Metropolitan Waterworks and Sewerage System
Corporate Office
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The transfer of the operations of MWSS to its Concessionaires, Maynilad and Manila Water, inevitably resulted into the transfer of some, if not all, of the operations of the former to the latter. MWSS’ mandate, however, of providing an uninterrupted and continuous supply of potable water
• In August 01, 1997, the operation of the system of waterworks and sewerage services was privatized under a Concession Agreement subdivided into east and west service areas:
  • The east service area was awarded to the Manila Water Company Inc. (MWCI)
  • The west service area was awarded to the Maynilad Water Services Inc. (MWSI)

Reasons for Privatization

<table>
<thead>
<tr>
<th>Pressing Needs</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve Water Delivery</td>
<td>Huge Investment</td>
</tr>
<tr>
<td>Expand Coverage</td>
<td>Answer</td>
</tr>
<tr>
<td>Develop New Water Sources</td>
<td>Privatization</td>
</tr>
</tbody>
</table>

Objectives

- Transfer financial burden to private sectors
- Improve service standards
- Increase operational efficiency
- Minimize tariff impact
In August 1997, the Philippine government entered into 25-year Concession Agreements with two private consortia comprised of local and international partners, transferring the operational responsibilities of the Metropolitan Waterworks and Sewerage System to the Manila Water Company in the East zone, and Maynilad Water Services in the West Zone.

In 2009, the concession agreement was extended by another 15 years by MWSS and the Philippine Government, thereby extending the term from May 2022 to May 2037. Another third Concession in the North Zone entered the 30-

MANILA WATER COMPANY, INC. (MWCI)

Manila Water Company, Inc. (MWCI), is a joint venture between Ayala Corporation and two foreign companies, the United Utilities of the United Kingdom and the Mitsubishi Corporation of Japan.

Manila Water operates the water utilities in eastern Metro Manila and nearby province of Rizal. It is tasked to supply water, manage the distribution system and improve and expand the east zone concession area for 25 years.

Its franchise area includes Mandaluyong, Marikina, Pasig, Pateros, San Juan, Taguig, Makati and parts of Quezon City and Manila. It also services Antipolo City and the Rizal towns of Angono, Baras, Binagonan, Cainta, Cardona, Jala-Jala, Morong, Pililla, Rodriguez, Tanay, Taytay and San Mateo.

Manila Water has seven (7) business areas namely: Balara Business Area, Cubao Business Area, Makati Business Area, Marikina Area, Pasig Business Area, San Juan-Mandaluyong
Maynilad Water Services, Inc. (MWSI), a partnership between the Benpres Holdings Corporation, the flagship company of the Lopez group and Suez Lyonnaise des Eaux of France. Benpres eventually left the partnership in 2006 to settle a US$240 million debt. Then on January 24, 2007, a consortium led by Metro Pacific Investments Corporation and the DMCI Holdings, Inc. took over the company and able to pay the debt by January 2008. Maynilad manages and operates the water and waste-water services in the cities of Manila (except San Andres), Pasay, Parañaque, Caloocan, Muntinlupa, Las Pinas and Valenzuela, parts of Makati and Quezon City, including the municipalities of Navotas and Malabon. Its franchise area also covers Cavite City and the Cavite municipalities of Bacoor, Imus, Kawit, Noveleta and Rosario. Maynilad has four (4) business areas namely: Northeast Business Area; Northwest Business Area; Central Business Area; and South Business Area.

Luzon Clean Water Development Corporation is a consortium of San Miguel Corporation that provides bulk water for the water districts of Bulacan. They are responsible for the financing, construction, operation, and maintenance of facilities for abstraction, treatment, and conveyance of treated bulk water supply. The BBWSP consists of three stages. Stage 1 covers six water districts consisting of San Jose del Monte, Marilao, Meycauayan, Bocaue, Obando and Balagtas. Stage 2 covers seven water districts consisting of Guiguinto, Calumpit, Bulakan, Plaridel, Sta. Maria, Paombong and Malolos. Stage 3, for implementation soon, will cover the remaining 11 municipalities of Baliuag, Plaridel, Pandi, Hagonoy, San Rafael,
1. MWSS’ Delegated functions to its Concessionaires

Both Concessionaires provide water treatment, water distribution, sewerage and sanitation services to a broad range of residential, semi-business, commercial and industrial customers. Specifically, they should (1) ensure the 24 hour supply of clean drinking water in its concession area; (2) expand water services to new customers; (3) rehabilitate the water supply and distribution network to minimize leakage and (4) reduce non-revenue water (NRW) to the lowest possible level.

Under the terms of the CA, both Concessionaires have the right to the use of land and operational fixed assets, and the exclusive right, as agent of MWSS, to extract and treat raw water, distribute and sell water, and collect, transport, treat and dispose used water, including reusable industrial effluent discharged by the sewerage system in the East and West Zone.

