizational structure is designed to carry out the implementation of this Master Plan.

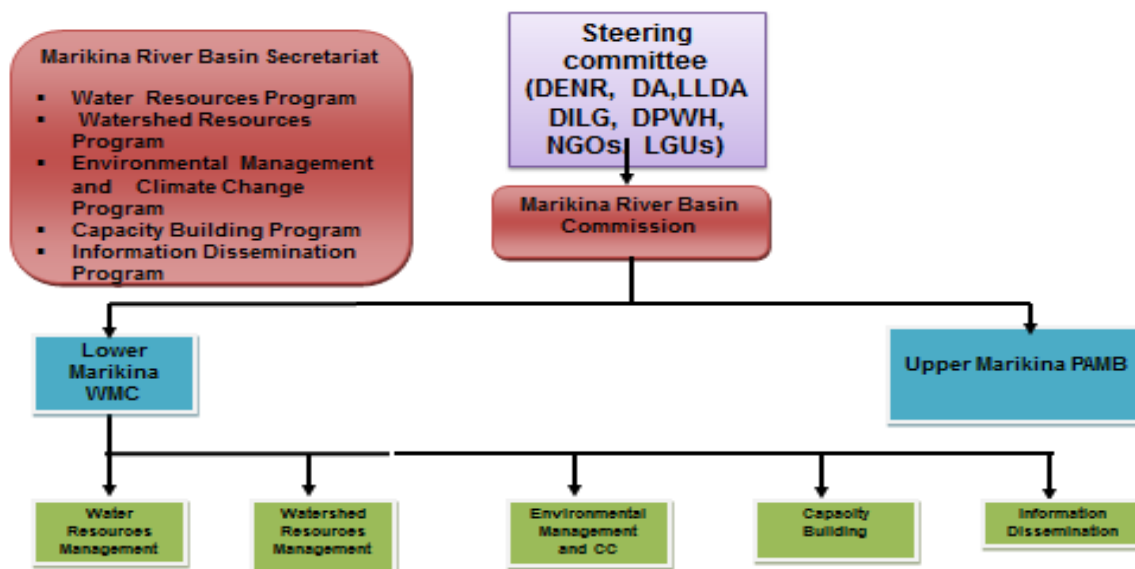


Figure 2 Proposed Organizational Structure for the IRBM of MRB

It will also facilitate the formation of various committees in each watershed management councils to address concerns on specific component element of river basin management, namely:

- Water resources committee takes charge of the concerns related to water resources including irrigation and hydropower, water supply for domestic and industrial use, water related disaster mitigation, drainage and flood control and hazard management, waste water, navigation, and wetland and river management.
- Watershed development committee takes charge of concerns related to the management and use of land resources inside the watershed, as well as activities to conserve natural resources and improve the condition of the watersheds to enable them to optimally provide the goods and services they should be providing.
- Environment committee is concerned about the way water is used in relation to the environment. It includes in its concerns waste management, clean air and pollution.
- Capability building is concerned with the transfer of knowledge and skills to the different stakeholders who have roles in properly managing the basins.
- Information dissemination committee takes charge of communicating to the different stakeholders the different programs and projects of the river basin organizations to further solicit participation from the stakeholders.

The policy making body is a top level body composed of representatives of private and public organizations that have stakes with the river basins. It will be co-chaired by the 2 Regional Executive Directors (R4A and NCR) of the DENR. The body will be composed of representative from the government owned and controlled corporations (M), national government agencies (NEDA, DILG, DA, DPWH), local government units (mayors, governor), and civil societies or non-government organizations (NGO). The areas of concerns which will be covered by the policy making body will include the following:

1. Develops programs for funds and friends raising
2. Promotes management & development coordination
 - Endorses applications for water use permits to NWRB
 - Coordinates activities of the different stakeholders
 - Prioritizes water supply projects
3. Creates enabling conditions for the implementing stakeholder partners
 - Formulate effective system for monitoring of water extraction
 - Monitor progress in implementing programs and projects
 - Provide enabling environment for implementing agencies to achieve goals for their assigned tasks for the river basins
4. Strengthens stakeholder linkages/partnerships
 - Facilitate the process of inter-LGU cooperation in IRBM
 - Enable LGUs to incorporate IRBM in the local government agenda
5. Formulates policies for capability building

6. Undertakes conflict management
 - Develop policies to harmonize the management, control and regulation of water resources management/development.
 - Develop procedure for conflicts resolution
7. Formulates internal operational policies
 - Review existing policies and laws related to integrated water resources management
 - Monitor compliance of existing laws and policies related to integrated water resources management
 - Recommend policies to NWRB and other related bodies
 - Recommend and integrate policies and actions for protection, management, conservation and development of water resources
 - Promote incentives for water conservation
8. Planning and Implementation
 - Coordinate planning & implementation of Integrated Water Resources Development
9. Create a Secretariat
 - Establish and operationalize management info system (land and water)
 - Inventory of all water resources
10. Approve strategies for ICE campaign

11.6 PROPOSED PROJECTS

11.6.1 CAPABILITY BUILDING OF BASIN ORGANIZATIONS

The effective implementation of the master plan requires the participation of different stakeholders. Stakeholders should be provided with capabilities to enable them carry out their allocated tasks. a) Development of MRB Project Monitoring and Evaluation Systems; b) Establishment of RIIIMS; c) Update and implementation of Protected Area Management Plans for UMWPL; d) Formation and Strengthening of RBO.

