



WATER, MEGACITIES
AND GLOBAL CHANGE

MANILA

The City of Manila

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CHAPTER 1

Geography

1. Manila¹, with a current estimated population of 12 million, is situated in Luzon island (the largest of the 3 main groups of islands in the Philippines) on the narrow deltaic plain of the Pasig River that flows in a north-westerly direction to the iconic Manila Bay (see Figure 1). The city sits on top of centuries of prehistoric alluvial deposits created by the flows of the Pasig River and on some land reclaimed from Manila Bay. To its north is the deltaic region of the Pampanga River. In the north and northeast are low plains which abut into the southern range of the Sierra Madre mountains. Laguna de Bay, a large freshwater lake (the largest in Southeast Asia, but now significantly polluted) where the Pasig River originates, is situated on Manila's southeastern flank. Farther south lies the Taal Lake, and the extensive hilly ridge that wraps around it. In many ways, the essentially flat characteristics of Manila's surrounding areas lend themselves to the urban sprawl that Manila has evolved into.

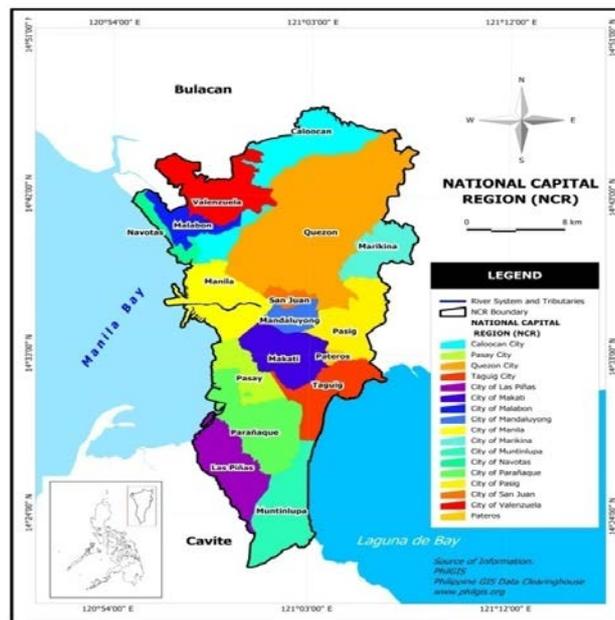


Figure 1: Administrative Map of Metro Manila

2. The city has a tropical savanna climate with mean temperatures ranging from 20-38 degrees Celsius. Humidity levels are high and the wet season

¹ In this Paper, Manila means Metro Manila; the term is often used interchangeably – see paragraph 6 for a full explanation

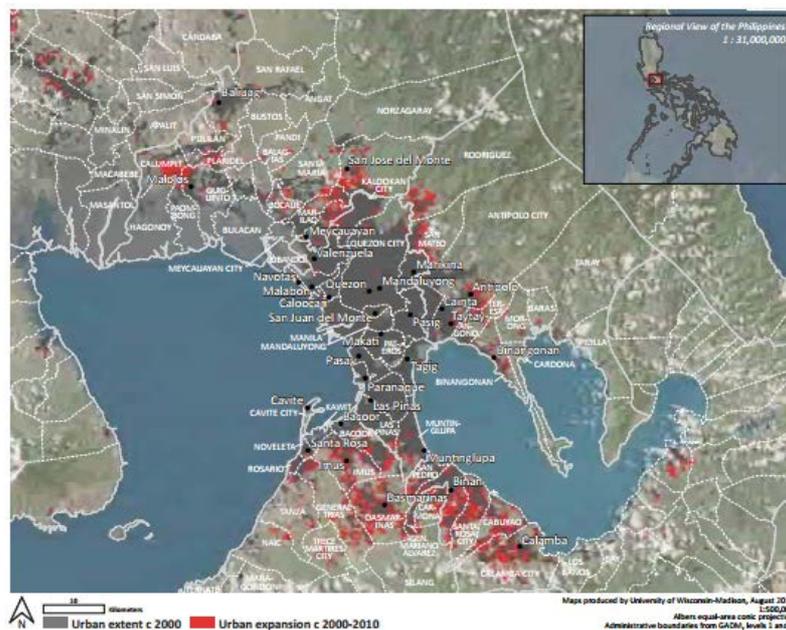
extends from June to November. Manila is in the path of most Pacific-originating typhoons, and is typically affected by them from June to September. The city is also in the midst of several fault lines including the seismically active Marikina Valley Fault System that poses a continued earthquake threat to Manila and the national capital region in general.

History

3. Manila has had a chequered past. Its recent origins date to about 900 AD. At the time of the arrival of the Spanish conquistador, Miguel Legaspi, in 1571, Manila was a thriving trading settlement ruled by Rajah Sulayman. A short war ensued, resulting in Manila coming under Spanish rule. Although the city was attacked by the Chinese and the Dutch in the 16th and 17th centuries respectively, Spanish dominance over Manila prevailed until 1898. The Philippines was then 'sold' to the United States for \$20 million, and Manila became the capital city of an American colony till 1946 when the Philippines gained independence.
4. The city of Manila, centered around Intramuros (the walled city), suffered considerable damage during the second world war while under Japanese occupation. It has been said that, after Warsaw, Manila was the most damaged city during the 6-year war.
5. Because of over 400 years of Spanish and American rule, Manila's characteristics were influenced by a mix of the two cultures reflected in the city's layout, its buildings, and its management. In terms of social impact, Roman Catholicism was introduced to Manila and several churches, convents, and schools established. Much of Manila's educational systems, especially higher education, were modeled after those of the United States.
6. Manila has grown significantly over the last 70 years to become a thriving metropolis today. Reconstruction work started in the post-war years and several industrial and residential areas developed covering the 4 cities of Manila, Pasay, Caloocan, and Quezon City, and 13 municipalities. In 1976, this conglomerate of urban centers was designated as Metro Manila comprising 17 municipalities. Today, it covers an area of about 636 square kilometers, and is also known as the National Capital Region. Also in 1976, Manila was proclaimed as the capital city of the Philippines, a position held by Quezon City since 1948.

Population and Demographics

7. While the city's nominal population is about 12 million, its total urban area that spreads to the neighbouring provinces of Bulacan, Cavite, Laguna, and Batangas has a population of 24 million. It is the most populous region of the Philippines, and the 6th most populous in the world. The female-male ratio in 2010 was estimated at 51:49. There is a significant youthful profile to the population; the median age in 2010 was estimated at 25.5 years. Figure 2 shows the direction of expansion of Manila.



Note: In this map, only labeled areas are counted as part of the Manila urban area.

Source: World Bank. 2015. *East Asia's Changing Urban Landscape: Measuring a Decade of Spatial Growth*. Urban Development Series. Washington, DC: World Bank. doi: 10.1596/978-1-4648-0363-5. License: Creative Commons Attribution CC BY 3.0 IGO, p.112.

Figure 2: Map Showing the Direction of Expansion of Metro Manila

8. In terms of the dependency ratio, the household population comprised 29.1% of young dependents (0-14 years) and 3.4% old dependents (age 65 and older). The overall dependency ratio was 48 per 100 persons in the working age population, down from 54 in the previous decade. The employment rate in 2012 was estimated at 89.6%. Metro Manila accounts for 13% of the country's total employment and contributes 36.3% to the Philippines' GDP.
9. A major impediment to the provision of urban services is the density of Manila's urban population estimated in 2010 at 19,130 persons per square kilometer (the city of Manila had 66,140 persons per square kilometer, one

of the highest in the world)². With 56% of the urban land in the country, Manila housed 70% of the total urban population³. Most of the population growth is taking place in the neighbouring provinces of Cavite, Bulacan, and Laguna. But in Metro Manila itself (in this case, the National Capital Region), 23 million people were added between 2000 and 2010 with a negligible increase in the built up area (a mere 14 square kilometers). The average household size was 4.3, a slight decline from 4.6 over the previous decade.