MWSS-CO retained the functions of (1) facilitating the exercise

2. MWSS CO’s Retained Functions

by the concessionaires of its agency powers; (2) carrying out accounting and notification functions; (3) monitoring, reporting, and administering the MWSS loans, and performing related functions in connection with existing projects; (4) providing such other services or functions; (5) managing and/or disposing of the retained assets; and (6) managing MWSS Projects.

The MWSS-Regulatory Office (RO) is primarily mandated to im-

3. MWSS RO’s Functions

plement the provisions of CA such as (1) reviews, monitor and enforces rates and service standards (2) arranges and reports regular independent audits of the performance of the Concessionaires; and monitors the infrastructure assets.
MISSION
For its customers in Metro Manila and expansion areas:
• Optimize and expand our water sources and secure their watersheds and facilities
• Provide equitable access to clean, potable and affordable water
• Expand the coverage of sewerage and sanitation services
• Ensure prudence and efficiency in the implementation of all our plans

VISION
By 2024, MWSS-CO shall be a world-class benchmarked agency for its water security program with technically competent personnel and infrastructure

COMMUNITY VISION
Malinis na Tubig; Walang Korupsyon; Sapat na Daloy ng Tubig; Serbisyong Tunay

CORE VALUES
S - Service Excellence
Q - Quality
I - Integrity
R - Results-Oriented
We at Metropolitan Waterworks and Sewerage System (MWSS) have carefully created a long-term Vision and Mission that will guide every aspect of our organization. This provides the framework for the goals we have established, the purpose we serve and the principles we stand for.

As the State’s chief agency on water and sewerage services, we will ensure that our concessionaires’ actions are equally guided by this Vision and Mission.

We derive our Mandate primarily from Republic Act 6234 which states the basic goals of the System and declares as its major policy the proper operation and maintenance of waterworks system to ensure an uninterrupted and adequate supply and distribution of potable water for domestic and other purposes and the proper operation and maintenance of sewerage systems in

Our Corporate Philosophy

We pursue water security with profound respect for the environment and the resources we utilize, fully cognizant of the truth that in their continuous use lies the future of the country’s successful and sustainable economic growth and the very life and livelihood of

Our Corporate Policy

We institute these beliefs and values in our way of life, through leading by example and by making them an integral part of our performance management system.

CSR Statements

ENVIRONMENTALLY-FRIENDLY VALUE CHAIN

TO ENSURE THE ENVIRONMENTAL SOUNDNESS AND SUSTAINABILITY OF OUR PROGRAMS, PROJECTS, AND ACTIVITIES, WE:

• Integrate environmental considerations into the project decision-making process.
• Comply with governmental environmental laws and regulations and secure the project approvals.
• Conduct consultation with affected communities and relevant national and local regulatory agencies.
• Identify measures to avoid or mitigate adverse project impacts on the environment and proactively manage risks.
• We believe that we can deliver sustainable conservation outcomes by utilizing the latest science and best practices for biodiversity management and by working in partnership with governments, civil society, and communities.
• We are committed to improving our operational water management and engaging proactively with stakeholders in sectoral water challenges and solutions. We value water as a precious resource and seek to create a water stewardship legacy within the communities that we source our water.
• Through MWSS Innovation and Technology Group, we support research of our water and wastewater treatment supplies, their uses, and value streams to better understand potential positive and negative impacts on human health and the environment, and to identify mitigation measures. We encourage, or require where practical, our Concessionaires to adopt similar objectives.

STAKEHOLDERS’ RELATIONSHIP AND ENGAGEMENT

The MWSS-CO’s circle of concern as embodied in its Charter Statement, Manual of Corporate Governance and Performance Scorecard is its stakeholders. Towards this end, WE commit –

• To sustainable development. It requires all officers and employees to comply with social, environmental laws and regulations.
• To transparently communicate with stakeholders, and to respect all peoples.
• To address the key social and environmental risks that the agency faces.
• To build and strengthen relationships of trust, share knowledge and relevant information, and identify new cooperation opportunities that could generate value for our stakeholders: creditors, water concessionaires, lessees, customers, suppliers, government agency partners, local government units, employees, and communities where operate.

We do so through four(4) major pillars:

1. Quality Service. We build relationships that are founded on a commitment to each other’s success; act with humility and a willingness to listen, and be committed to resolving differences and conflicts in a constructive and transparent manner; and seek mutually beneficial outcomes in our decision making such that we contribute to sustainable development.
2. Transparency. We seek to establish and maintain transparent relationships built on mutual respect and trust with communities affected by our operations.
3. Reliability. We engage with local communities to build productive and healthy relationships and contribute to creating shared value.
4. Respect. We respect the dignity, wellbeing and human rights of employees and the communities in which operate, as well as others affected by our operations.
It all starts with the Angat River that provides raw bulk water to the Angat Dam and Reservoir. Angat Dam is the main water source of the people of Metro Manila, which is also getting additional water from the Umiray River through the Umiray-Angat Transbasin Tunnel. From Angat Dam, the raw water courses a distance of 6.4 kilometers directly to Ipo Dam then to the three tunnels and basins in Bicti. Currently, the construction of the 4th tunnel is on-going to increase reliability of raw water. Another completed project is the Bulacan Bulk Water Supply Project (BBWS) operated by LCWDC/San Miguel Corp., which is tapped from one of the six aqueducts to provide water in the districts of Bulacan.