11.6.2 CLIMATE RESILIENCY AND GREEN GROWTH OF LGUS

Climate change affects the way the basin will be managed. How the various components of the basin and the resources inside are affected by climate change should be considered in identifying and implementing strategies to manage the basin. a) Capability building for remaining LGUs not covered by the ADB Climate Resilience and Green Growth Project; b) Baseline assessment; c) Natural Resources Assessment; d) Identification and prioritization of CCA measures; e) Updating CLUPs of LGUs; f) DRRM Planning.

12 GENDER ACTION PLAN

The success of the development intervention and achievement of the goals and objectives of the MRB management and development are likely to be constrained by gender-related factors, many of which can be avoided if addressed early on. A gender analysis of the development problem can identify gender issues in the management and development of the river basin. In doing so, the activities or interventions may directly reduce gender gaps and inequalities, while utilizing the skills and knowledge of both men and women, and building capacities of the vulnerable and marginalized group of MRB population. This will also ensure that the activities and strategies do not create negative impact on the status of women, children, elderly and disabled.

12.1 ISSUES AND PROBLEMS

There are two major social issues and concerns identified during the consultation with stakeholders of the MRB, namely:

- River pollution and forest degradation resulting not only from the rapid population growth within the basin but more from uncoordinated solid waste management among adjacent LGUs, unregulated environmentally-harmful domestic and economic activities like untreated domestic and industrial wastes, and lack of coordinated institutional arrangements to simply manage the pollution generated within the basin.
- Lack of community stake in managing the river basin most often results to improper practice that both degrades the water bodies or the watershed areas, and worse contributes to the perennial problem of flooding. Same lack of environmental concern also often results to community disregard to environmental laws and regulations.

12.2 GENDER DEVELOPMENT AND MANAGEMENT GOALS AND OBJECTIVES

The Gender Action Plan (GAP) is meant to ensure that women and the vulnerable sector of the MRB will benefit from development and management of river basin. The plan will warrant suitable avenues available for their participation to contribute significantly to the mitigation of negative impacts and/ or reduction of risks associated with the interventions within MRB.

In line with the social development goal for the MRB of invigorated civil society and private sector in managing and developing the basin, the following specific objectives of the GAP with corresponding possible project:

- Encourage wider participation of the youth, women, elderly, and disabled during the planning, implementation and monitoring of MRB development and management

- Strengthening of community-based groups of women, youth, elderly, disabled and IPs to be more constructively involved in environmental protection
- Establishment of a database and mapping of active groups of women, children, elderly and disabled
- Creation/ activation of “environmental army”
- Livelihood improvement and small-scale infrastructure support in vulnerable communities
- Survival training during disasters
- Community-based early (multi-hazard) warning system and Flood adaptation programs
- River systems water quality monitoring
- River rehabilitation
- Reforestation Project
- Increase awareness among the vulnerable sectors within the MRB and their participation in community activities
 - Training and awareness programs on conservation and protection of watershed areas and water bodies
 - Capacity-building on Community-based Disaster Risk Reduction and Management
- Uphold gender sensitivity in the development and management of MRB
 - Gender sensitivity seminars among local leaders and community members
 - Participatory watershed land-use planning

The MRB strategy emphasized community participation as a vital element in a sustainable development. The sense of ownership of the community, especially the women, children, elderly, disabled and the marginalized IPs, empowers them to be more active stakeholders of a balanced eco-system of the river basin.

In lieu of climate change adaptation, a likely example of participation that may result to a very positive outcome is the community-based monitoring of pending disasters- natural or man-made. A community-based early warning system that has no community buy-in is bound to fail. Women, children, elderly and the disabled when informed, consulted, involved and empowered from the very beginning may actually lessen if not totally remove risk and danger of disasters. This is also true if this vulnerable sector is enlisted as advocates for a clean, safe and productive MRB.

12.3 PROJECTS AND ACTIVITIES

The following projects particularly address gender issues and concerns:

12.3.1 ALTERNATIVE LIVELIHOODS ENHANCEMENT PROJECT

Goal: To provide alternative livelihood options for river basin communities.

Activities:

- Identification of existing off-farm livelihood strategies

- Identification of other possible alternative livelihood strategies
- Technical Training
- Propose livelihood projects to specific support agencies

12.3.2 STRENGTHENING OF WOMEN'S ORGANIZATIONS

Goal: To promote wider participation of women in community activities and decision-making.

Activities:

- Organize women's organizations (for those with none)
- Call an assembly of all members of the org
- Election of officer
- Planning of major activities
- Organizational and Leadership skills training

12.3.3 GENDER SENSITIVITY SEMINARS FOR STAKEHOLDERS

Goal: To enhance gender sensitivity among the various stakeholders in river basin management.

Activities:

- Schedule gender sensitivity seminars per sector per area
- Conduct gender sensitivity seminars per sector per area
- Identify and discuss gender issues and concerns
- Identify areas for improvement of gender sensitivity in the household, economic production, and river basin management

13 INFORMATION EDUCATION AND COMMUNICATIONS PLAN

A caveat to an effective IEC plan is a corresponding efficient River Basin Information System, as well as a functional Monitoring and Evaluation System. The success of river basin management systems relies upon coordinated actions, including provision of and access to information as well as the capability to correctly interpret and use this information.

