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Governance Philippines
Program for Hydro-meteorological Disaster Mitigation in Secondary Cities in Asia

Safer Cities 22

Case studies on mitigating disasters in Asia and the Pacific

Flood Disaster Mitigation and River Rehabilitation by Marikina City, Philippines

In the 19th century, the Marikina riverbanks were Marikina town's picnic ground and site of religious town celebrations called fiestas. By the 1970s, the river was all filth and stench. Uncontrolled encroachment on the riverbanks by informal settlers, structures within the river, plus the indiscriminate disposal of both domestic and industrial wastes worsened the impacts of the annual river flooding events. The 'Save the Marikina River' Program was begun in 1993 to revive the river and its environs, and develop the waterway into the city's biggest recreational and sports area. While the main objective was to rehabilitate the river, the program actually started from the idea of mitigating the annual flooding to ultimately contribute to river rehabilitation objectives.

Introduction

Marikina City lies within Marikina Valley and is bounded by Quezon City and the Marikina river on the west, Pasig City and Cainta to the south, Antipolo City in the east, and by San Mateo to the north. The city has an estimated population of 490,612 for 2008, and its major industry is shoemaking.[1] Marikina river is the major waterway in the city; it flows through the center of Marikina Valley between Capitol Hills and the Sierra Madre mountain range. It also flows alongside the Valley Fault Line, and so Marikina faces riverine flooding, earthquakes from the fault, and liquefaction along the Marikina riverbanks.

Marikina City: Location and Boundaries **Figure 1**

Source: http://gis.marikina.gov.ph/website/map2/viewer.htm

Marikina City began as a town established by Jesuit priests in 1630. By the 19th century, the riverbank area evolved into the most important *hacienda* (farming estate) that produced rice and vegetables in great quantities. The city was industrialized in the 20th century, with a shift in emphasis from agriculture to shoemaking and heavy industries. With industrialization came population increases and the conversion of rich agricultural land into residential areas. The river became heavily polluted with domestic sewage and industrial waste. The quarrying on the riverbanks led to scouring and erosion. The end result was poor water quality and flooding that claimed lives and destroyed property. Informal settlements along the riverbanks added to the pressures of pollution and flooding.

Abstract

Urban riverine flooding can be worsened by local urban processes and activities that cause river flow obstruction and pollution. This case study presents the flood mitigation efforts by Marikina City's local authority and people, with a special focus on how the physical restoration of the riverbanks and solid waste clean-up contributed to flood disaster mitigation.

What's inside

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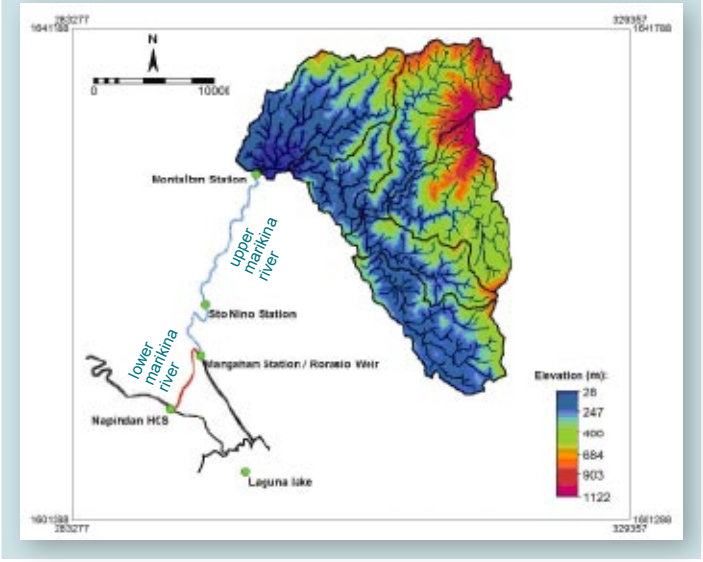
The Pasig-Marikina river basin and its river systems. **Figure 2**



Source: Badilla, 2008.

The river's importance to modern Philippine society stems from an old maritime and riverine culture. Filipinos trace their roots largely from seafaring Malays who came over in frail wooden boats called *balangays*, and subsequently established villages called *barangays* along the island shores or farther upriver. Even the name of the main ethnic group in Metro Manila -Tagalog - means from the (*taga*) river (*ilog*). Through much of Philippine history, Manila Bay was the archipelago's front door, while Pasig River and its tributaries (such as Marikina river) were the major passageways to the various settlements.

Even though the river had destructive flooding events in modern times, the riverbanks were still considered as potential settlement sites by those who could not afford to buy land or property in safer parts of the city. Despite the water pollution, informal settlers still drew on the river for cooking and washing needs. Rehabilitating the river could have a great cultural and health impact for the city residents. Furthermore, the approach taken that was based on flood disaster mitigation, and so the flood risk could be reduced for the city's constituents in general and for informal settlers in particular.