- 10.** An estimated 4 million people live in slums in Manila (about 37% of the city's population). Most slum dwellings average 30 years in age and some are older than 50 years. About half the slum population is engaged in the formal sector. Informal employment comprises construction labour, domestic help, vending, self-employment, and factory labour. The slum population increased at an annual rate of 3.14% compared to an urban population growth rate of 2.3% during the 6 years to 2006⁴. It is projected to increase to about 9 million by 2050. While income poverty is acute, more than 50% of the slum population have per capita incomes of \$2-4 per day. However, they reside in extremely unsatisfactory environmental conditions and are victims of severe physical depredation. Income levels are low; the per capita poverty threshold in 2012 was estimated at 20,344 Pesos (equivalent to \$452) and the family poverty incidence estimated at 2.6%, slightly higher than the 2.4% number of 2009⁵.

Economy

- 11.** Manila is the country's financial capital, and also the principal hub for its tourism industry. In 2014, the share of output by industry was estimated as follows: trade and tourism: 31.4%; business/finance: 28.6%; local/non-market: 15.6%; manufacturing 12.5%; transportation: 4.9%; construction: and 4%; utilities: 2.8%⁶. Put differently, 82% of Manila's output came from the services sector⁷.
- 12.** Business process outsourcing (BPO) has grown significantly in Manila and the city now occupies 3rd place (2013) globally for outsourcing companies,

² National Statistics Office, Special Release No. 2012-10 of 25 September 2012

³ East Asia's Changing Urban Landscape, The World Bank, 2015

⁴ Marife Ballesteros, Policy Notes, Philippine Institute of Development Studies, Jan 2011 (ISSN 1656-5266)

⁵ Philippine Statistics Authority, National Statistics Coordination Board (Family Income data)

⁶ Brookings Institution; Global Metro Monitor Map, 2014

⁷ Final Report: Roadmap for Transport Infrastructure Development for Metro Manila and its Surrounding Areas (Regions III and IV), March 2014. National Economic Development Agency and Japan International Cooperation Agency

after Bangalore and Mumbai⁸. The city's retail sector is strong, founded essentially on rising remittances from overseas workers, an expanding BPO industry, and a growing tourism sector. The property market continues to thrive and Manila is expected to add 1.85 million square meters of office space between 2015 and 2017 in the principal business districts of Makati, Taguig, and Quezon City⁹

- 13.** Manila receives about 1 million visitors annually of the approximately 3.2 million who visit the country. It is the principal gateway to Philippines' several beach destinations apart from being a historic and cultural destination in its own right. In terms of economic impact, Metro Manila contributed 52.2% of the total revenue from hotel establishments in the country estimated at 40.8 billion pesos in 2009¹⁰. It also had the highest share of employees at 31.7% of the country's total.
- 14.** The transport sector is a major economic driver in Manila. About 433 bus companies operate 805 routes. Taxis comprise 35% of the estimated 1.9 million vehicles in Manila. The ubiquitous jeepneys serve 785 routes in the city, in addition to the numerous utility vehicles that provide point-to-point services, and tricycles and pedicabs. While some of the main road corridors in Manila have high capacities, they also sustain extremely high traffic volumes and traffic congestion is legion. It is estimated to cause economic losses¹¹ equivalent to 8.0% of GDP¹². According to another source, the losses are estimated at \$19.46 billion per year¹³ and are likely to rise by 60% by 2030 under a business-as-usual scenario.

Manila's Urban Governance Framework

- 15.** Manila's urban governance institutions are a potpourri comprising several authorities and agencies. The 17 local government units of Metro Manila are administratively the same as provinces. They function autonomously under elected Mayors and have full revenue and expenditure powers within their jurisdictions. These units are grouped into four districts essentially for fiscal and statistical purposes; they serve no other function.

⁸ Metro Manila, Cebu among top global BPO destinations. Yahoo! Southeast Asia Newsroom, 31 January 2013

⁹ GMA News Online: Global Firms Fuel Record Surge in Manila Office Space. 26 February 2015.

¹⁰ 2009 Survey of Tourism Establishments in the Philippines for Accommodation: Final Results. 13 January 2012

¹¹ Comprising, essentially, two elements, viz. Vehicle Operating Costs, and Opportunity Costs of Time Lost in Transit

¹² Philippine Economic Update (Report No. 93530-PH). The World Bank. January 2015

¹³ See footnote 7, *ibid*

- 16.** The Metropolitan Manila Development Authority (MMDA) was set up in 1995 vide Republic Act 7924 as a form of coordinating agency for delivery of public services in Metro Manila under the direct supervision of the President of the Philippines. However, its role is confined mainly to traffic management, solid waste management, and disaster and relief management. It has no authority over the municipalities which is the main reason for its lack of effectiveness. However, its so-called policy making functions are vested in a body called the Metro Manila Council comprising the individual city mayors. Its revenues come mainly from the national government as subsidies, contributions from member local government units (set at 5% of their total annual gross revenue of the preceding year), and fees and fines¹⁴.
- 17.** 17. There are a plethora of institutions and agencies that are involved in programs and projects in Manila. These include national government agencies such as the Department of Public Works and Highways responsible for roads, bridges, flood control, drainage, and traffic engineering, the Department of Transport and Communications responsible for traffic management, the National Housing Authority, the Housing and Land Use Regulatory Board for sub-division plans, MWSS for water supply and sanitation, the Department of Environment and Natural Resources, and the Department of Interior and Local Government. In addition, there is the Department of Health, the Laguna Lake Development Authority, and the National Economic and Development Authority responsible for planning, monitoring, and evaluation. Several ad hoc commissions and task forces also play a role including the Presidential Task Force on Solid Waste Management, Traffic Improvement and Management, the Philippine Council for Sustainable Development, and the Cabinet Officer for Regional Development.
- 18.** The framework for Manila's urban administration is not only unwieldy but is also emasculated by the multiplicity of organizations and several overlapping functions. With municipal governments functioning essentially as autonomous city administrations, there is little incentive to coordinate for the greater good of Metro Manila. Subjects such as traffic management, flood control and drainage, and solid waste management are, at one stroke, everybody's concern and nobody's. Holistic urban planning, design and execution of integrated projects, and unified urban management institutions are completely absent in the world's sixth largest megacity. Manila's urban governance model, representing uncoordinated

¹⁴ Governance and Urban Development: Case Study of Metro Manila. Manasan and Mercado. Philippine Institute of Development Studies. Discussion Paper Series No. 99-03

municipality-based autonomy with equally uncoordinated federal government support, is an unlikely recipe for sustained economic growth.