13.1 ISSUES AND PROBLEMS

An IEC plan is a tool to integrate the various components in developing and managing the MRB. However, in trying to integrate and harmonize the IEC messages across the various components of the MRB master plan, there are a number of challenges.

During the consultative meeting, the MRB stakeholders identified lack of coordinated efforts among stakeholders as a major constraint. This does not help that there are overlapping institutional and administrative jurisdiction over certain issues like pollution control and regulation. In addition, the absence of a common set of data or messages to use for IEC adds to the limitation of developing a harmonized IEC plan for the MRB. The absence of an institutional framework to harmonize the IEC and advocacy materials, for instance will result to several contradictory and ill-adapted messages to same target population and consequentially create confusion and lose of public trust to the MRB governance. Hence, an IEC intervention of this nature will be counterproductive to the cause for which the messages are designed.

Another anticipated concern resulting from above issue is the lack of guidance or policy to sort this confusion in implementing the IEC strategy. A guidance could have addressed the issue on the inclusion of inputs and participation of target audience in the formulation, monitoring and evaluation of impact of IEC and advocacy programs, as well as responded to the technical and logistics problem on implementing a high-impact IEC plan.

The IEC plan has a long list of MRB issues and concerns to address and focus on. To name a few,

- Spatially overlapping issues and concerns, like pollution control and regulation
- Absence of a functional data bank for pertinent population-based information, documentation and other data, e.g. relevant socio-cultural information, which could be easily accessed for a focused set of IEC and advocacy messages
- Sharing of common data for purposes of monitoring, mapping, data analysis; and timing of planning processes to optimize efficiency in data collection, assessment, and even public consultation
- Lack of community stake in managing the river basin that most often than not results to improper practice that both degrades the water bodies or the watershed areas, and worse contributes to the perennial problem of flooding.
- Disregard and/or ignorance of environmental laws and policies

Similar to the earlier chapter, problem analysis for the development of IEC plan should involve the participation of the stakeholders, in order to ensure that the strategies developed match the needs that will be addressed.

13.2 STRATEGY AND APPROACHES

Planning and Management Framework

In the context of integrated effort, the framework of IEC planning is geared from public awareness to behavior change. The approach is participatory and evidence-based. Thus, the importance of documentation of lessons and experience learned.

The key result areas are determined with the stakeholders. The inputs, outputs, outcomes and impact of the IEC plan revolve around the vision and developmental goals of the five key component of an integrated MRB.

The expected outputs of the **IEC plan**:

- Production, distribution and utilization of quality and cost-effective IEC and media materials for specific audiences using various formats and channels;
- Conduct scoping activities to determine the environmental and social environment, the enabling factors, and possible barriers to the effective implementation of the IEC plan;
- Conduct regular monitoring and evaluation of the IEC plan to determine the strengths of the plan and build up on it, and to address gaps;
- Efficient and effective coordination of IEC activities among government agencies, civil society organizations and other sectors involved in the implementation of the IEC plan;
- Best practices in environment and resource management IEC campaigns; and
- Professional IEC workforce creating public awareness to sustain environmental protection and conservation of the rivers, forest and other natural resources.

The **target audiences** are the following stakeholders:

- National Government Agencies (national and local)
- Local Government Units
- Civil Society (NGOs, POs, Church)
- Media (TV, Radio, Newspapers, Cable TV, Internet Providers)
- Schools (teachers and students)
- Private sector and businesses
- Local communities within the project area

IEC Development Objectives

At the end of the implementation of the IEC plan, the following are achieved:

- Increased public stake and buy-in in the management of the MRB
 - The concerned government agencies and local government units (provincial, municipal, and barangay) should be able to effectively implement rules and policies related to the environmental protection and preservation targeting maximum compliance.
- The stakeholders and the communities within the project area have a better understanding and increased appreciation of having a properly managed MRB
 - The stakeholders and the communities are aware of their roles, responsibilities and accountabilities and are able to know ways and means by which they can help in protecting and conserving the environment or resource base of the MRB to render it sustainable.
- Improved integration of the efforts of affected LGUs, civil society and private sector in advocating environmental protection of the MRB
 - Enabled communities in protecting and preserving the resource base of the MRB

13.3 STRATEGIES AND APPROACHES

Information can be communicated through many channels to increase awareness and assess knowledge of different populations about various issues and behaviors. It comes many forms – community meeting, mass or social media, etc. Whatever materials and formal programmes are developed, it is important to ensure that the different aspects are coordinated, and that the content of any messages and the media used to convey those messages are complementary. It is also vital to ensure that people are provided with the necessary support and resources to act in the manner advised.

13.3.1 CORE MESSAGES

The core messages for the IEC plan are identified as follows:

- Environmental policies and LGU resolutions
- Health and environmental risks of water pollution
- Protection and conservation of the rivers and forests
- Promotion of sustainable biodiversity
- Community-based and participative climate-resilient interventions

13.3.2 PUBLIC COMMUNICATION

The following are the different types of Public Communication:

- Public Information and Education – Aims to create public awareness, interest and understanding of environmental education and its many facets, generate commitment to specific roles and responsibilities, and develop relevant competencies.
- Social Mobilization – Refers to the process of generating total, active and sustained involvement and participation of all sectors of society at various levels (i.e., policy and decision-makers, implementers, community members) for the attainment of a shared goal or objective such as advocacy and promotion to protect and conserve resources of the river basins.
- Media campaign/media relations – Aims to establish and sustain good media relations to ensure sustained media coverage to create public awareness of all projects to be implemented and to address issues and concerns.