Flooding by Marikina River

Marikina River drains the Pasig-Marikina River Basin. The river basin is located east of the Metro Manila region with a total drainage area of 377.82 km^2. It drains through the Marikina River and then the Pasig River before it empties into Manila Bay. It has a Type I climate, meaning its annual rainfall is from 1,700 to 3,200 mm/year, with about 80% of the rainfall occurring from May to October. Serious flooding usually occurs from August to November. Most of the floods in the urban region's low-lying areas are runoff from the slopes of the Sierra Madre mountain range that run along the east of Marikina Valley (Badilla, 2008).

The entire length of the Pasig-Marikina river is 27 km with several catchment areas (at Napindan junction, Rosario Weir, Sto. Niño water level gauging station, and Montalban water level gauging station). Napindan Channel (a river) and the Mangahan Floodway connects it to Laguna Lake, the country's largest lake and temporary storage for excess flood water from Pasig and Marikina rivers.

Vulnerability

By the 1980s, more than 2,000 households resided on or near the riverbanks. Whether in its normal or flooded state, the river was a hazard to these communities. During continuous heavy downpours or typhoons, the river level rose so much that informal settlers had to vacate their homes and stay in evacuation centers until the floodwaters receded.

Sanitary Conditions of Informal Settlements; Source: Borje et al., 2004c

In normal times, the river was a health hazard for the locals who bathed and washed their clothes and dishes in the river. Sanitation was a major concern since the households either created make-shift toilets near the riverbanks or disposed of their wastes directly into the river. They could not have access to basic facilities such as potable water and sanitation because of their status as informal occupants of the land.

In the early 1990s, the environmental problems included limited garbage collection and dumping of wastes on open land and waterways. Aside from being irregular, the garbage collection service did not reach the settlements near the riverbanks. Some parts of the riverbanks turned into small illegal dumpsites; piles of wastes that would fall from these dumpsites into the river were carried by the current and eventually impeded the flow of water.

River Rehabilitation in Developing Countries

Towns and cities worldwide have historically been established close to or around waterways that provide access to food, water and transport. Subsequent increases of urban dwellers, especially along streams and rivers, affect the appearance and water quality of nearby water bodies). Continued urbanization and the use of alternative water sources for human consumption have made urban waterways a convenient drainage for sewage and storm water. For instance, the shape of the river channel becomes wider, deeper and more uniform, while its water quality degrades due to pollution from sewage effluent and storm water.

Urban rivers are influenced by the above-mentioned processes and activities that pollute the water resource. The UN World Water Development Report (2003) states that 50% of the population in developing countries are exposed to polluted water sources. Asian rivers are the most polluted in the world, with three times as many bacteria from human waste as the global average and 20 times more

Informal Settlements in the Riverbanks; Source: Marikina City Government

lead than rivers in industrialized countries. UNEP (1997) reports that more than 90% of sewage in developing countries is discharged directly into rivers, lakes, and coastal waters without treatment of any kind; the report urged that large cities make wastewater management a high priority.

The UN World Water Development Report (2003) states that 50% of the population in developing countries are exposed to polluted water sources.

Dead rivers used to be found in developed countries including Singapore and Australia; many of these countries have cleaned up their rivers and constructed water treatment facilities, although integrated management of the basin, use of alternative technologies and public participation are still needed (UNEP, 1997).

Most examples of river rehabilitation deal with measures like restructuring of banks, construction of in-stream structures or local widening (Fette et.al., 2007), with particular emphasis on the significance of the different aspects of sustainability. Sustainability includes environmental (such as protection of nature), social (like flood protection and recreation) and economic aspects (like economic proportionality) (Hostmann, 2005). However, the sustainable approach should include the following components: (1) flood control; (2) environmental management; and (3) housing and resettlement. The approach usually includes the following components:

Flood Control. Urban rivers are usually part of cities' drainage systems so that flooding especially during typhoons and the rainy season are very likely. River rehabilitation programs therefore involve flood mitigation through the construction and/or improvement of revetment, parapet or river wall and soil embankment among other flood control operations like dredging, sanitation works and warning systems. The clearing of structures, dredging the river, and cleaning all the esteros and waterways that drain into the river are done to reduce frequency and degree of flooding.

Environmental Management. River ecosystems will remain degraded if solid and liquid wastes are untreated before entering the watercourse. The establishment of environmental management systems (EMS) geared to improve solid waste collection and management as well as sewage treatment will help address pollution problems. The EMS may include regulations on river easement in order to minimize or prevent solid waste dumping, and policies to abate pollution loading from untreated industrial wastewater and sewage.