Urban Infrastructure

- 19.** Manila's urban area continues to expand to accommodate the urban population growth rate of 1.8% per annum (over the 2000-2010 period). Towns and cities within a 30-50 kilometer radius of Manila are absorbing the bulk of the growth. Population densities are increasing in central Manila (cities of Mandaluyong and Manila, for example, are already at 650 persons per hectare), and placing considerable pressure on an already inadequate infrastructure foundation.
- 20.** There is a significant shortage of affordable housing in Manila. The requirements are projected at 1.74 million units to 2016¹⁵. Two consequences arise from this extreme shortage. One is the growth of slum populations (already estimated at 33% of the total in Manila). The other is the expansion of informal settlements in the surrounding urban centers. In other words, as the urban area expands into what is currently known as Mega Manila, the slum population also correspondingly expands. In 2010, more than half a million households were on either government-owned land, privately-held land, or in dangerous areas such as canals and floodways. While no recent numbers are available, anecdotal evidence suggests that a high percentage of Manila's labor force resides in adjacent provincial urban centers and commutes daily to work.
- 21.** The road network in Manila is grossly inadequate to sustain efficient economic activity. At about 33,000 kilometers of national and local roads, the city is nominally well-endowed; however, the inadequacy is demonstrated by the fact that Manila has only 1 km of road per 424 vehicles. Paradoxically, private transport units occupy 78% of total road space while constituting only 31% of total traffic. And occupancy figures in cars have declined from 2.5 persons-per-car to 1.7. Road maintenance is also an issue with a vast majority of the roads either in poor to satisfactory condition, or seriously encroached upon thereby reducing net traffic capacities. Additionally, the costs imposed by traffic congestion (see paragraph 14) render the road system dysfunctional and a significant handicap to Manila realizing its full economic potential.

¹⁵ See footnote 7, *ibid*

22. The rail network is basic, and almost negligible. It covers 28 km to Alabang (double track) and a further 12 km to Laguna (single line). There are also 3 light rail transit systems with a total length of about 50 km. This elementary network carries about 1.3 million passengers daily, is in poor operating condition, and has not been expanded for decades.
23. Manila is essentially a port city. It has a natural harbour and can accommodate high-tonnage vessels. However, its 3 port groups of the North and South Harbours, and the International Container Terminal, are overworked and inefficient. Expansion is infeasible and the Philippine Ports Authority has plans to move some part of the port capacities to Subic (north) and Batangas (south) that are currently underutilized. However, these ports are incapable of handling more than 1 million TEUs¹⁶ of the more than 2.7 million TEUs handled by the Manila ports in 2012.

Climate Change

24. Manila is in the eye of a climate storm¹⁷. With a temperature rise forecast of 4 degrees celsius to 2100, sea level rise of up to 2 meters, saline intrusion into surface and groundwater sources, extended wet and dry seasons, heat island effect, and susceptibility to extreme weather events, the city is seriously imperiled. And since Manila is crucial to the Philippine economy (it contributes 36.3% of the country's GDP¹⁸), the climate change impacts are likely to be economically debilitating. The city's water supply sources (principally, the Angat reservoir – see paragraph 29) are already under pressure and new sources are sought to be developed, wastewater finds its way into the city's open drains and overflow areas and pollutes groundwater, sea level rise exacerbates internal flooding, and Manila's parlous infrastructure (road and rail networks, and water distribution systems) is constantly overwhelmed by climate-induced impacts. Adapting to climate change and investing in climate resilient infrastructure is the premium that Manila will have to pay, and very quickly, if it is to insure itself against nature's ravages.
25. Manila is situated on a semi-alluvial floodplain. At least 20% of the land area is considered prone to flooding by MMDA. Topography apart, the city is prone to flooding also because of its local climate. It has had a high rainfall regime over the 30 years to 1990 with annual precipitation ranging

¹⁶ Twenty-foot container equivalent unit

¹⁷ Maplecroft's Climate Change and Environmental Risk Analysis Atlas, 2013, ranked Manila 2nd (after Dhaka, Bangladesh) in its Climate Change Vulnerability Index.

¹⁸ National Statistical Coordination Board, 2013

from 1,834 mm to 2,257 mm. The very high levels of concretization have led to substantially increased volumes of run-off. Further, land subsidence and sea level rise have led to frequent coastal and riverine flooding, and saline intrusion¹⁹. Figure 3 shows the water bodies in Manila.

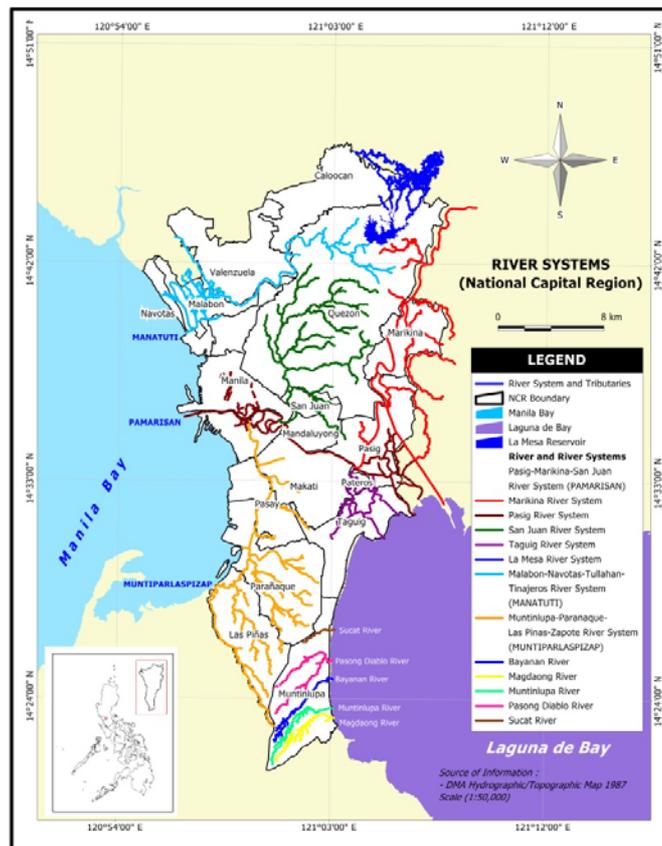


Figure 3: Map Showing the Water Bodies in Metro Manila

26. Notwithstanding its natural handicaps, Manila has to do more than just insure itself against climate change. Because it occupies such a dominant position in the country's economy, and consumes a significant volume of national resources, it needs to become a great deal more efficient in its use of these resources. Water, energy, and food have to be consumed efficiently and waste recovered and recycled. For Manila to become a green megacity will require more than just climate change action plans and statements of endeavor; it will require serious investments in promoting a green economy.

Air Quality

¹⁹ Flooding in Metro Manila. Claudius Gabinete. 2010

- 27.** Manila has the worst air quality in the Southeast Asian region. Air pollution remains a major cause of respiratory and cardiovascular diseases. Particulate Matter levels are consistently above those indicated as safe by the World Health Organization. A study by the University of Philippines, College of Medicine, revealed that more than 50% of the medicines sold are for respiratory ailments²⁰.