The basins then, control the water flowing from it to the six 16-km aqueducts going to the La Mesa Dam and Reservoir through the La Mesa Portal. From the La Mesa portal, 1500 MLD of water goes to La Mesa Treatment Plant 1, 900 MLD of water goes to La Mesa Treatment Plant 2, 1600 MLD goes to the Balara Treatment Plants 1 & 2 and 150MLD to Rodriguez Treatment Plant.

In 2019, new treatment plants have been added such as Putatan Treatment Plant (300 MLD) and Cardona Treatment Plant, both sourcing water supply from Laguna Lake.

La Mesa Water Treatment Plants 1 & 2 and Putatan is being operated by Maynilad that
## RAW WATER SOURCES CONVEYANCE

<table>
<thead>
<tr>
<th>Structures</th>
<th>Design Capacity (mld)</th>
<th>Project Cost</th>
<th>Funding Source</th>
<th>Contractor</th>
<th>Year Constructed</th>
<th>Year Operational</th>
<th>Remarks</th>
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</thead>
<tbody>
<tr>
<td><strong>a) Tunnels:</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Tunnel No. 1</td>
<td>760</td>
<td></td>
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<td>1/ 1935 - 1938</td>
<td>1939</td>
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<td>Tunnel No. 2</td>
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<td>1/ 1965 - 1968</td>
<td>1969</td>
<td></td>
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<tr>
<td>Tunnel No. 3</td>
<td>2,000</td>
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<td></td>
<td>1/ 1988 - 1991</td>
<td>1992</td>
<td></td>
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<tr>
<td>Tunnel No. 4</td>
<td>1,642</td>
<td>PhP 3.29 B</td>
<td>ADB Loan</td>
<td>CMC di Ravenna</td>
<td>2016 - 2020</td>
<td>2020</td>
<td>ON-GOING CONSTRUCTION</td>
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<td>Tunnel No. 5</td>
<td>1,642</td>
<td>PhP 4 B</td>
<td>CPF Funding</td>
<td></td>
<td>2020 - 2024</td>
<td>2024</td>
<td>ON-GOING BIDDING PROCESS</td>
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<td><strong>b) Aqueducts:</strong></td>
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<tr>
<td>Bicti-Navaliches Aqueduct -1 (AQ-1)</td>
<td>380</td>
<td></td>
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<td>1/ 1936 - 1938</td>
<td>1939</td>
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<td>Bicti-Navaliches Aqueduct -2 (AQ-2)</td>
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<td>1/ 1945 - 1947</td>
<td>1948</td>
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<td>Bicti-Navaliches Aqueduct -3 (AQ-3)</td>
<td>830</td>
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<td>1/ 1966 - 1968</td>
<td>1969</td>
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<td>Bicti-Navaliches Aqueduct -4 (AQ-4)</td>
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<td>1/ 1980 - 1982</td>
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<td>Bicti-Navaliches Aqueduct -6 (AQ-6)</td>
<td>2,000</td>
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<td>China International Water</td>
<td>2010 - 2012</td>
<td>2013</td>
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<td>Bicti-Navaliches Aqueduct -7 (AQ-7)</td>
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<td>2020 - 2023</td>
<td>2024</td>
<td>ON-GOING BIDDING PROCESS</td>
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<tr>
<td>Novaliches-Balara Aqueduct -1 (NBAQ-1)</td>
<td>565</td>
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<td></td>
<td></td>
<td>1/ 1925 - 1928</td>
<td>1929</td>
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<tr>
<td>Novaliches-Balara Aqueduct -3 (NBAQ-3)</td>
<td>850</td>
<td></td>
<td></td>
<td></td>
<td>1/ 1964 - 1967</td>
<td>1968</td>
<td></td>
</tr>
<tr>
<td>Novaliches-Balara Aqueduct -4 (NBAQ-4)</td>
<td>1,000</td>
<td></td>
<td>CPF Funding</td>
<td>CMC di Ravenna</td>
<td>2019 - 2022</td>
<td>2023</td>
<td>ON-GOING CONSTRUCTION</td>
</tr>
</tbody>
</table>

**LEGEND:**

- **MLD** *million liters per day*
- **CPF** *Common Purpose Facility (a joint venture of Manila Water and Maynilad)*
- **1/** *assumed period of construction*
HOW WATER IS BEING PROCESSED

SCREENING – Surface water (water form Angat Dam, and Ipo Dam) often has large debris, such as sticks, logs, leaves, fish and trash, floating in it. These objects can clog the water-treatment system and must be removed before the water enters the treatment plant. Treatment facilities that use surface water have large screens covering the site of water intake. The debris is too large to pass through the holes in the screens. Thus, as the water enters the tunnels and aqueducts, the large debris is removed. The screens must be cleaned periodically to remove any objects that stuck, so that they do not clog the screen and impede water flow into the plant.