Housing and Resettlement. Many of the urban riverbanks are lined with informal settlements, so that the orderly and peaceful relocation to identified resettlement sites is relevant for the health of the river ecosystem and the safety of riverbank communities. Affected communities are moved to secure and affordable socialized housing projects and are given a stake in the formal housing sector. A livelihood program can be provided to affected communities to maintain, restore and/or enhance their incomes that may have been disrupted due to relocation. Despite planned strategies, community people may still protest against many demolition and subsequent relocation projects for economic reasons. This can be addressed by opening avenues for their participation within the formal planning process.

Flood Structural Mitigation

Within Marikina City, Marikina River has a length of about 11km and an area of about 220 hectares (1 hectare = 10,000 m^2). Its depth can go from 3 m to as high as 21 m during heavy downpours. The flooding map of the city identified the whole stretch of its riverbanks as flood-prone. Structures built on the creeks, riverbanks and other waterways ran the risk not only of being flooded, but also of being carried away by strong river currents.

Although there is no established flood historical record for the river, some idea of the typical flooding pattern can be gained from the flooding event in 1992, when an area of about 6.4 km^2 (27.52% of the entire city) was flooded. Flood events like these were considered normal for the rainy season. In part, this situation was due to an inefficient drainage system as well as obstructions along and within the river.

More than 27% of Marikina including the river was classified as a flooded area in 1992, with over 10,000 homes exposed to flooding (Borje et.al., 2004a). Using an average annual budget of PhP 43 million (USD 1.08 million), Marikina began a flood-control project for 12 barangays that included:

- Construction or rehabilitation of major outfalls.
- Improvements in the networks of canals, drainage systems, creeks and waterways. Improvements were done to sidewalks and the drainage network, as well as part of a 6-km road dike.
- Paving roads to reduce the amount of sand, pebbles and mud that enters the drainage system. In 1992, less than half of Marikina's 500 km of roads were paved. Under this activity, the city's engineering department brought the length of paved road up to 350 km by year 2000.
- Removal of informal settlements through the resettlement program, and the removal of commercial buildings, slaughterhouses and other industries from the riverside.
- Regular river dredging, which is a responsibility of the national government that the city government took on.

As of 2004, only the seven barangays closest to the river still needed attention. Structural mitigation efforts, however, were expensive and were limited to the city government's administrative area, and only one km out of a six-km road dike was finished as of 2004 (Borje, 2004a).

Flooding Problems in Marikina, 1992; Source: Borje et al., 2004a.

Policy Environment

The *Sangguniang Panlungsod ng Marikina* (Marikina City Council) has enacted many ordinances and resolutions (local laws that apply only to the Marikina City administrative area) related to emergency preparedness and disaster management. The policy environment emphasized the public safety and quality of life of the city's residents and businesses. The key ordinances include:

- Ordinance 59 of 1993: keeping sidewalks, alleys and public spaces clear to maximize free movement of vehicular and human traffic (essential during emergencies).
- Ordinance 10 of 1994: declaring an easement of 96 meters from either side of the Marikina River centerline, and authorizing the relocation of all residents found within the easement to safer ground.
- Ordinance 264 of 1998: creating a Disaster Management Office also known as Rescue 161, to be responsible for emergency preparedness, coordinating response, for first response skills training, and monitoring during emergencies. The ordinance defines the staff for the office, their salaries, and that the city will provide the annual budget for the office.
- Ordinance 171 of 1999: declaring two titled lots found by the river as a danger zone and non-buildable area, revoking unused building permits for the area, and prohibiting any new construction.
- Ordinance 54 of 2005: authorizing the use of 20% of the Calamity Fund for Disaster Preparedness, specifically for disaster-related tools, gadgets and equipments to be used during emergencies.
- Ordinance 109 of 2005: creating the Comprehensive Earthquake Disaster Reduction program and action plan, and identifying the roles of 20 offices/agencies of the local authority.

Other ordinances support the resettlement of informal settlers, monitoring of water quality, and promoting solid waste management as part of a sanitation code.

Two important actors were key in advocating for the necessary local policies and institutional arrangements of the city government – Mayor Bayani F. Fernando (1992 – 2001) and Mayor Ma. Lourdes C. Fernando (2001 – 2010). They both had consistently pushed for the welfare of their constituents. Mayor Bayani Fernando was the prime mover behind the Save the Marikina River program that prompted the flood disaster mitigation efforts, and Mayor Ma. Lourdes Fernando pushed for the Comprehensive Earthquake Disaster Reduction program as well as the Eco-Savers program that promotes solid waste management at the household and school levels.