Trends and Prospects

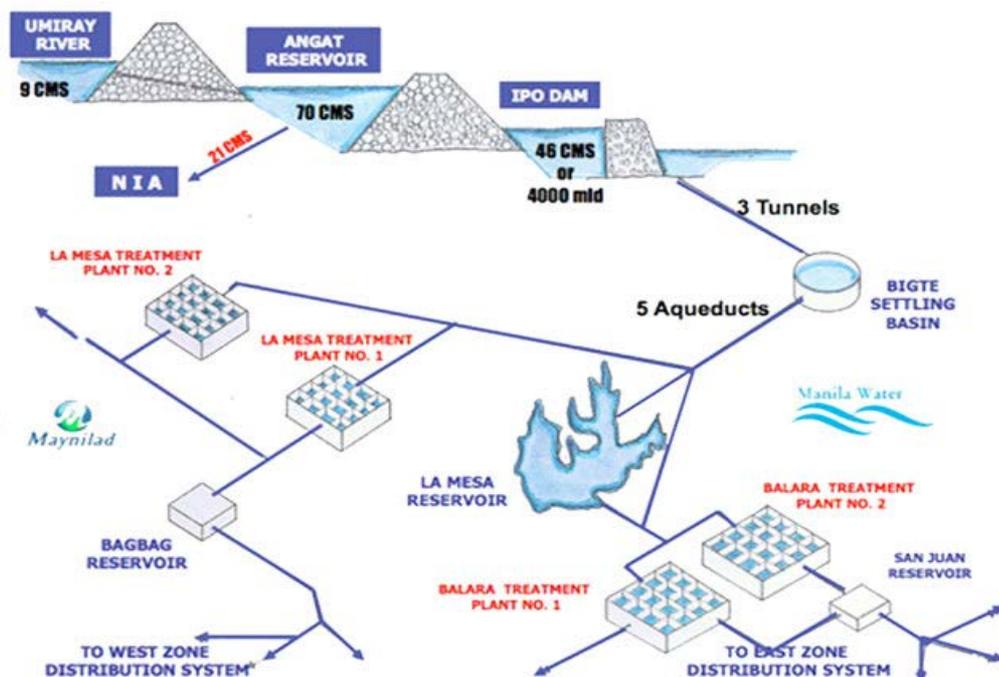
- 28.** Manila's economy has grown by almost 10% per annum since 2000 compared to 5% per annum for the national economy. But this growth has been fueled largely by the rise of the business processes outsourcing industry, and the real estate boom. Investments in infrastructure have not kept pace; in fact, infrastructure spending was less than 1% of GDP annually, there were fewer than 10 new road projects, and the last major LRT project was in 2004. This has huge implications for Manila's economic prospects. Coupled with the high costs of power supply, the inefficient functioning of the ports, and climate change impacts, Manila's economic potential can be in serious jeopardy.

²⁰ Metro Manila Air Quality Status Report. Environment Management Bureau, National Capital Region. 2011

Chapter 2

Water Supply and Sanitation

29. The main sources of Manila's water supplies are the Angat, Ipo, and La Mesa dams (see schematic below). As can be seen, a total of 4,000 million liters of raw water per day is available to the two private sector concessionaires in Manila. The Angat Multipurpose Reservoir provides water for irrigation, in addition to water for Manila; it also has a 246 MW power plant. To supplement the raw water provided by the Angat reservoir, the Metropolitan Water and Sewerage System (MWSS) also draws 100 MLD²¹ from Laguna de Bay and another 90 MLD from groundwater. However, groundwater abstraction ceased in 2009, and Manila now has a confirmed supply of 4,100 MLD. The demand, however, is projected to increase to 4,500 MLD by 2020 and to 6,412 MLD by 2037.



30. While the water infrastructure assets in Manila are publicly owned by MWSS (created in 1971), water supply and sewerage services are managed by two private concessionaires, one each for the east and west zones of the city. MWSS is responsible for two separate functions. One is to regulate, for which the MWSS Regulatory Office (MWSS-RO) has been established. The

²¹ million liters per day

other is to administer and manage retained assets, existing loans, facilitating bulk water supplies, and developing new water sources. This is the function of the MWSS Corporate Office.

- 31.** The change in institutional arrangements was brought about in 1997 following the promulgation of the National Water Crisis Act of 1995 when it was clear to the Philippine government that MWSS was not in a position to provide quality water and sanitation services to Manila, and private sector participation was a feasible alternative. Consequent to the bidding out of the operational and investment functions of MWSS in water and sewerage functions, these were transferred in July 1997 to the Manila Water Company Inc. (MWCI - east zone) and Maynilad Water Services Inc. (MWSI - west zone). The privatization of MWSS was the largest of its kind in the world; it was estimated in 1997 that over the 25-year life of the concessions, about \$7 billion would have to be invested by the concessionaires²². Figure 4 indicates the service areas of the two concessionaires.

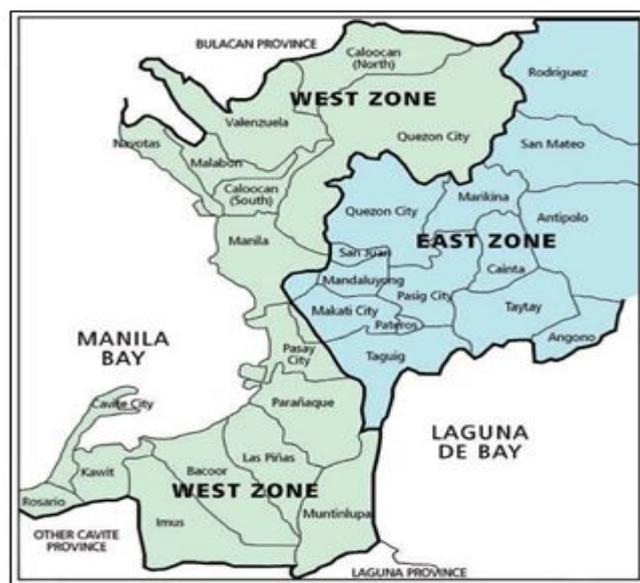


Figure 4: Service Coverage Area of Metro Manila Water Concessionaires

- 32.** MWSI currently serves about 7.2 million people in 16 cities and municipalities and had 955,234 water connections in 2013. MWCI had 857,981 water connections and covered about 6.2 million people in 23 cities and municipalities²³. Water quality is generally good in both service areas although additional domestic treatment is still the norm in most households.

²² The Manila Water Concession. Mark Dumol. The World Bank. July 2000.

²³ Urban Sanitation Review: Philippines Country Study. World Bank (East Asia and Pacific Region) and Australian Aid. December 2013

33. Although Manila has almost 99% coverage in terms of access to potable water in the service areas of the two concessionaires, less than 15% of the city's population is connected to a sewerage system; less than half is provided with sewage treatment²⁴. In 2013, it was estimated that MWCI had secured sewerage coverage of 13% in its service area with a treatment capacity of 128 MLD through 38 sewage treatment plants. MWSI, on the other hand, had 6% coverage in its service area and operated 5 treatment plants with a capacity of 468 MLD. It plans to obtain full coverage by 2037. MWSS estimates about 2.17 million septic tanks in Manila (about 84% of all households) that have often been poorly constructed²⁵. Maintenance is spotty and is carried out under arrangements provided by the concessionaires (vacuum trucks) and private means. An indication of the size of the task is seen from the fact that only 107,000 septic tanks were desludged by the two concessionaires in 2012. Open drains are the most common recipients of liquid wastes, and for effluent from septic tanks. Up to 75% of pollution is caused by residential sewage. The newer condominium developments have commenced installation of separate sewers and small sewage treatment plants.

34. The absence of effective wastewater treatment, and the clogging of most water bodies with solid wastes and attendant pathogens, has created an appalling public health situation in Manila. The Marikina and Pasig rivers are biologically dead, even though the latter is of crucial hydraulic importance to Manila as it connects Laguna de Bay with Manila Bay and balances out oceanic tidal variations. But this also means that pollutants are transferred to Laguna de Bay thereby degrading the quality of its freshwater.

The Legal Underpinnings of Water and Sanitation Services

35. Manila's water supply and sanitation services have been the responsibility of MWSS, a government owned and controlled corporation. Its evolution is straightforward. Originally established in 1878 as the Manila Waterworks Authority, it was incorporated into the National Waterworks and Sewerage Authority in 1955, until its own creation in 1971. There are two Acts of Congress under which Manila's water infrastructure develops and operates. One is the National Water Crisis Act of 1995 which provided the legal framework for MWSS to involve the private sector in its operations. The

²⁴ Manila: Third Sewerage Project. Implementation and Completion Report. The World Bank. December 2012

²⁵ See footnote 15, *ibid*

other is the Clean Water Act of 2004, which although applicable to the entire country, is instrumental in the management of Manila's water and sewerage services.