PRE-CHLORINATION (Disinfection) – This step is used to kill the organisms in the water that may maybe harmful to human (pathogens). This is done by adding a chlorine to the water. This step is repeated at the end of all other treatment sequences to ensure the destruction of these organisms.

RAPID MIXING – The first step of the treatment process involves vigorous mixing of the water. This promotes the dispersion of the coagulation chemicals (Aluminum Sulfate and Polymer) in the raw water. A series of chemical reactions occur to begin formation of a “floc” (a cluster of coagulative chemicals and impurities, such as suspended solids and organic matter). The mixing intensity of the water is then reduced allowing well-defined pinhead sized particles of floc to begin to form.

FLOCCULATION – Small particles with non-rigid surfaces are made to agglomerate by mixing the water (and thus bringing the particles into contact with one another so that they would stick together). When the agglomeration of the particles gets large enough, the aggregate can settle in still water by sedimentation. The larger particles continue to combine (floculate) into much larger and heavier particles. These particles become too heavy to float and begin to sink (settle). After flocculation, the water is ready to the next step in the treatment process – sedimentation. Other suspended particles do not agglomerate well by flocculation. To remove these particles from the water, polymer must be used.

COAGULATION – Aluminum Sulfate is added to the water entering the plant. The water is mixed, rapidly at first, and then more slowly as the water goes this process. The reaction of the chemically treated water to the mixing causes the small, light weight particles to clump together (coagulate) into much larger particles. Coagulation is the process of gathering particles into a cluster or clot, often achieved by the addition of special chemicals known as coagulants. The most common coagulant used in water treatment facilities is aluminum sulfate (alum, Al2(SO4)3). Other Al and Fe salts, including polyaluminum chloride, ferric chloride, and ferric sulfate, may be used as well. As this precipitate forms, other particles are caught in the solid, forming a mass.

SEDIMENTATION – Other suspended (insoluble) particles, such as sand and dirt, are small enough to pass easily through the screens. These particles must be removed from the water by another process known as sedimentation. When water is allowed to sit, heavy suspended particles (e.g., sand) will settle to the bottom over time because they are denser than water. The water, now free of the suspended impurities, can be collected form the top without disturbing the layer of sediment at the bottom (which is eventually discarded).

FILTRATION – Often, the particles generated by the precipitation reactions described above are too small to settle efficiently by sedimentation. One strategy that is frequently improved to remove these solids is gravity filtration. In this process, water containing solid impurities is passed through a porous medium, typically layers of sand and gravel pieces. However, the solids (from precipitation) get stuck in the holes, and are thus retained in the porous medium. The water that passes through the bottom of the filter no longer contains those solid impurities.

Gravity Filters at water-treatment plants have a pipe feeding into the under drain, the bottom layer where the clean water is collected. By adding water to the filter through this pipe, clean water can be forced upward through the filter to remove the solids that have collected in the filter. This process is used to clean the filter.

DISINFECTION - In many water supplies, the most serious health threats are posed not by chemicals, but by infectious organisms (bacteria) in the water. Chlorine (Cl2) is a major disinfectant that is cheap and kills most of the serious disease-causing bacteria in the wa-
PROJECTS
ANGAT WATER TRANSMISSION
IMPROVEMENT PROJECT

DESCRIPTION:
Rehabilitation of raw water transmission system from Ipo Dam to La Mesa Dam, with the construction of new Tunnel No. 4 (4.00 meters diameter x 6.40 kilometers length) as the priority work in order to facilitate the rehabilitation of the whole transmission system. This will be able to supply 19cms of raw water and will improve the flow and flexibility of the whole raw water transmission system.

Project Cost: 3.29 Billion
Project Location: Norzagaray, Bulacan
Contractor: CMC di Ravenna
Funding Source: ADB Loan

Status (3rd quarter of 2019):
- 95% physical accomplishment of construction work
- TBM excavation was completed on 11 February 2019, 3 months ahead of schedule. Final breakthrough was achieved on April 2019.
BULACAN BULK WATER SUPPLY

DESCRIPTION:

475 MLD of treated bulk water supply to the entire Province of Bulacan through its water districts.

Project Cost: 16.32 Billion

Project Location: Norzagaray, Bulacan

Contractor: Luzon Clean Water Development (San Miguel Corp. + K-Water)

Funding Source: Private Proponent (PPP Scheme)

Stages 1 and 2 are fully operational:

A. Stage 1: completed on 17 December 2018; Commercial operation started on 14 January 2019, now serving Water Districts of San Jose del Monte, Marilao, Meycauayan, Bocaue, Obando and Balagtas.