Emergency Preparedness and Rescue 161

Marikina raised its emergency preparedness and response capacity by setting a target response time of five minutes to reach emergency situations. With Ordinance 264 of 1998, it set up an emergency operations center called "Rescue 161", named after the three-digit telephone number of the emergency service. Representatives of the first responders – police, fire and ambulance services – receive phone calls and coordinate the response to emergencies. Their physical presence in the center is a hallmark of governance since none of them are under the jurisdiction of the city government. However, the city government inked Memoranda of Understanding with their respective organizations, and jointly developed standard operating procedures, monitoring systems and alert systems.

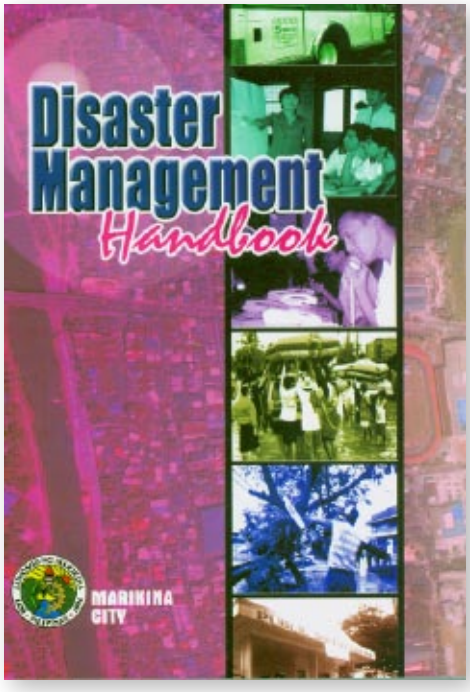
The city government expanded the service by setting up three more public safety centers in strategic locations, to serve as additional staging areas for emergency response. The effort has paid off; in 2004, the average response times of Rescue 161 first responder services were: police – 3 minutes; fire – 4 minutes; ambulance – 3.2 minutes (Borje, 2004d).

The Rescue 161 program won in the DILG *Galing Pook* Hall of Fame award for 1999.[2] In the same way, 161 rescuers were the overall champions at the Department of Health 2006 Skills Benchmarking with an average response time of three minutes. Marikina City was among the eight Pacific healthy cities in 2006, cited by the World Health Organization for outstanding achievements in emergency preparedness and response planning.

Because the city has an earthquake risk, the city government has invested in pontoon bridges (in the event of bridge collapse) and several Collapsed Building Retrieval Boxes, each containing digging and lifting tools, hand tools, personnel safety equipment, lighting and shelter equipment, and a first aid kit. During emergencies, Rescue 161 can use the city government's heavy equipment (e.g. excavators, cranes, pay loaders and water tanker trucks) and light equipment (e.g. power saws, generators, rubber boats with outboard motors, and search lights). The city government operates a narrowcast radio station (DZBF-1674 MHz) with daily programming; in times of emergencies, the radio station transmits public information and emergency alert signals.

Public Awareness

The city government has some unique efforts to raise public awareness and disaster management and emergency preparedness. The city has established a Disaster Preparedness Education Center that features an Audio Visual/Training Room, a small disaster management museum, and a disaster management library for children and adults.



The city government has reached out to companies and non-governmental organizations to join its efforts at disaster management. As a result, the city government can tap a volunteer fire brigade, six private hospitals, heavy equipment, about 2000 public order and safety volunteers (*Bantay Bayan* and Civic Action teams), and army reservists.

The city has published a Disaster Management Handbook that contains instructions on how the public should prepare for emergencies, lists what to do during emergencies, and the procedures followed by Rescue 161. This handbook is distributed to the presidents of the different homeowners associations, as well as to mayors of other cities and municipalities.

Removal of informal settlements from the riverbanks, just like river dredging, would be a repeated task unless a comprehensive effort was made to make resettlement an attractive option, and the use of the riverbank converted into something compatible with flood management. The program started in 1993 with the principle: "The people have to touch and smell the water." Many thought it would take a miracle to restore the river because past attempts at removing trash and relocating informal settlers along the banks have failed. Surprisingly, the program generated enthusiasm from socio-civic groups, NGOs and city residents.

An important basis for the river rehabilitation program was a 1987 study that cited the need to improve the riverbanks for better water discharge, reduced flooding, and to serve as a safe inundation area. Furthermore, the Department of Public Works and Highways (DPWH) encouraged Marikina city government to remove illegal structures and prevent the construction of new ones within the easement laid down by Ordinance 10 of 1994. The rehabilitation plan was laid out: (1) building access roads to allow men and equipment to go near the river and undertake the necessary cleaning and clearing operations; (2) clearing the banks both of its informal settlers and other encroachments; (3) improving the river water quality by demanding industries to set up and maintain water treatment facilities; (4) creating sports facilities, historical and cultural structures and; (5) enhancing the aesthetic appeal of the river environment by planting various flora.