13.3.3 CREATING BEHAVIOR CHANGE

Many public information campaigns are limited to creating public awareness and interest among stakeholders, which has resulted in a wide gap between knowledge and practice. This gap has been observed in projects such as health, nutrition, solid waste management, and reproductive health. Such weakness can be attributed to the development of communication plans that are activity-oriented rather than results-oriented.

This proposed IEC Plan will purposively include behaviour change communication, which aims for concretize observable actions reflective of change in attitude and behaviour. While recognizing the need to create public awareness, behaviour change communication will also highlight what needs to be done by specific individuals, groups and communities. Departing from traditional western strategies of information diffusion and dissemination, behaviour change communication calls for an 'activists' role for communication and advocacy.

Specific behaviour change indicators for primary target audiences will be developed and integrated in the Monitoring and Evaluation component. For example, local communities should be able to develop, over time, that conscientious effort to protect the environment alongside efforts to enhance development of the project area. Studies show that environmental issues could really stem from aggressive destruction of the forest. Local communities and other stakeholders should be mobilized to bear accountability of the environment while enjoying the benefits gained from an improved industry and other economic development. Before people can be mobilized to doing, they have to have the necessary knowledge and valuing for the environment to be able to really espouse conservation and protection efforts. It is in this sense that communication takes a key role in curbing people's behaviour to advocate for the environment and refrain from being indifferent and neglectful of their responsibility and accountability towards the environment. After all, it is where their livelihood depends on.

Hence, for the duration of this communication plan, the stakeholders should be able to practice these behaviours:

- Care for the environment, the rivers and the forest through actual field protection and conservation activities;
- Adherence to conservation and protection policies;

- Consciousness of the need to restore abundant water supply; and
- Awareness of roles, responsibilities and accountabilities to protect and conserve the rivers and the forest.

13.3.4 PARTICIPATORY APPROACH

The participatory process in the conduct of environmental education, IEC and advocacy work means that the plan implementers shall work closely with relevant groups, with the clients, and the intended beneficiaries (target audiences), preferably at all stages of the project -- from planning to implementation, management and evaluation. This approach has two objectives:

- First, to ensure that the needs and experiences of all stakeholders are integrated in all phases of the project; and
- Second, to provide a mechanism for hands-on training enabling client and beneficiaries to acquire communication competencies during the project term.

Participatory approaches can be achieved through joint planning exercises, workshops, regular dialogue, focus group discussions, coaching and mentoring, and regular training, among others.

13.3.5 DOCUMENTATION OF LESSONS LEARNED AND EXPERIENCES

Documentation of lessons learned and experiences in the planning and implementation of the IEC Plan should be ensured. The focus will be the strategies and activities undertaken and their impact. Attention will be given to (a) strategies which work (or so-called Best Practices) and (b) issues and concerns which emerge and how these are addressed. Traditional project documentation reports only on what happened, and the results of these issues and events. It will be useful for validation and replication.

13.3.6 INTEGRATED, SINGLE-LOOK, UMBRELLA CAMPAIGN APPROACH

This IEC Plan adopts the 'act individually but not separately' and an 'integrated, single-look, umbrella campaign' approach. The integrated approach will 'maximize' the effectiveness of the several but separate efforts of the different government agencies, civil society and other organizations." The Plan will also be 'strategic and focused for specific target audiences.' While the integrated IEC plan is a product of its consensus among key stakeholders, there must be provision for continuing critical formative evaluation to allow other outside stakeholders to have a say in its evolution. This kind of flexibility ensures continuing integration of new ideas in the light of dynamic changes going on in environmental management.

13.3.7 PUBLIC AWARENESS WITH A COORDINATING ARM FOR BETTER COMMUNICATION

The integrated, single-look, umbrella campaign requires effective and efficient coordination and administrative communication among government agencies, civil society and other

stakeholders in its implementation. A core IEC committee, participated in by representatives from various stakeholder groups, should be formed with an identified staff to head the committee. This committee will be the coordinating arm for all IEC initiatives. It should function as 'databank' for IEC activities and materials produced.

13.3.8 INTERPERSONAL AND GROUP COMMUNICATION

Interpersonal and group communications are still the most effective communication processes or channels because of the Filipino's high regard for personalism and familism. Personalism puts emphasis on the importance of the person with whom one has immediate face-to-face contact. The advantages of interpersonal and group communication are: immediacy, ability to clarify and validate issues and concerns, and establishment of rapport or personal relationship.

Interpersonal communication includes dialogues and briefings. Group communication channels include seminars, trainings, conferences and similar fora.

13.3.9 DEVELOPMENT, PRODUCTION, AND DISSEMINATION OF IEC AND MEDIA MATERIALS

This approach has been the most common in IEC. Not only does it have the advantage of mass reach, the target audiences often has the better recall of the core messages when properly packaged and disseminated.

13.3.10 ADMINISTRATIVE COMMUNICATION CHANNELS

These are written orders (in print or electronic formats) in the form of administrative orders, circulars, memoranda, and official letters.

13.3.11 MASS MEDIA CHANNELS

Mass media are still the most preferred public information channels because of their wide reach, penetration, immediacy, and ability to influence opinions of policymakers and the public.

Mass media channels include: (a) radio, (b) television, (c) newspapers (national dailies and community newspapers), and Cable TV.