B. Stage 2: Now serving Water Districts of Guiguinto, Calumpit, Bulakan, Plaridel, Sta.
NEW CENTENNIAL WATER SUPPLY
PROJECT—KALIWA DAM

DESCRIPTION:
Development of new water source in order to meet the increasing water demand by constructing a redundant dam for Metro Manila's domestic water supply. Additional volume of raw water in the amount of 600 million liters per day (600mld) once completed.

Project Cost: 12.86 Billion
Project Location: Brgy. Pagsangahan, General Nakar, and Brgy. Magsaysay Infanta, Quezon
Funding Source: Official Development Assistance (ODA) - China Loan

Status (3rd quarter of 2019):

FREE AND PRIOR INFORMED CONSENT (FPIC) PROCESS (Jointly with the NCIP)
a). QUEZON
1st IP Community Assembly --- Completed 18 April 2019
2nd IP Community Assembly --- Completed 18 May 2019
3rd IP Community Assembly --- Completed 18 August 2019
b). RIZAL
IP Community Assembly: Cluster 1 --- 18 September 2019
Cluster 2 --- 05 September 2019
Cluster 3 --- 12 September 2019

ENVIRONMENTAL COMPLIANCE CERTIFICATE
- DENR-EMB issued ECC on 11 October 2019

LOT ACQUISITION FOR THE TUNNEL OUTLET PORTAL
- Initial payment for landowners --- 25 October 2019

RESETTLEMENT
On-going coordination with DENR-IV-A , General Nakar and IPOs for the resettlement site.

OTHERS
- Workshop for the implementation of Collaborative Approach for the Management of Kaliwa Watershed Forest Reserve --- scheduled on October 2019
Rehabilitation, Operation and Maintenance of MWSS-owned Auxiliary Turbines 4 & 5 of the

DESCRIPTION:
The project involves the opportunity to optimize the benefit from the MWSS-owned Auxiliary Turbines 4 & 5 by developing the hydropower generation component, a "by-product" of the raw water flowing through the turbines and water supply security for the entire MWSS service area.

- Part of the originally conceived Umiray-Angat Transbasin Project’s three diversion sites
- Will contribute a minimum additional discharge of 2.2 CMS to Angat Reservoir

Project Cost: 1.155 Billion
Project Location: Norzagaray, Bulacan
Funding Source: Private-Public Partnership Scheme

Status (2nd quarter of 2019):
- On-going preparation of NEDA-ICC and DOF requirements, among others, is the financial model being attended to by the Inter-agency TWG (NPC/PSALM, DOE,
SUMAG RIVER DIVERSION PROJECT

DESCRIPTION:

This involves the tapping of the Sumag River which was originally part of the Umiray-Angat Transbasin Tunnel Project to increase the volume of raw water coming from the Umiray River going to the Angat Reservoir. Once completed, this 600 meter length of tunnel (2.50m diameter) will be able to provide an additional raw water supply of 188 million liters per day.

Project Cost: 774 Million
Project Location: Umiray, General Nakar, Quezon
Funding Source: Common Purpose Facility (Maynilad and Manila Water)

Status (3rd quarter of 2019):

- Since the drowning incident in August 2016, the Project has not yet resumed to date due to quarry permit. On-going negotiation with LGUs to secure permit.
REHABILITATION OF UMIRAY-ANGAT TRANS-

DESCRIPTION:

Rehabilitation and strengthening of existing tunnel structures to withstand future typhoons in order to ensure the continuous flow of raw water from the Umiray River to Angat Reservoir.

Project Cost: 749.43 Million
Project Location: Umiray, General Nakar, Quezon &
Outlets: Macua, Doña Remedios Trinidad Bulacan
Funding Source: Common Purpose Facility (Maynilad and Manila Water)

Status (3rd quarter of 2019):
• The construction works which resumed last 4 January 2019,
DAMS and RESERVOIRS
I. BACKGROUND:
The Angat Hydro Electric Plant (AHEP), located about 60 kilometers northeast of Metro Manila, was constructed by the National Power Corporation (NPC) in late 1960’s as a Multi-Purpose Project for Power, Flood Control, Irrigation and Water Supply. Major structures of the Angat HEP are the 131 meter high rockfill dam with inclined earth core and the 52 meters high rockfill Main Dyke also with inclined earth core.

The importance of the Angat HEP to the Philippine Government cannot be overemphasized considering that it generates approximately 246 MW power for the Luzon Grid of NPC, irrigates 25,000 hectares of riceland for NIA and supplies 97% of water for the service area of MWSS equivalent to 4,000 million liters per day.