- 36.** Executive Order No. 311 of 20 March 1996, under the National Water Crisis Act, encouraged the participation of the private sector in the operation of the assets of MWSS and paved the way for its privatization. Consequently, in February 1997, MWSS entered into a concession agreement with two privately-owned concessionaires, MWCI and MWSI. They were required to operate, repair, decommission and refurbish the facilities in their service areas, and had the right to bill and collect for water and sewerage services. A concession fee was payable to MWSS by the concessionaires for the rights so granted to them. Both concessionaires formally took over the operational functions of MWSS in August 1997. The concession agreements were initially in effect for 25 years. They were subsequently extended by 15 years each to 2037.
- 37.** While MWSS was divested of its operational functions, it retained ownership of the assets which are managed by a corporate office, and was vested with regulatory oversight through its regulatory office. This was an unusual arrangement in that, typically, asset ownership and regulatory functions are separated and not combined in a single entity. It creates an obvious conflict of interest and is not considered international good practice. Both concessionaires and MWSS currently have a strained relationship in terms of issues arising from the quinquennial rate rebasing exercise that determines investment requirements, tariffs, and return on investments.
- 38.** The Clean Water Act of 2004 requires MWSS, through its concessionaires, to provide sewerage and sanitation facilities throughout their service areas and enforce the mandatory connection of sewage lines from domestic, commercial, or industrial establishments to an available sewerage system. The sewage treatment facilities of MWCI and MWSI are also required to comply with the guidelines on sanitation of the Department of Health and the effluent standards of the Department of Environment and Natural Resources. In effect, the Clean Water Act and the Code of Sanitation of the Philippines (1975) provide the regulatory framework for sewerage and septage management programs. And it is because of the Clean Water Act that the government prepared (2010) the National Sewerage and Septage Management Program that is currently under implementation.
- 39.** What is interesting is that the Supreme Court of the Philippines resolved in 2008, in the Manila Bay Mandamus case, that the authorities concerned,

including MWSS, had a mandate to take specific actions relating to the clean-up of Manila Bay. This was an important decision that required MWCI and MWSI to plan city-wide sanitation and sewerage investments. As a result, both concessionaires had made progress in sanitation service delivery. In 2012, sewerage coverage was 13% and 6% respectively for MWCI and MWSI and both have projected full coverage by 2037. As an interim target, wastewater treatment plant capacity in 2022 has been set at 1,000 MLD and 661 MLD respectively²⁶.

Public Responsibility and Private Management

- 40.** 40. The model selected by the government to manage Manila's water and sanitation services after the enactment of the national water crisis law in 1995 has served the city well. Ownership of the assets remains in government hands (through MWSS) and the concessionaires operate and maintain them. Additional assets created by the concessionaires to expand the service area and meet quality obligations (as required in the concession agreements) will revert to MWSS at the end of the concession period. Meanwhile, performance parameters are monitored regularly by MWSS-RO, and formally reviewed every 5 years on the occasion of the rate rebasing exercise.
- 41.** After 18 years of the award of the concessions (now extended to 2037), Manila's water services rank among the best in developing Asia. Service coverage is almost 100%, 24/7 service is now the norm, water pressure is uniformly good, and water quality meets standards prescribed by the government²⁷. In the case of MWCI, for example, cases of diarrhea dropped from 15 per 1,000 population to 4 in 10 years²⁸. Some issues, however, remain. These relate principally to climate change impacts, the need to adapt to them quickly, and the related need to improve operational efficiency.
- 42.** Water availability is an issue, especially in prolonged dry periods. While MWSS is planning investments in developing additional water sources – the Laiban Dam, the Kaliwa Dam, and the Bulacan Bulk Water Supply Project have been on the anvil for several years – there is no overt attempt at managing demand. Average consumption in Manila is estimated at 300

²⁶ Philippines Country Study. Urban Sanitation Review. World Bank. December 2013

²⁷ Philippine National Standards for Drinking Water

²⁸ International Finance Corporation.

http://www.ifc.org/wps/wcm/connect/industry_ext_content/ifc_external_corporate_site/industries/infrastructure/waterandutilities/manila+water+company,+philippines

liters per capita per day. With average tariffs at about 31 pesos (US \$0.69 cents) per cubic meter, demand should be affected by price. Clearly, it is not and there is room for using the price instrument to curb demand. However, given the rate of return approach to govern net income for the concessionaires, there may be difficulties in using price to limit demand unless MWSS can indicate a separate water conservation surcharge and collect it directly.

- 43.** In the case of MWCI, measures have been taken to reduce non-revenue water to about 11%. In other words, the concessionaire has understood that it has no more raw water than that allocated to it to serve its customers within its defined service area. It has no choice but to cut water losses, maintain sales revenue, and protect profits. MWSI, on the other hand, still has NRW of 38.7% and is unable to make the same progress in reducing water loss as MWCI. The fact that its raw water is supplied at no cost by MWSS, and that it has fulfilled its coverage targets in its service area, may have led it to determine that it is cheaper to have high NRW levels rather than invest in reducing losses. However, the continued loss of large quantities of treated water at a time of extended dry seasons in the catchment areas serving Manila, and plans of MWSS to develop additional water sources given that the Angat Reservoir will be unable to meet Manila's water needs after 2025, is not in line with international good practice.
- 44.** Private sector participation in urban water management often centers around the issue of tariffs. Manila's tariffs have risen sharply since 1997 when the concessions were awarded. In May 2015, MWSS approved a basic water charge of US \$0.583 per cubic meter in respect of MWCI and US \$0.704 in respect of MWSI²⁹. However, the quality of service has improved significantly since 1997 and there are no universal protests against the tariff regimes.
- 45.** Access for the poor in Manila has been ensured through a variety of means, including measures adopted by the two concessionaires. MWCI adopted an approach to connect poor communities through a single bulk meter for up to 100 households. In the MWSI area, a local NGO called Streams of Knowledge provides water at discounted bulk rates bought from MWSI and for which revenues are collected from the communities³⁰.

²⁹ MWSS announcement. <http://www.rappler.com/business/industries/93397-mwss-metro-manila-water-rates>

³⁰ Development in Practice. The Making and Unmaking of Community-based Water Supplies in Manila. Petr Matous. Volume 23, Issue 2, 2013

Civil Society Participation

- 46.** Civil society organizations in Manila have been active at two levels. One, in keeping a close watch on the performance and returns on investments of the two concessionaires and, two, in promoting community-led water supply schemes for the large, underserved population of informal settlers³¹. The campaign against rate increases (involving the Freedom from Debt Coalition, among others), for example, was a useful means of keeping public attention focused on the terms of the concession agreement. Advocacy was further built by networks such as *Bantay Tubig* and the Citizens' Network for Adequate, Potable and Affordable Water. At the very least, this resulted in the concessionaires formally recognizing the need to deal with civil society views and by reorganizing their corporate structures to include arrangements for engaging with NGOs.
- 47.** Many local communities have organized small-scale water providers which collaborate with the concessionaires to supply water to unserved areas. In these cases, people's organizations (POs) have been set up as the interface to mobilize the communities, metering the consumption of water, ensuring bills are paid on time, and operational issues (such as leaks and theft) are addressed. The POs play a useful role in helping the concessionaires meet their obligations to serve the urban poor. A useful by-product of this arrangement is that earnings from POs are often ploughed back into local communities and used for social projects such as paving footpaths, street lighting, and securing formal ownership of the land on which the community is located.