13.3.12 ELECTRONIC MEDIA

Among the electronic channels are: email, web page, CD-ROM, and powerpoint presentations.

13.3.13 PRINTED IEC MATERIALS

Among the most common printed materials are brochures, leaflets, flyers, posters, flipcharts, comics, calendars, stickers, streamers, and billboards.

13.3.14 PROMOTIONAL MATERIALS

Among the most common materials are T-shirts, vest, caps, bags, hand towels, ballpens, fans, and umbrellas.

13.3.15 SPECIAL EVENTS

Contests (Environmental Quiz, poster-making, essay writing, sayawit), concerts, photo contest, games, exhibits, environmental fiesta, fun run, tree planting, green and clean up drive, `lakbay-aral' or cross visits, and launching events are examples of special events.

14 BUDGETARY REQUIREMENTS

The projects were identified based in part on specific project articulations by participants and what the Study Team considered as most appropriate projects to address the development concerns and issues mentioned by the participants during the first stakeholders' workshop in October 2013.

The projects were validated and prioritized during the 2nd stakeholders' meeting in June 2014. The approach for prioritization involved meeting participants scoring each project in terms of contribution to 3 vision elements – clean, safe and productive watersheds; managed by competent, dynamic and well-coordinated institutions; and inclusive social, environmental and economic development.

Some projects identified by the agencies within the Marikina River Basin area that are supportive of the objectives and aspirations of the IMRBMDMP or the MRB Master Plan were also adopted by the Study Team. These consisted of the small hydro power plant projects and the Pasig-Marikina River Channel Improvement Project Phase III (PMRCIP III).

The budgetary requirement for this list of projects is at least ₱3.68 billion, with the largest project being the mini-hydro power plants at ₱3.1 billion. No cost was provided for the PMRCIP III as this Department of Public Works and Highways (DPWH) project is still subject to feasibility study, while the capability strengthening of the maintenance of flood control projects excludes hiring of personnel.

Of the amount, ₱209 million will required for the immediate/short-term projects, ₱347 million for the short- to medium-term projects, and ₱3,100 million for the long-term projects. Immediate projects are those that have to be implemented within a year of Master Plan execution, short-term projects are those that have to implemented within 1-3 years, medium-term within 3-6 years, and long-term in 6 years or beyond.

In terms of priority, those with the highest priority ranking as well as with immediate to short-term implementation period should go ahead of the rest. These are the updating of water body classification/water quality assessment and monitoring under water resources management; integrated watershed protection and management, climate change resilience and green growth, community forest management project and watershed management capability enhancement under watershed resources management; climate resiliency and green growth of LGU's and capability building of basin organization under institutional framework and physical structure management; alternative livelihoods enhancement project, gender sensitivity seminar for stakeholders, and strengthening of women's organizations under the general action plan; and, IEC campaign under the IEC plan. All these priorities would need a total budget of about ₱390 million in 3 years, with up to ₱285 million set aside for Year 1. The proposed investment plan summary including the project cost for 15 year period is contained in **Table 8**.

Table 7 Investment Requirement

Project	Executing agency/ organization	Investment requirement (PM)	Priority ranking	Implementation Period
Water Resources Management				
Characterization of Marikina River Tributaries	DENR	20.0	4	Immediate/ Short-Term
Assessment of Groundwater Resources	NWRB	2.0	4	Immediate/ Sort-Term
Hydropower Development	Private Sector	3,100.5	19	Long-Term
Sewerage Projects (Antipolo, Marikina and San Mateo/ Rodriguez only)	MWSS Concessionaires	2,631.0	N.A.	Throughout Master Plan Period
	Total Amount	5,753.5		
Watershed Resources Management				
Integrated Watershed Protection and Rehabilitation	DENR, MWSS, Water Concessionaires, LGU's, Community Organizations, NGO's	52.0	1	Short- to Medium-Term
Disaster Risk Reduction Management	LGU's, National Government Agencies (NGA's), NGO's, MCWD Private Organizations	30.0	3	Immediate/ Short-Term
Community Forest Management Project	DENR, DA, DAR, Private Sector, Civil Society, Local Communities	25.0	6	Immediate/ Short-Term
Watershed Management Capability Enhancement	DENR, LGU's, NGA's, Communities, NGO's, Private Organizations	20.0	7	Short- to Medium-Term
Forest Production Development Project	DENR, Business Groups, LGU's, DA, DOST, DTI	40.0	9	Medium-Term
Livelihood Generation	DENR, Private Sector, LGU's, Community	65.0	10	Short- to

Project	Executing agency/ organization	Investment requirement (PM)	Priority ranking	Implementation Period
Project	Organizations, NGO's			Medium-Term
Policy & Institutional Reform Study	DENR, LGU's, NWRB, UPLB-FDC, UP, NGO's	8.0	10	Immediate
Water Management Planning	DENR, LGU's, Communities, NGO's, DA, DAR, DTI	20.0	11	Short- to Medium-Term
Harmonization of Tenurial Instruments Study	DENR, DAR, LGU's, DA, Local Communities, Civil Society	50.0	14	Short-Term
	Total Amount	310.0		
Flood Control and Hazard Management				
Pasig-Marikina River Channel Improvement Project (PMRCIP)	Department of Public Works and Highways (DPWH)	198.4	5	Long-Term
Strengthening Capability for the Maintenance of Flood Control Structures	Metropolitan Manila Development Authority (MMDA) and/or DPWH	1.0 ¹	12	Short-Term
	Total Amount	199.4		
Institutional Framework and Physical Structure Management				
Climate Resiliency and Green Growth of LGU's	LGU's, Private Sector, EMB-DENR, Communities, NGO's	150.0	1	Short- to Medium-Term
Capability Building of Basin Organization	Stakeholders, DENR	60.0	2	Immediate
	Total Amount	210.0		
Gender Action Plan				
Alternative Livelihoods Enhancement Project	LGU's	10.0	5	Short- to Medium-Term
Gender Sensitivity Seminar for Stakeholders	LGU's	2.0	5	Short-Term