After more than a decade of development, Marikina's riverbanks now have an 11-km jogging/biking lane, the biggest roller skating rink in the country, trees, picnic grounds, children's playgrounds, sports facilities like a baseball field and basketball court, a Youth Camp, a Chinese Pagoda, a Roman Garden, a gazebo, a riverboat, floating stages used for cultural events, an amphitheater, and a Senior Citizens' Lifestyle Center. Some of the city's annual celebrations, such as the Mama Mary Fluvial Parade and Festival and the Marikina Christmas Festival, are held in the river and riverbanks. Its success may be partly due to the motivation that the program will not only to rehabilitate, improve and restore the environmental qualities of the river, but also facilitate sustainable development in Marikina.

Organizational Structure

The city government recognized that it needed to modify its organizational structure in order to implement the river rehabilitation program and closely monitor its progress. Two new offices were created within the city government to implement the program – the Marikina River Park Authority and the Marikina Settlements Office. These two offices and the Engineering Department were identified as key program implementers while the city council was identified as a necessary partner who could create an enabling policy environment. The roles of the various actors were:

- The *Sangguniang Panlungsod ng Marikina* passes the necessary ordinances for the rehabilitation and relocation programs, especially on issues pertaining to resettlement. These ordinances created the legal bases for changing the land use of the riverbanks.
- The *Engineering Department* looks after structural flooding mitigation along the riverbanks, and provides basic services and infrastructure in the resettlement areas.
- The *Marikina Settlements Office* (MSO) promotes community participation in the program's delivery and management. The MSO organized community associations to help the communities become active and self-reliant towards their own development. The office hired some of the program beneficiaries as project officers for specific tasks: (1) liaise with barangay officials and community leaders, (2) monitor the building of illegal structures within their areas of assignment, (3) serve as watchdogs of the community in case of emergency or of any other problems, (4) organize associations where necessary, and (5) ensure that all other problems resulting from the relocation of the community were answered (Chuico-Tordecilla, 1998).
- The *Marikina River Park Authority* develops the river by planning and designing the various facilities. It leads tree planting activities. It works with the Engineering Department during creek and river clean-up, and helps enforce regulations on waste disposal of factories and homes.

Relocation of Informal Settlements in the Riverbanks

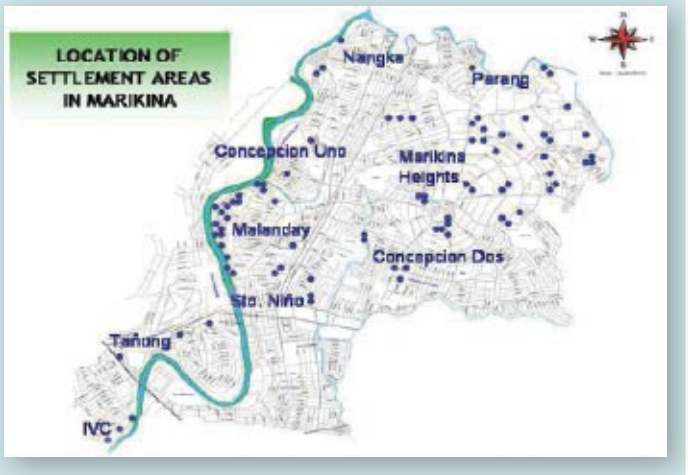
The resettlement of the families living within the defined easement was a major program geared towards rehabilitating Marikina River. The city considered the riverbank area as a danger zone, and intended to utilize it for projects that could rehabilitate the river and mitigate flood disasters. Ordinance 10 of 1994 combined with the resettlement program made it possible to relocate the settlers and demolish the houses along the river, creeks and government-owned land.

Resettlement required a combination of several activities: a city-wide registration and census of informal settlers; identification of resettlement areas in the city; demolition of illegal structures; resettlement in new sites; and monitoring against the construction of new ones within the easement and resettlement areas.

Census of informal settlers. A census was taken of informal settlers from 1992 to 1994; 23,000 families were found who stayed along the river banks, esteros and creeks, on private property, and on public land targeted for infrastructure development.

Identification of resettlement areas. The MSO identified potential resettlement sites through city mapping and land surveys. Since these were usually occupied by informal settlers, the land owners were approached and persuaded by the officials from the MSO and the Community Mortgage Program (CMP) to sell their lands as settlement sites. Tax incentives were given to the land owners for their cooperation, with some bargaining over the value of the property versus the costs of removing the informal settlers. Six relocation sites were eventually used for the city's resettlement program (Malanday, Nangka, Tumana, Dona Petra, Tanguile, and

Location of Settlement Areas in Marikina City **Figure 3**



Source: Borje, J. et.al. (2004b)

San Miguel Realty); the families from the riverbanks were moved to only three sites (Barangay Malanday, Nangka and Tumana). Figure 3 shows the resettlement sites, with a total area of about 106 hectares.