Upstream of Angat Dam is the Umiray Transbasin Tunnel which supplement additional water to the Angat Reservoir coming from the Umiray River, while on the downstream is the Ipo Dam down to La Mesa Dam. Except for Angat Dam, Umiray Tunnel is being operated by MWSS including Ipo and La Mesa Dam.

II. MWSS’ CONTRIBUTION TO ANGAT RESERVOIR:
- Additional 15 cms of raw water coming from the Umiray River as conveyed through the MWSS-owned Umiray Tunnel, resulting to additional power generation.
- Additional 10 MW of power generated by the MWSS-owned Auxiliary Turbine No. 4.

MWSS Present Water Rights

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angat Original Allocation to MWSS</td>
<td>22.0 cms</td>
</tr>
<tr>
<td>Angat Conditional Allocation from NIA</td>
<td>15.0 cms</td>
</tr>
<tr>
<td>Umiray Angat Transbasin Tunnel</td>
<td>9.0 cms</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>46.0 cms</strong></td>
</tr>
<tr>
<td><strong>OR</strong></td>
<td><strong>4,000 mld</strong></td>
</tr>
</tbody>
</table>

60% goes to the West Service Area = 2,400 mld
40% goes to the East Service Area = 1,600 mld

cms – cubic meters per second
mld – million liters per day
III. MEMORANDUM OF AGREEMENT (MOAs):
MOA executed by and between NAWASA (now MWSS) and NPC in October 5, 1962 relative to the construction of the Angat Hydroelectric Plant wherein MWSS contributed P21.50M for the expenses and cost of the Project.
MOA executed by and between MWSS and NPC in February 9, 1990 relative to the construction of Auxiliary Turbine No. 5 which MWSS shouldered the whole Project cost.

IV. OPERATION RULES FOR THE ANGAT RESERVOIR:
The utilization of water from the reservoir is to be regulated by rule curves. The rule curves serve as basis for the proper allocation of discharges for irrigation, water supply, power generation and flood control operations.

There are two rule curves used in the Angat reservoir, the flood rule curve and the operation rule curve. The flood rule curve, which was developed by NPC, controls the surcharge storage available in the reservoir. The operation rule curves, which was developed by NWRB, indicate the minimum water surface elevation requirement at any given time the
The New Operation Rule Curve for Angat Reservoir was adopted in December 1998, under NWRB Resolution No. 02-1298. It consisted of upper rule curve with starting elevation at 212 meters and lower rule curve with starting elevation of 207.30 meters. At reservoir water level of 180 m., the Main Units of the reservoir cannot be operated and could not release water for irrigation.

In order to assure optimum benefits from the reservoir and to safeguard against shortage of water supply during El Niño or risk of overtapping of the dam during the La Niña, the following are the operation criteria in conjunction with the rule curve:

1.) The water surface elevations of the reservoir at any given time should not be allowed to go below the lower rule curve except during critical water shortages where it should first be cleared with the NWRB;

2.) As long as water surface elevation is above the upper and lower rule curves, water releases should be allowed to satisfy all requirements for water supply, irrigation as well as additional releases in the main and auxiliary;

3.) During critically wet periods when actual inflow is more than the design inflow and the elevation is above Elevation 212 M, additional releases for water supply requirement over and above the MWSS requirement used in the development of the rule curves may be allowed when requested, provided that the resulting reservoir level will not fall below the upper rule curve; and

4.) During critically dry periods when actual inflow is less than the inflow used in the development, releases for irrigation, in addition to water supply requirement may be allowed provided that the resulting reservoir level will not fall below the lower rule curve. Appropriate irrigation and water supply releases under this condition should be first cleared with the NWRB.
SAFETY ASSESSMENT OF THE ANGAT DAM & DYKE:

- The Angat Dam and Dyke had been in operation for about three decades when PHIVOLCS (Philippine Institute of Volcanology and Seismology) announced that the West Valley Fault (also known as Marikina West Fault), which hems through the Central Metro Manila Area, is potentially active. PHIVOLCS is of the opinion that the fault that crosses the main Dyke is a branch (splay) of the West Valley Fault. When the West Valley Fault slips, the branch under the Dyke may produce horizontal shear and vertical shear displacement. Two main areas of concern, if the Angat Dam/Dyke failed, are that MWSS is 97% reliant on the Angat Dam as a source of water supply for Metro Manila and that there is a direct safety risk to about 500,000 people living below the Dam in the province of Bulacan. Thus the urgency to immediately undertake safety assessment of the Angat Dam and Dykes.