Project	Executing agency/ organization	Investment requirement (PM)	Priority ranking	Implementation Period
Strengthening Women's Organizations	LGU's	2.0	8	Short-Term
	Total Amount	14.0		
Information Education and Communications (IEC) Plan				
IEC Campaign	Multi-Sectoral Group for Policy/Plan Implementation (RBO)	20.0	1	Immediate/ Short-Term
Knowledge Management			13	Short-Term
	Total Amount	20.0		
	GRAND TOTAL	6,441.9		

¹Assessment only; excludes cost of additional personnel

**Table 8 Investment Plan Summary
(Million Pesos)**

Project	Investment Requirement	Short-Term (Year 1-3)			Medium Term (Year 4-6)	Long Term (Year 7 to 15)
		Year 1	Year 2	Year 3		
Water Resources Management						
Characterization of Marikina River Tributaries	20.0	10.0	8.0	2.0		
Assessment of Groundwater Resources	2.0	1.9	0.1			
Hydropower Development	3,100.5					3,100.5
Sewerage Projects (Antipolo, Marikina and San Mateo/Rodriguez only)	2,613.0	67.0	119.0	75.0	500.0	1,870.0
Sub-Total	5,753.5	78.9	127.1	77.0	500.0	4,970.5

Project	Investment Requirement	Short-Term (Year 1-3)			Medium Term (Year 4-6)	Long Term (Year 7 to 15)
		Year 1	Year 2	Year 3		
Watershed Resources Management						
Integrated Watershed Protection and Rehabilitation	52.0	18.0	17.0	17.0		
Disaster Risk Reduction Management	30.0	30.0				
Community Forest Management Project	25.0				25.0	
Watershed Management Capability Enhancement	20.0				20.0	
Forest Production Development Project	40.0					40.0
Livelihood Generation Project	65.0					65.0
Policy and Institutional Reform Study	8.0					8.0
Water Management Planning	5.0					5.0
Sub-Total	245.0	48.0	17.0	17.0	45.0	118.0
Flood Control and Hazard Management						
Pasig-Marikina River Channel Improvement Project	198.4					198.4
Strengthening Capability for the Maintenance of Flood Control Structures (Assessment Only)	1.0	1.0				
Sub-Total	199.4	1.0				198.4
Institutional Framework and Physical Structure Management						

Project	Investment Requirement	Short-Term (Year 1-3)			Medium Term (Year 4-6)	Long Term (Year 7 to 15)
		Year 1	Year 2	Year 3		
Climate Resiliency and Green Growth of LGU's	150.0	50.0	50.0	50.0		
Capability Building of Basin Organization	60.0	30.0	15.0	15.0		
Sub-Total	210.0	80.0	65.0	65.0		
Gender Action Plan						
Alternative Livelihoods Enhancement Project	10.0	4.0	3.0	3.0		
Gender Sensitivity Seminar for Stakeholders	2.0	2.0				
Strengthening Women's Organizations	2.0	2.0				
Sub-Total	14.0	8.0	3.0	3.0		
Information Education and Communications (IEC) Plan						
IEC Campaign	20.0	15.0	5.0			
Knowledge Management						
Sub-Total	20.0	15.0	5.0			
Grand Total	6,441.9	230.9	217.1	162.0	545.0	5,286.9

The list of projects and the corresponding budget of ₱3.68 billion covers only those identified by the Study Team. But there are also projects that are on-going or are being contemplated within the Marikina River Basin area by national government agencies, LGU's and private organizations as indicated in such reports and documents as follows:

- Flood Management Master Plan for Metro Manila and Surrounding Areas of the Department of Public Works and Highways (DPWH)

- Pasig-Marikina River Improvement Report Annex 1. Extent of Detailed Design of the Department of Public Works and Highways
- A-7 RESILIENCE 2011-2013 Integrated Disaster Risk Reduction and Management Program of the Alliance of Seven
- Comprehensive Upper Marikina River Basin Protected Landscape Management Plan (CUMRBPLMP) of the Manila Water Company, Inc. (MWCi)
- Water Security Legacy Plan of the Metropolitan Waterworks and Sewerage System (MWSS)

Eventually, the proposed River Basin Organization (RBO), if in place already, should determine the status of these programs and projects and how they relate to the integrated river basin development concept being pushed by the MRB Master Plan. These projects include:

- Disaster Vulnerabilities Capacities and Needs Assessment – LGU's belonging to the Alliance of 7 (₱8.09 billion)
- East Manggahan Floodway (Cainta and Taytay River) Improvement – DPWH (₱25.9 billion)
- West Manggahan Area Drainage Improvement – DPWH (₱5.52 billion)
- Pasig-Marikina River Improvement and Dam Construction – DPWH (₱198.4 billion)
- Watershed Management – Reforestation of 5 watersheds including Marikina River adopting the Integrated Water Resources Management (IWRM) approach – Metropolitan Waterworks and Sewerage System (MWSS) (Total budget of ₱6 billion)
- Optimization of Water Source: Flood Plains in Marikina River Basin – MWSS (budget N.A.)