Chapter 3

Climate Change and Manila's Water Supplies

- 48.** As stated earlier (paragraph 24), Manila is in the eye of a climate storm. The Japan International Cooperation Agency (JICA) undertook a definitive study of climate change (precipitation, temperature, and extreme weather events) in 2013³². Much of the discussion in the succeeding paragraphs is based on this study (the study). The study area includes Manila, and its adjoining areas, in order to arrive at an integrated assessment taking all water

³¹ Case Study. Philippines: CSO Involvement in Urban Water Sector Reform. Water Aid. 2009.

³² The Study of Water Security Master Plan for Metro Manila and its Adjoining Areas. Final Report. Water Balance Study. March 2013. By Japan International Cooperation Agency (JICA) in partnership with Nippon Koei and University of Tokyo.

resource needs into account. This area includes a population of 15.68 million in the MWSS service system and about 13.35 million in the adjoining localities – almost 31% of the country’s population. In terms of this population’s water demand, domestic water consumption increased by an average of 5.7% per annum over the 10 years from 2000 aggregating 781 million cubic meters in 2010.

Precipitation

49. Extensive modelling of climate scenarios in the study to 2040 indicate that the volume of precipitation in the areas (Quezon and Aurora provinces) facing the Philippine Sea is expected to increase by about 500 mm/year which is 10-15% more than the current rainfall in the area. On the other hand, the western half of the Pampanga River Basin (immediately north of Manila) is projected to receive an increase in precipitation of 100 mm/year in the same year period, or about 6% more compared to the present rainfall. Generally, areas with historically higher rainfall are projected to have higher precipitation rates in the future compared to low rainfall areas. The figure below illustrates present and future annual precipitation maps of the vicinity of Manila. Red indicates areas with higher precipitation rates. Note that southern Manila (Laguna and Cavite provinces) will receive substantially less rainfall in the 10 years from 2040.

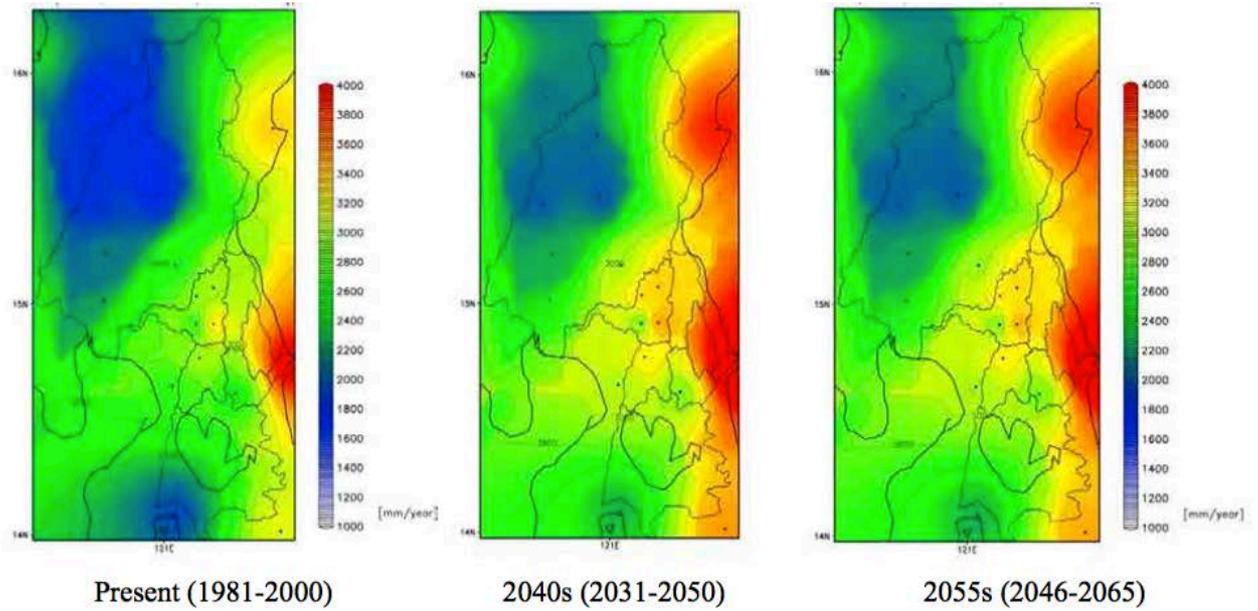
50. The following table indicates mean annual minimum and maximum rainfall by basin. It will be seen that while maximum precipitation declines in Marikina, Angat, and Umirai basins, it increases in the others.

(Unit: mm)

Min/Max	Period	Laguna	Marikina	Angat	Pampanga	Umirai	Agos
Min	Present	56.57	38.8	46.2	45.4	49.9	84.0
	Future	63.6	45.3	52.1	56.7	60.8	95.4
Max	Present	395.3	503.4	516.2	384.4	518.3	414.5
	Future	416.0	492.9	486.7	404.2	489.5	431.5

Source: JICA Study Team

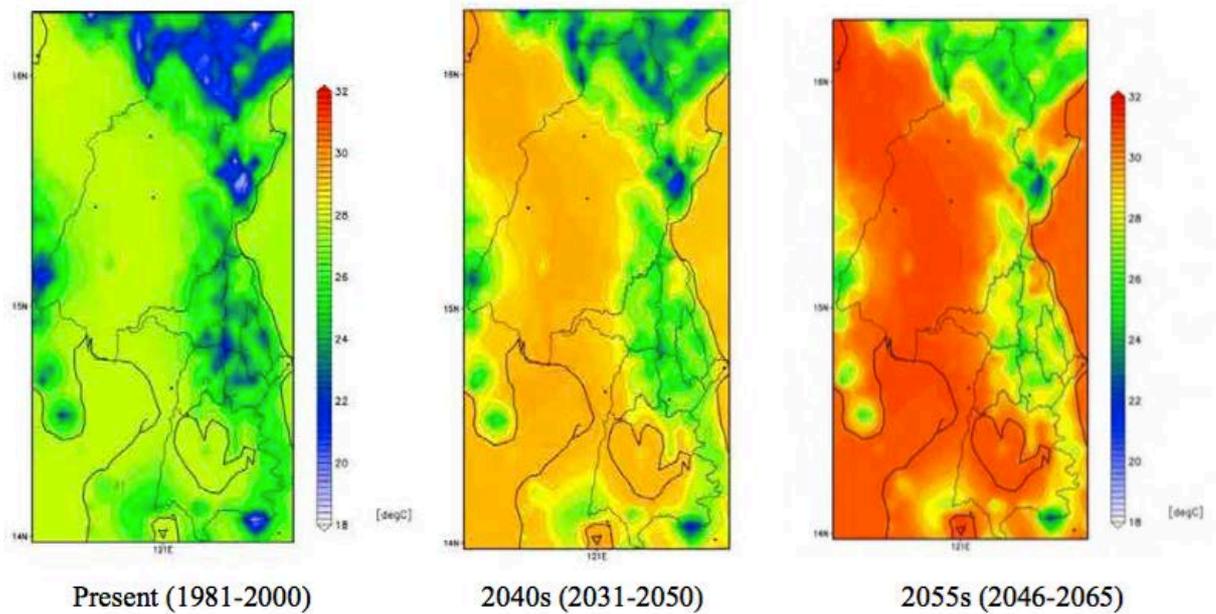
Precipitation Figures (see paragraph 49)



Temperature

- 51.** The annual mean surface air temperature is expected to rise at about 1.8-1.9 °C in the 2040s year and 3.0-3.4 °C in the 2055s. The projected changes in the temperatures for each month are minimal. The figures below illustrate the present and future annual mean temperature maps of the vicinity of Manila. Red denotes areas with higher surface air temperatures. As can be seen, Manila gets a great deal warmer in the 2040s and 2055s compared to the current temperature conditions.