Resettlement. Resettlement areas were made available with reliable utilities, basic infrastructure, garbage collection, and access to emergency services; these urban amenities were not possible on the riverbanks. Small lots (24 m^2) were sold to the settlers under the Community Mortgage Program (CMP), wherein each family paid monthly mortgage amortizations from PhP 250 to 400 (USD 6 to 10). The program established several criteria for identifying its potential beneficiaries, as defined under the Urban Development and Housing Act (Republic Act 7279 of 1992):

- Filipino citizen
- Underprivileged and homeless
- Does not own real property, whether in urban or rural areas
- Not a professional squatter, nor a member of squatting syndicates
- Member of a community association (the MSO helped the informal settlers form a total of 168 associations)

The mortgage program itself is run by the national government, but the city government acted as a facilitator to assist the families in getting the mortgage and forming the required community associations. Marikina City Government added its own criteria (Chuico-Tordecilla, 1998):

- Settlers who are renting from others and paid between PhP 150 to 400 (USD 4 to 10) per month are eligible
- Married children and other relatives of the owner are not entitled to a relocation site

Of course, there was some resistance to resettlement. The city government employed a strategy of using massive flood events as an opportunity to evacuate the informal settlers and then seal off the area under Ordinance 10 of 1994. Under these conditions, the informal settlers would see the advantage of moving into the resettlement areas.

Monitoring illegal structures. Encroachment of new settlers on the easement was controlled by reinforcing an existing law that the city government must issue a permit for new construction and could demolish new structures without this permit. The building of illegal structures was monitored with the help of barangay officials, while the city government established a demolition unit that served in many demolition operations. It grew to include members who once had their homes demolished.

Even when there are existing laws that support the need to keep riverbanks and other waterways free from obstruction, the resettlement of people and clearing away structures are always difficult undertakings. While supporters to the program claimed that the local government was pro-people throughout the entire relocation process and that they even volunteered to help demolish their own structures, non-supporters believed that their rights were violated. In spite of the controversy, the resettlement program has received recognition within the Philippines as a good initiative by a local authority, having won the Galing Pook Award in 1998. About 22,000 families were resettled, and only 800 families are still living within the easement.

The clearing of settlements ensured the safety for both people and structures close to waterways, and made the area navigable for engineering equipment to conduct regular creek and river clean-up, therefore mitigating obstruction problems that could lead to or exacerbate flooding. About 500 hectares were freed for development this way, whereas only 106 hectares of private land were required for resettlement.

Compatible Land Use of the Floodplain

After the flood-mitigation work in the river and removal of structures, the riverbanks (which is the river's floodplain) were designated as recreational land. The land use was converted into parks, sports facilities, historical and cultural structures (like the Chinese Pagoda and Roman Garden). These land uses facilitate the timely evacuation of anyone who happens to be on the riverbank, and allow for the river to safely enter its floodplain.

Establishment of a Solid Waste Management System

The inefficient collection of solid wastes was seen as a major contributor to river pollution, either through direct dumping of wastes in the waterways or via throwing of uncollected garbage near the riverbanks. Solid waste accumulated as sludge in the waterways and impeded the drainage of flood waters. Upon recognizing this, the local government strictly enforced an anti-dumping ordinance and introduced a refuse collection policy.

By 1996 the Waste Management Office (WMO) was established with the responsibility of delivering the city's solid waste management services and managing facilities related to sanitation. The office helped draft an ordinance that adopted the Users Pay Principle in 2002. This was aimed at persuading commercial establishments to minimize garbage while generating funds to augment the costs incurred in managing solid wastes. Establishments pay more for generating more garbage, while residents are asked to pay a flat rate of PhP 50 (USD1.25) per month regardless of the amount of garbage the household produces.

Residents are initially informed of the collection schedule and how to dispose of their garbage (to place wastes in plastic bags or trash receptacles, and put bags or receptacles outside their gates or in areas where the garbage compactor may pass). Garbage was allowed to be placed outside the home only on the day and time of collection; non-compliance had a penalty of PhP 2,000 (USD 50).

By 1999, the estimated total solid waste generation in Marikina was between 150-200 tons or roughly 400 m^3 per day. During the same year, the city is credited with a high garbage collection efficiency rate of 98%. This was due to many factors including the effective deployment of equipment and manpower, the use of a Garbage Transfer Station, as well as the establishment of a collection system in coordination with the residents and other constituents (CPO, 2007). However, the amount of garbage generated within the city grew over time (see Table 1).