- In 2000, NPC commissioned Tonkin & Taylor International, Ltd. (T&T) of New Zealand in association with EDCOP, to undertake a preliminary Safety Review of the Angat Dam and Dyke. The review was carried out in accordance with the internationally recognized Safety Evaluation of Existing Dams, SEED Manual criteria. The study was completed in early 2001 and concluded with a “CONDITIONALLY POOR” rating for the Dam and Dyke. This result was due to the combined issues of lack of key data and surveillance systems and uncertainties over the stability of the Dam and main Dyke.

- Thus in 2001, the NPC, the government agency responsible for the Angat Dam joined with MWSS to form a committee known as MWSS-NPC Task Force on Angat Dam and Dyke to look into the apparent risks at the Dam and Dyke, with an initial common fund of PhP10 million (a MOA was executed for this matter for an equal sharing of P5M each). During the progress of the study, NPC and MWSS Consultants traced the West Valley Fault and found it extended to the Angat Dyke and this was confirmed by PHIVOLCS.

- In 2018, Seismic retrofitting was completed including flood forecasting, instrumentation and warning system.
The Ipo Dam is owned and operated by MWSS as a single purpose water supply dam. It has an available storage capacity of 6100 million liters per day.

The dam is located at the confluence of Angat River and the Ipo River.

The old Dam which is located 200 meters upstream of Ipo River was completed in 1938, and other necessary infrastructures, namely, the Ipo-Bicti Tunnel and the Bicti-Novaliches Aqueduct were commissioned in 1939.

In the 60’s a larger tunnel was driven from Ipo to Bicti, a third aqueduct was constructed from Bicti to Novaliches.

A fourth Bicti-Novaliches aqueduct was completed in 1983 and in 1984, the new Ipo Dam was completed. It is 7.5 kilometers downstream of Angat Dam. The new dam has a maximum **storage capacity of 7.5 million cubic meters**, an increase of 2,500 MLD from the old Ipo Dam capacity.

The spilling level of the dam is at an elevation of 101 meters and it has seven radial floodgates. The watershed topography is characterized by mountainous terrain similar to the Angat Reservoir Watershed with moderate forest cover.

The dam watershed and reservoir is of about 70 square kilometers and receives an average annual rainfall of 3,500 millimeters.

**IPO Conveyance Structures**

Water from the dam is diverted to the Novaliches Portal and the La Mesa Dam through three intake structures going down to three connecting tunnels into five connecting aqueducts.

Water released from Angat Dam by the auxiliary turbines or spillway travels down river approximately 9 Km to the small impoundment created by Ipo Dam. The dam is fitted with radial flood control gates.

Being located downstream of the confluence of Ipo River, the additional catchment so controlled yields a further 350Mld average annual supply.

At Ipo Dam, water for Metro Manila enters three tunnels which run to Bicti. Water entering the tunnels passes through trashracks and course traveling plate screens.

The total design capacity of the three tunnels is 4,650 Mld, although the maximum measured flow is reported to have only reached 4,400 Mld.

At Bicti, structures enable balancing of the flows from two of the upstream tunnels across the four of the downstream aqueducts which flow to La Mesa. The third and newest tunnel from Ipo connects directly to the newest aqueduct to La Mesa. Total capacity of the five aqueducts is 4,460Mld.

The releases from Angat reaching Ipo are normally all diverted into the tunnels to Bicti. At times of flood, the tunnel gates are used to control the flow entering the tunnels but the gates can be used at other times when required.
LA MESA DAM AND RESERVOIR

The **La Mesa Dam** is an earth dam with a **height of 24 meters (79 feet)** in Novaliches, Quezon City. The elevation at its crest is 82.5 meters (271 feet) while the **elevation at its overflow section is 80.15 meters (263 feet)**. It is part of the Angat-Ipo-La Mesa water system, which supplies most of the water supply of Metro Manila.

The **La Mesa Reservoir** has a maximum capacity of about 50.5 million cubic meters (**1,780 million cubic feet**) occupying an area of 27 square kilometers. Water from the reservoir spills into the Tullahan River which transports the water to the Manila Bay.

The water collected in the reservoir is treated on-site by the Maynilad Water Services and at the Balara Treatment Plant further south by the Manila Water.

Furthermore, **La Mesa Watershed covers 2,700 hectares (2,000 ha of forest lands and 700 ha of reservoir/lake)**. It is the last forest of its size in Metro Manila and is centrally located.
As of September 2019, reported total no. of trees planted by the participating agencies is 469,600.