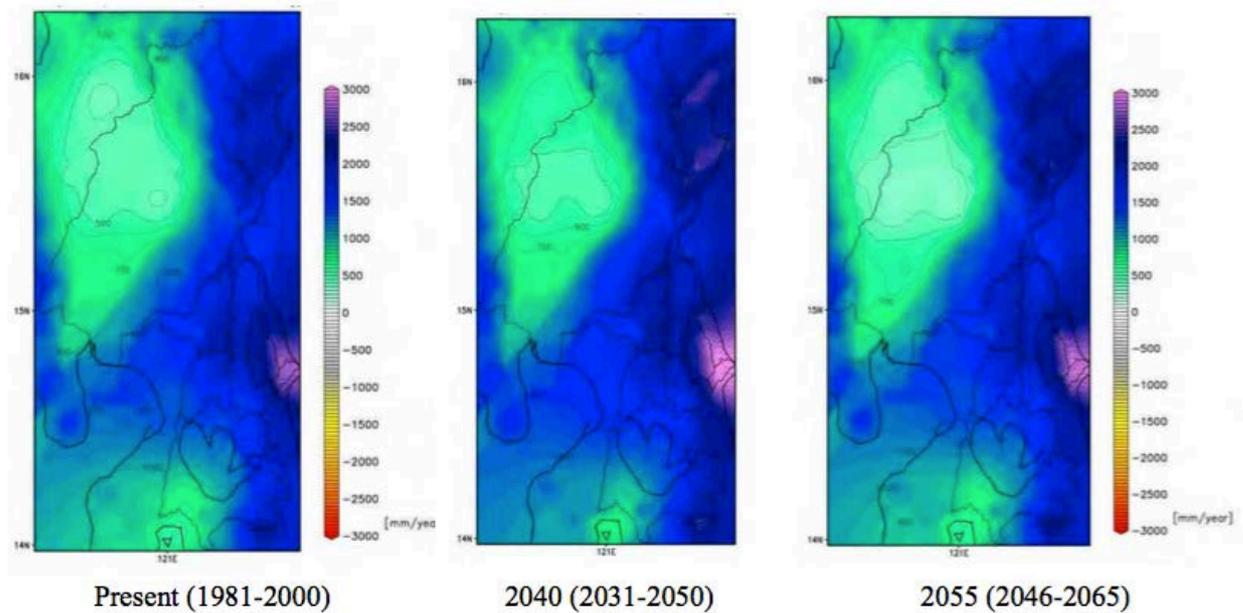
Ambient Air Temperature (see paragraph 51)



Potential Evapotranspiration

52. The difference between precipitation and potential evapotranspiration is the amount of effective rainfall infiltration the land area receives. It is, therefore, a good indicator of the climate change impact on water resources. The potential evapotranspiration is forecast to increase across the study area since air temperature is also expected to rise. The increase by 2040 is projected to be around 140 mm/year in the plains areas and around 80 mm/year in areas with higher elevation. This translates to higher rates of evapotranspiration in the basins in the 2040s at about 0.2-0.5 mm/day, and by the 2055s to about 0.8-1.0 mm/day. The expected annual amount of evapotranspiration for the 2055s climate is twice that of the 2040s climate. The Pampanga river basin is forecast to experience significantly drier pressure in the 2055s as will be seen in the figures below.

Differences in Precipitation and Evapotranspiration (see paragraph 52)



Flood Impacts

- 53.** In regard to extreme weather events, it is important to understand the topography of Manila. The area of the Pasig-Marikina River basin is 639 square km, excluding the Mangahan basin of 84 square km. In the Marikina River basin, with an area of 538 square km, or 81% of the whole basin, the entire basin is susceptible to the flood in the Pasig-Marikina River basin. Flooding in the upstream area of Sto. Niño is most influential because it has an area of 517 square km which is located between mountain area and alluvial plain. Its short flood concentration time, and short traveling time, are influenced by the channel slope of over 1/100 gradient, as well as the channel length of 36.5 km.
- 54.** Most of the floods in the basin have occurred due to typhoonal or (tropical depressions) or monsoonal precipitation (orographic rainfall). Using the annual maximum daily rainfall data after 1978 (the year from which reliable data was available), the study examined the types of weather disturbances and identified two types, namely, i) typhoon-type and ii) monsoon- and others-type. The study noted that the probability density functions of probable rainfall are different, depending on the type of weather disturbance. The probable rainfall over two return periods was estimated as follows:

	Typhoon Type	Monsoon and Others Type
Return Period 1/30	232.4 mm	203.3 mm
Return Period 1/100	285.5 mm	244.6 mm
Data Number	58	61

Source: JICA Study Team

55. The study also concluded that flood flows in 2040 are expected to be higher than those at present, and the increasing rate of the top 5% values are estimated at 27% for Angat, 32% for Pampanga, 22% for Pasig-Marikina, 27% for Umiray, 32% for Agos, and 62% for Laguna basin. The average monthly flows are expected to increase slightly, while the flows during drought year are expected to decrease. The river flows in normal years will not change drastically for all Manila basins.

Droughts

56. According to the evaluation results, about two-thirds of general circulation models showed trends of increasing drought risk, while the remaining one-third showed a decreasing trend. From these evaluations of drought indices, it is difficult to present an assured assessment of drought risk; however, in order to formulate a water resources management plan, it will be prudent for Manila to assume a possible increase of drought risk in the future.

57. The river flows during the rainy season are likely to be significantly lower. The decreasing amount of drought flow towards the future rainy season may be larger than that during the dry season. The river flow of Pasig-Marikina River in August of drought year was assessed at 33 m³/s at present, and will decrease to 14 m³/s, which is almost 40% of the present condition. For the Laguna Lake basin, the river flow in October of drought year was evaluated at 47 m³/s at present, and will reduce to 30 m³/s in the future, which is about 60% of the present condition. Similarly, the river flow of the Agos River in September of drought year was calculated at 41 m³/s at present and 16 m³/s in the future.

Groundwater Situation

58. In regard to groundwater, it is clear that the uncontrolled development and excessive pumping of groundwater caused a decline in water levels in artesian aquifers resulting in saltwater intrusion, most especially in coastal areas. In a study conducted in 2004 for the National Water Resources Board,

it was detected that continuous groundwater withdrawal in Metro Manila, Bulacan and Cavite by private and public wells caused the water level to drop to 80 meters below sea level. Dependence on groundwater to make up for any surface water shortages is not recommended. The figure below shows the areas affected by the decline in groundwater.



Source: National Water Resources Board

Overall Impacts

59. The principal climate change impact will be on water availability in Manila. A rise in air temperature and increasing evapotranspiration will mean a lower threshold of water availability. According to MWSS, its projected water demand in 2037 is 6,412 MLD or 74.3 m³/s as against 35.9 m³/s which is the current demand. The ability of the Angat reservoir to provide anything more than 46.3 cubic meters/second, equivalent to the current allocation of 4,000 MLD, in 2040 is suspect essentially because of rising evapotranspiration and declining reservoir capacity. Clearly, supplementary sources will have to be developed, in conjunction with other measures including, principally, water conservation and demand management.