Solid Waste Generation of Marikina City — **Table 1**

Estimated waste generation: 1999	400 m^3/day
Estimated waste generation: 2004	690 m^3/day
Proportion of biodegradable waste (2004)	45%
Proportion of non-biodegradable waste (2004)	55%

Source: WMO, 2007; Gawad Galing Pook, 2004

The city aimed to maintain the high garbage collection efficiency rate by introducing capacity-building projects for waste management by the manufacturing business community, ecological solid waste management plans at the barangay level, and the noteworthy Eco-Savers Program.

Introduced in June 2004, the Eco-Savers program instills waste segregation and recycling practices at the household level. Once a week, students are required to bring recyclable waste from their respective households during an assigned Eco Day. Accredited junk shops weigh the waste, value it according to the prevailing market price, convert it into points (PhP 1.00 = 1 point), record the points in Eco Savers passbooks, and haul away the collected waste. Points earned entitle the Eco-saver to shop in the Eco-Savers Mobile Store that visits the school twice within the school year, bringing educational materials such as dictionaries, books, school supplies and educational toys. Individual savings within one school year ranges from PhP 50 to PhP 1,800 (USD 1 to 45), and helps reduce family spending.

For the city, Eco-Savers meant reduced waste collection trips from 50 truckload-trips a day to an average of 30 trips a day, reduced traffic decongestion and air pollution, conserved fuel, and it provided junk shops with a regular supply of recyclable materials. Through this program, a total of 238,000 kg of waste with a value of PhP 1.3 million (USD 26,000) have been diverted from dumpsites and reduced the sludge that accumulated in the waterways. Eco-Savers won a *Gawad Galing Pook* in 2004.

Water Quality Improvement

In the 1970s, Marikina River was rated as clean enough to be used as public water supply. By 2002, the overall water quality of Marikina River had deteriorated (LLDA, 2002), due to untreated domestic and industrial wastes discharged directly into canals that ultimately flow into the river. The worsening water quality is related to incidence of water-borne diseases, and is likely to increase the negative impact of floods on human health. Table 2 shows the incidence of water-borne diseases in Marikina City.

Number of Cases of Water-borne Diseases in Marikina City **Table 2**

Disease	2005	2006
Diarrhea	1,438	1,189
Unspecified intestinal parasitism	555	154
Typhoid	2	32
Viral hepatitis	2	5
Amoebiasis	107	64
Ascariasis	152	33

Source: WMO, Marikina (2007)

The city government decided to improve water quality by constructing wastewater treatment plants in strategic areas, and improve sewage disposal. It is aided by the Manila Water company that holds the water service concession for the East Zone of Metro Manila (including Marikina). Through a public-private partnership between the city and the company, Manila Water began massive pipe-laying operations to provide potable water to all of the city's households, and will be constructing a wastewater treatment plant in Marikina. Manila Water also conducts free scheduled septic tank emptying services to customers not connected to a sewer network under the '*Sanitasyon Para Sa Barangay*' (Sanitation for the Barangay) program.

Conclusion

The impact of the flood mitigation program can be derived from a comparison of 1992 and 2004 figures for the extent of the floods and the number of exposed buildings (see Table 3). The program shows some improvement and requires monitoring. Urban flood mitigation is a complex effort wherein both structural and non-structural mitigation play equally important roles. In the case of Marikina City, the local authority was able to sustain its efforts that began in 1998.

The local authority was able to promote good urban governance by engaging the participation of key actors: the city council to provide the needed policy environment, the community to act as volunteers, companies and NGOs who make their equipment and medical facilities available during emergencies, and other national agencies who coordinated police and fire services with a common emergency response effort for Marikina City.

Other programs that have flood disaster risk reduction as a secondary benefit are sustaining the disaster risk reduction effort. Examples of such programs include the relocation of informal settlers to safer places, emergency preparedness efforts, river rehabilitation, and solid waste management.

Exposure of selected items to 1992 and 2004 floods **Table 3**

Exposed Item	during 1992 flood	during 2004 flood
Land (flooded area)	6.36 km^2	4.40 km^2
Residences	10,446	4,789
Businesses	450	289
Critical Facilities	11	9

Source: WMO, Marikina (2007)

Lesson Learned

- Urban flood mitigation requires the coordination of efforts by multiple agencies. The governance approach promotes and recognizes transparency and consensual decision-making by stakeholders can facilitate coordination efforts. This is supported by Marikina's experience in establishing and maintaining the inter-agency Rescue 161 emergency operation center.
- The political will exhibited by the mayors not only sustained the disaster management effort, but also motivated support from the other key actors like the city council, the dedicated staff of the concerned departments of the city government, private companies and NGOS, national agencies for emergency response, and the relocated communities.
- It is important to integrate disaster risk reduction in all development projects. A river rehabilitation program is an example of how to mainstream flood disaster risk reduction by removing obstructions in the waterways and riverbanks, designating compatible land use for the floodplain area, managing solid waste, and improving water quality.