15 FINANCING MECHANISM

15.1 BASIC MASTER PLAN PROJECT FINANCING PRINCIPLES

Flood control projects are mostly financed through the national and local budgets, which means they are funded by taxpayers. Project feasibility studies do not perform financial cost-benefit analysis as no revenues are booked on flood control projects. Only economic cost-benefit analysis is conducted, where the benefit essentially reflects the replacement value of structures, buildings, properties, standing crops and other agricultural commodities, etc. that are likely to be damaged without the project.

The cost of providing water supply, sewerage and sanitation services within the Manila Waterworks and Sewerage System (MWSS) service area is recovered through water tariffs allowed under the MWSS agreement with its two concessionaires, Manila Water Co. Inc. (MWCI) and Maynilad Water Services, Inc. (MWSI). What is not considered in the tariff-setting is the cost of raw water extracted from surface and ground sources. Ideally, this should be included in the water charges. But this could raise the rates significantly it would require strong political will to implement. Nonetheless, if carried out, this could be an effective means of conserving and encouraging more efficient use of a resource that is as scarce as it is essential to life. Moreover, explicit recognition of raw water price will require a mechanism that will handle the proceeds and ensure that they are used to preserve and enhance the value of the resource.

Retention or restoration of quality within the river basin ecosystem is partly addressed by the sewerage master plan of MWSS and its concessionaires, in which customers pay for through the water charges. There are also anti-water pollution laws, such as the Clean Water Act of 2004 (R.A. 9275), which follows the “polluters’ pay” principle. Polluters pay wastewater charges/fees for discharging regulated effluents into water systems. This law should be strictly enforced and the charges imposed must ensure that mindless throwing away of wastes into the river basin is discouraged. Relocation of informal settlers living along water systems should also help address the massive discharge of human wastes.

Preventing floods and pollution in a more sustainable way would require not just the development of infrastructure facilities addressing such problems, but also providing services that safeguard the river basin ecosystem (other than information and education campaigns and values formation). This is the first line of defense against such environmental disasters. This involves such actions as tree planting, renewal of soil and soil fertility, introduction of crops and vegetation, clean-up of river and landscaping. Most especially those that apply to the lowland areas of the river basin system.

There are 3 forms of financing for these services, namely:

- Imposition of taxes and charges by the government that are dedicated to specific ecosystem services

- Cap and trade, which allocates pollution/abstraction permits that provide cap for water pollution/abstraction, and the trading of these permits
- Private payment for ecosystem services (PES), which is a scheme organized between private sellers of services and buyers of such services, with the latter compensating the former directly.

Ecosystem services which support cleaner air, such as forest preservation, renewal, development, and management for striking a balance between commercial use and conservation can have beneficial effects of reducing the carbon footprint. Hence, they can earn carbon credits from a recognized global carbon emission reduction certification body which can be traded in the market, allowing the ecosystem service provider additional revenues.

In considering these alternatives, the following factors are crucial:

- Key stakeholders must be organized to form an institutional mechanism to manage the scheme, including price-setting/rewards, use of the proceeds, and the resolution of relevant issues in the implementation of the payment scheme
- Cost-benefit analysis exercise must be conducted to determine if the benefits of implementing the scheme outweighs its costs
- Development of or the existence of legal framework for the services

In the private PES, for example, the following elements must be present to make it more effective:

- Voluntary in nature
- Buyers and sellers of the service exist
- Benefits of the service must be measurable, and with the benefit directly traceable to the service provided
- Most applicable in localized problems (difficult to implement on a larger scale)

15.2 SOURCES OF FINANCING FOR PROPOSED PROGRAMS AND PROJECTS

DPWH's major flood control projects, such as the PMRCIP III, intend to tap government funds and/or official development assistance (ODA) as sources of financing. Japan International Cooperation Agency (JICA) is the major source of ODA for the project. JICA have financed the development of the master plan in which the project was based and having been the major funder of the project's previous phases. It can also be expected that these financing institutions would be willing to finance the implementation of the projects if they are determined to be feasible from the financial, economic, social, legal and environmental standpoints.

Among the bottlenecks in project implementation in the past was the lack of counterpart financing on the part of the national government. That does not seem to be the case now, with the government in a healthy cash position given improved revenue collection and better managed spending programs, proof of which is the fact that the country is enjoying investment-grade credit rating from international rating agencies. This means that the government can generate the needed counterpart financing for ODA-funded projects with relative ease today, a trend that is expected to continue at least over the medium-term. In fact, for relatively smaller public sector projects, those costing well below ₱1 billion, the national government can most probably provide for the budgetary requirements without having to tap foreign funding. For even smaller local projects costing much less than ₱100 million, large LGUs especially those within the MRB area may have the capability of financing through allotments from the national government and their own revenue generation programs, i.e., local taxes, fees and charges.

Given the highly liquid position of the country's banking system, funds are also available from private financing of major infrastructure projects through such approaches as public-private partnership (PPP) scheme. For relatively smaller projects, companies can provide contributions by way of their CSR programs, such as in the case of some activities. There are also efforts under the CUMRBPLMP to develop payments for ecosystems services (PES) arrangements to finance a number of reforestation and agro-forestry livelihood projects, similar to what was done in Banga Watershed, Lanaodel Sur and Manupali Watershed, Bukidnon.