- 60.** The incidence of internal flooding will be significant, and will increase from present rates. Continuing urbanization and construction activities will erode Manila's ability to manage storm water runoff. Land subsidence will continue as a result of heavy construction activity and groundwater withdrawals. This will likely compound the situation of internal flooding. The poor state of Manila's stormwater drainage system, with most canals and esteros having lost a significant portion of their hydraulic efficiencies, will exacerbate flooding. The potential damage to Manila's water and wastewater infrastructure can be major if not adequately addressed.

Chapter 4

Governance, Innovation and Technology

- 61.** Water and Wastewater services in Manila have improved significantly over time. In operational terms, both MWCI and MWSI can claim to be among developing Asia's top 5 water operators. Coverage of service areas is almost 100%, water is supplied 24/7, water quality is good, and tariffs are affordable. In financial terms, both operators are profitable. Wastewater treatment infrastructure is being accelerated and full coverage is assured by 2037. Nonetheless, several issues remain that, coupled with climate change impacts, pose significant challenges for the sustainable development of Manila.

Governance

- 62.** Manila's water and wastewater services are organized on a public-private partnership basis. The assets are owned by the government (MWSS) and the services are concessioned to two private sector operators to 2037. However, regulation is undertaken through an unusual arrangement vested in the MWSS-RO. It is unusual in that there is an inherent conflict of interest by the owner acting as regulator. The principal task of the MWSS-RO is to ensure the implementation of agreements incorporated in the concession contracts. There have been numerous disputes between the concessionaires and MWSS-RO. A current dispute relates to the inclusion of the corporate income tax, charged by the government on the profits of the concessionaires, in the water tariff³³. The matter has been taken to the country's Supreme Court by MWSS-RO since the two appeals tribunals

³³ See <http://ro.mwss.gov.ph/?p=3368> (MWSS Implements Rates Adjustments for Manila Water and Maynilad. 18 May 2015).

which were petitioned by the concessionaires gave differing awards. A truly independent regulator will be more effectively able to safeguard consumer interests, and assure the public that the concessionaires are delivering quality services at prices that accord with principles enshrined in the contracts.

- 63.** An interesting feature of Manila's water supply situation is the partnership between the private concessionaires with informal, mainly community-based, organizations (CBOs) to provide water through micro-networks. MWCI initiated its pro-poor programme in 1998. Known as *Tubig Para sa Barangay* (Water for the Poor), it has served about 1.7 million people. MWCI also set up its own programme to meet the needs of the urban poor within their concession area but outside their commercially viable operational boundaries. Initially known as the *Bayan Tubig* (Water for the Nation), it morphed into the *Samahang Tubig Maynilad* (Water Association of Maynilad) and essentially replicated MWCI's model in western Manila³⁴. In the majority of cases, bulk meters were used to sell water to CBOs who undertook distribution within their micro networks. Over time, however, most of the bulk meter connections were converted to individual connections. Both programmes have been widely acclaimed as models of partnership between utilities and vulnerable sections of communities. Both parties win; the communities get potable water at affordable rates, and the utility meets its service obligations.

Innovation and Technology

- 64.** With private management of water services in Manila, innovation came to the forefront. It was needed to meet the high standards set in the concession contracts, and to maximize profitability within the limits set by the agreements. It will be useful to discuss a few examples.
- 65.** MWSS, that owned and operated the services before the award of concessions, had a very high number of staff, typical of bloated water utilities in developing Asia. But MWCI dramatically altered labor productivity by reducing the staff-to-connection ratio from 9.8 staff per 1,000 connections to less than 1.4³⁵. A large number of MWSS employees took early retirement under an attractive compensation plan; others were rehired by the new operators. Costs declined and productivity increased

³⁴ The Persistence of Informality: Small-scale Water Providers in Manila's Post-Privatization Era. Deborah Cheng. 2014. See www.water-alternatives.org

³⁵ Regulation and Corporate Innovation: The Case of Manila Water. Perry Rivera. Global Water Summit. 2010.

also as a result of new management methods. In 2011, MWCI won the Asian Human Capital Award.

- 66.** Involving private operators also led to a greater willingness on the part of development finance institutions like the World Bank to participate in the growth of the utilities. This partnership resulted in technology and innovation being transferred at significant scale. Under its Manila: Third Sewerage Project, the World Bank helped finance the Olandes Sewage Treatment Plant that received the 2010 Project Innovation Honors Award from the International Water Association³⁶.
- 67.** In another interesting development, MWCI pioneered the use of an advanced dewatering technology called Geotube to treat wastewater more effectively and reduce the volume of sludge. Experience so far indicates that sludge volumes have reduced by as much as 90%, thereby helping the utility manage its costs and maintain high standards³⁷.
- 68.** MWSI has also not been far behind MWCI in embracing the value of investing in technology and innovation. It has partnered with specialist international technology providers to reduce water losses in its concession area. Non-revenue water declined from 43.5% in 2012 to 38.7% in 2013 and is projected to decline further with the adoption of new technology to detect leaks, monitor system operating parameters in real time, and incentivizing speedy leak repairs. MWSI has gained valuable experience in active leakage control and non-revenue water management which it is now able to transfer to other water utilities in the country, as well as outside it.
- 69.** The single-most important area where innovation and technology is needed is in managing water demand and in assessing the feasibility of options to create 'new' water by reuse and recycling. As discussed in paragraph 59, Manila's water demand in 2037 is likely to outstrip supply by almost 50%. Meeting this demand solely through supply-side solutions like new source developments, reservoirs, and treatment plants is not only expensive but wasteful. Demand, currently in excess of 300 liters per capita per day, is unusually high and can be reduced by 50% without any hardship. If additional water is still needed, especially by the manufacturing and industrial sectors, it is far more economical to recycle and reuse water that is currently treated as waste and not as a resource.

³⁶ Philippines: Providing Sewerage and Sanitation to Over 3 million People. See <http://www.worldbank.org/en/results/2013/04/08/philippines-manila-third-sewerage-project>

³⁷ Manila Water uses innovation for treatment of used water. 10 January 2013. See <http://www.philstar.com/science-and-technology/2013/01/10/895092/manila-water-uses-innovation-treatment-used-water>

70. If Manila were to undertake a demand management exercise that looked at conservation and demand reduction as first priorities, and investing in source development as last priorities, it would see the economic and financial benefits of sustainable, long-term water security. Additionally, such an approach will also demonstrate how a new level of economic activity will be created dedicated to reducing, and maintaining, water footprints in the municipal and industrial sectors. It should learn from other large coastal cities, including several in the Asian region, that have achieved significant reductions in demand through conservation and efficiency-in-use campaigns before resorting to expensive insurance solutions such as desalination plants.

Conclusions

71. Manila is a megacity with promise. It already contributes more than 1/3rd of the Philippines GDP. It has a youthful, well-educated population that can compete with the best in developing Asia in terms of skill levels and job diversity. It has one of Asia's best water supply services, and a fast-improving and expanding wastewater management service. However, Manila's inadequate urban infrastructure, and its poor organization and management, is its Achilles Heel. High levels of air and water pollution, traffic congestion, insufficient and poorly maintained drainage infrastructure, rapid and largely unplanned urban expansion, high susceptibility to extreme weather events, and fragmented urban governance arrangements hold back Manila from realising its full social and economic potential. Reversing this picture will not be easy but it is necessary if Manila is to take its rightful place as one of the prosperous megacities in Asia's 21st century.