References

Badilla, Roy. "Flood Modelling in Pasig-Marikina Basin," M.Sc. thesis, ITC, March 2008, *http://www.itc.nl/library/papers_2008/msc/wrem/badilla.pdf*

Borje, Julie et al. 3cd Sound Practice Series.
No. 5, "Marikina City Flood Mitigation Countermeasure Program," 2004a, *http://emi.pdc.org/soundpractices/Metro-Manila/SP5-MM-Flood-Mitigation-Marikina.pdf*
No. 6, "Save the Marikina River," 2004b, *http://emi.pdc.org/soundpractices/Metro-Manila/SP6-MM-Save-the-Marikina-River.pdf*
No. 7, "Marikina City Squatter-Free Program," 2004c, *http://emi.pdc.org/soundpractices/Metro-Manila/SP7-MM-Marikina-Squatter-Free.pdf*
No. 8, "5-Minute Quick Response Time: Rescue 161 in Marikina City," *http://emi.pdc.org/soundpractices/Metro-Manila/SP8-MM-5-Minute-Quick-Response.pdf*

Chuico-Tordecilla, C. "The Gatekeepers of Marikina: A Case of In-City Relocation and Management of a Squatter-Free Community," a case study for the Best Practices on the Urban Development and Housing Act Seminar, ASG, 1998.

LLDA (2002). The Water Mondriaan: Monthly Water Quality Status Report, January 2002, *http://www.llda.gov.ph/SD_Mondriaan/MonthlyReport_files/2002/January_Home.htm*

Fette, M., and C. Weber, A. Peter, B. Wehrli. "Hydropower Production and River Rehabilitation: A case study on an Alpine River," Environmental Modeling and Assessment, 12(4), 2007, pp. 257-267.

Gawad Galing Pook awards description, 1994 to latest awards: *http://www.galingpook.org/awardees.htm#year*

Hostmann, M. "Decision Support for River Rehabilitation," dissertation, Swiss Federal Institute of Technology Zurich, Diss. No. 16136, 2005.

Marikina City Development Authority – City Planning Office (CPO). "2007 Comprehensive Land Use Plan"

UNEP. "Freshwater Issues," Global State of Environment Report, 1997, *http://www.unep.or.jp/ietc/Issues/Freshwater.asp*

UN. World Water Development Report, 2003, *http://www.wateryear2003.org/en/ev.php-URL_ID=3129&URL_DO=DO_TOPIC&URL_SECTION=201.html*

Yu, Carlyne. "Urban River Rehabilitation in a Developing Country: A Case Study in Marikina City, Philippines," M.Sc. thesis, AIT, May 2008.

Endnotes

1 http://city.marikina.gov.ph

2 This refers to the Gawad Galing Pook, an award for innovative practices by local authorities in the Philippines. The winners are chosen from a national search of local governance programs, evaluated through a multi-level rigorous screening process based on positive results and impact, promotion of people's participation and empowerment, transferability and sustainability, and efficiency of program service delivery. Winning programs become models of good governance. The award is conferred by the President of the Republic of the Philippines.

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PROMISE

During the implementation of the Asian Urban Disaster Mitigation Program (AUDMP), ADPC recognized the importance of interventions in urban areas and accordingly identified Urban Disaster Risk Management as one of its core thematic areas of work, experiences from which have also guided the selection of the target secondary cities. ADPC has developed 'Strategy 2020 for Urban Disaster Risk Mitigation in Asia' which aims to reach 200 cities by the year 2020.

The need to minimize the destructive impacts of these hydro-meteorological events on the vulnerable communities, particularly the urban communities and the economic infrastructure through enhanced preparedness and Mitigation is therefore the main trust of the present intervention in implementation of the Program for Hydro-Meteorological Disaster Mitigation in Secondary Cities in Asia (PROMISE).

ADPC considers PROMISE program as an opportunity to associate with many communities living in Asian cities vulnerable to hydro-meteorological hazards with the aim of reducing the impacts of such events and demonstrate innovative applications for community preparedness and mitigation.

This case study documents the efforts under a specific program objective to *increase stakeholder involvement and further enhancement of strategies, tools and methodologies related to community preparedness and mitigation of hydro-meteorological disasters in urban communities.*

The Asian Disaster Preparedness Center (ADPC) is a regional resource center dedicated to safer communities and sustainable development through disaster risk reduction in Asia and the Pacific. Established in 1986 in Bangkok, Thailand, ADPC is recognized as an important focal point for promoting disaster awareness and developing capabilities to foster institutionalized disaster management and mitigation policies.

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