In summary, project financing will be secured through the following:

- Official development assistance (ODA)/donor financing – As mentioned previously, the Pasig-Marikina River Channel Improvement Project will be financed by JICA, as the previous two phases of the project was JICA-financed. Funding for the other DPWH flood control projects will most probably be negotiated also with JICA, but World Bank and ADB may also be willing to bankroll these projects.
- Foreign grants – International financial institutions such as JICA, World and ADB generally have built-in grant element in project loans, usually for feasibility studies and capability building. Some foreign organizations, including aid agencies such as US

Agency for International Development (USAID), also provide direct unrequited financial assistance to certain activities that support their vision, mission and advocacies, such as addressing climate change, protecting watersheds, and reversing environmental damage.

- Government (national and local budgets) – ODA-funded projects require counterpart financing from the national government so the projects identified immediately above will also be allocated funds through the national budget. There will also be locally-funded projects, or those which either: (a) be primarily financed by the national government without foreign borrowings; or (b) those financed by the LGU's through allotments from the national government and/or revenues raised by the LGUs themselves.
- Private sector – Private contributions, in the form of grants, outright cash, CSR and PES schemes are among the key features in the financing for the programs. MWSS water supply and sewerage projects are being coursed through its concessionaires, Manila Water Company Inc. (MWC) and Maynilad Water Services Inc. (MWSI), which are able to also tap World Bank and other multilateral financial institution (MFI) financing under certain arrangements with local development banks, and which are recovered by the concessionaires through the rate rebasing mechanism as provided for under the concession agreement.

As already mentioned, there are ready ODA funding commitments for the flood control projects. Capability-building budgets can be feasibly incorporated in the agency (DPWH and/or MMDA) operating budgets.

For watershed resources management project, the proposal is to tap development loans, grants and the DENR budget. Accessing microfinance banks for livelihood projects is also a possibility for consideration.

Given that it is revenue-generating with assured returns to investors, water resources projects can easily attract private investors if these projects are found to be financially feasible and there are no unreasonable barriers to investment.

16 OTHER CONSIDERATIONS

16.1 CO-MANAGEMENT APPROACH

As can be gleaned from the list of proposed projects and as described in the briefs of proposed projects, the River Basin Commission must address the need to have the LGUs adopt cooperative projects that transcend their LGU boundaries but will contribute to the overall sustainable management of the river basin.

16.2 SUSTAINABLE DEVELOPMENT APPROACH

Sustainable Development remains the major guiding concept in planning the management of the MRB. As required by NEDA, the River Basin Commission should adopt a Programmatic Environmental Impact Assessment (PEIA) for sequential or phased development projects and F/S studies within the MRB, especially for large and contiguous areas that are to be developed and will result to: 1) a change in land use / resource use (especially groundwater, surface water and marine water resources), and 2) the introduction of new/alternative technologies/activities and foreign species or other natural resources. The potential impacts within the contiguous areas proposed for phased development and the downstream areas should be properly identified, assessed and provided with appropriate mitigation measures. In addition adaptation solutions should be those that will make the LGUs be climate resilient. A resilient MRB LGU is "one where disasters are minimized because the population lives in communities with organized services and infrastructures that adhere to sensible building codes, without informal settlements built on flood plains or steep slopes because no other land is available; where a competent and accountable local government is concerned about sustainable urbanization and that commits the necessary resources to manage and organize itself before, during and after a natural hazard event; where people are empowered to participate, decide and plan together with local authorities; and where there is an ability to respond and implement immediate recovery strategies and quickly restore basic services after such an event."

With PEIA as comprehensive guiding strategy, it should become moot and academic that DRRM and CCA are integrated and cross-cutting planning factors/tools in all levels of proposed project planning, design and the selection of alternatives (location of appropriate areas, types of compatible activities and accompanying environmentally-acceptable mitigation measures or enhancements).

The MRB commission has to be made aware that the new NEDA guidelines for the preparation of provincial physical framework and regional development plans have also integrated DRRM and CCA factors and issues in the "ridge to reef" or basin planning guidelines. As proposed by this masterplan, in its project climate resilience and green growth, all lgus within the mrb will integrated DRRM and CCA (watershed approach) in updating their CLUPs. As the various initial steps in DRRM and CCA requires LGU level activities, the consequent selection and adoption of measures, like GHG emission reductions and green growth strategies should be discussed in the MRB commission so that said projects become basin level and in that manner, LGUs are also made to think and plan within the framework of IRBM.

16.3 MULTI-LEVEL APPROVAL AND ADOPTION

This Master Plan is proposed to get the imprimatur of the Regional Development Councils of both Region 4 and 4A, through the Environment and Economic Committee being headed by NEDA. This is necessary so that projects that are lined up in this Master Plan become parts of the plans of the region, considered consistent with the overall plan of the regions. Being such, said projects can easily have the endorsement of NEDA for possible funding through various modes mentioned in the section of this Master Plan on Financing the Master Plan projects. Lobbying at the provincial and municipal city levels are also necessary to gain support for the approval and adoption of projects in the master plan.

The MRB Commission will also ensure that partial or selective adoption of projects in the master plan by the LGUs in their respective areas will not result to ineffectiveness or may cause more environmental problems.

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