A MILLION TREE CHALLENGE PROJECT

This initiative was launched on 23 June 2017 at the Ipo Dam Norzagaray, Bulacan. The Annual Million Tree Challenge (AMTC) aims to conserve and protect our water sources from the six critical watersheds namely La Mesa, Ipo, Angat, Umiray, Laguna Lake and Marikina River. These six watersheds are the major sources of Metro Manila’s drinking water but have currently been threatened and degraded due to inhu-

Updates on Trees Planted and Commitment:

<table>
<thead>
<tr>
<th>No.</th>
<th>Agency</th>
<th>Commitment for 2017</th>
<th>No. of Trees Planted As of December 2017</th>
<th>Commitment for 2018</th>
<th>No. of Trees Planted As of December 2018</th>
<th>Commitment for 2019</th>
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<tbody>
<tr>
<td>1</td>
<td>MWSS CO</td>
<td>50,000</td>
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<td>9,850</td>
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<td>2</td>
<td>MWSS RO</td>
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<tr>
<td>3</td>
<td>DENR Region III</td>
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<td>296,000</td>
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<td>5</td>
<td>DENR NCR</td>
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<td>107,391</td>
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<td>MWCI (Manila Water)</td>
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<td>100,000</td>
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<td>7</td>
<td>ALFKI (Bantay Kalikasan)</td>
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<td>MWSI (Maynilad)</td>
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<td>11</td>
<td>PWWA (Philippine Water Works Association)</td>
<td>20,000</td>
<td>2,000</td>
<td>10,000</td>
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<td>2,000</td>
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<td>DepED</td>
<td>100,000</td>
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<td>13</td>
<td>Angat Hydropower</td>
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<td>5,000</td>
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<tr>
<td>15</td>
<td>Rotary Club District 3780</td>
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<td></td>
<td>5,000</td>
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<tr>
<td>16</td>
<td>LGU - General Nakar</td>
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<tr>
<td>17</td>
<td>LLDA (Laguna Lake Development Authority)</td>
<td>11,835</td>
<td>22,590</td>
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<td>18</td>
<td>JCI Senate Phils.</td>
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<td>19</td>
<td>Luzon Clean Water Development</td>
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<td>20</td>
<td>Mga Anak ni Inang Daigdig</td>
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<td>21</td>
<td>NAPOCOR</td>
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<td>22</td>
<td>Bambuhay Social Enterprise</td>
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<td>Total</td>
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<td>1,511,200</td>
<td>1,245,300</td>
<td>1,675,000</td>
<td>987,317</td>
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TREATMENT PLANTS
<table>
<thead>
<tr>
<th>Facility Name</th>
<th>Balara Water Treatment Plant 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility Location</td>
<td>Carriedo St., Matandang Balara, Quezon City</td>
</tr>
<tr>
<td>Lot Area (sq. m.)</td>
<td>Approximately 47,000sq.m.</td>
</tr>
<tr>
<td>Year Constructed</td>
<td>1935</td>
</tr>
<tr>
<td>Influence Area</td>
<td>San Juan City, Mandaluyong City, Parts of Quezon City and Makati City</td>
</tr>
<tr>
<td>Service Area Covered</td>
<td>300,000 service connection</td>
</tr>
<tr>
<td>Raw Water Source</td>
<td>Angat-Ipo-La Mesa System</td>
</tr>
<tr>
<td>Treatment Technology</td>
<td>Conventional Treatment Process</td>
</tr>
<tr>
<td>Design Capacity (MLD)</td>
<td>470 MLD</td>
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</tbody>
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Process Diagram:

- Pre-Chlorination
- pH Adjustment
- Intermediate Chlorination
- Post-Chlorination
- RAW WATER
- Coagulation
- Flocculation
- Sedimentation
- Filtration
- Treated Water
- pH Correction
<table>
<thead>
<tr>
<th>Facility Name</th>
<th>Balara Water Treatment Plant 2</th>
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</thead>
<tbody>
<tr>
<td>Facility Location</td>
<td>Matandang Balara, Quezon City</td>
</tr>
<tr>
<td>Lot Area</td>
<td>Approximately 70,000sq. meter</td>
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<tr>
<td>Year Constructed</td>
<td>1958</td>
</tr>
<tr>
<td>Influence Area</td>
<td>Tandang Sora, Katipunan, Makati, Taguig, Pasig, Pateros, Paranaque, Marikina and parts of Rizal</td>
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<tr>
<td>Service Area Covered</td>
<td>671,839 service connections</td>
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<td>Raw Water Source</td>
<td>Angat-Ipo-La Mesa System</td>
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<td>Treatment Technology</td>
<td>Conventional Treatment Process</td>
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<tr>
<td>Design Capacity</td>
<td>1,130 MLD</td>
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</table>

Process Diagram:

1. **Pre-Chlorination**
2. **pH Adjustment**
3. **Intermediate Chlorination**
4. **Post-Chlorination**
5. **Coagulation**
6. **Flocculation**
7. **Sedimentation**
8. **Filtration**
9. **pH Correction**
10. **Treated Water**
<table>
<thead>
<tr>
<th>Facility Name</th>
<th>Cardona Water Treatment Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility Location</td>
<td>Diversion Road Brgy. Remedio, Cardona, Rizal</td>
</tr>
<tr>
<td>Lot Area</td>
<td>5 hectares</td>
</tr>
<tr>
<td>Year Constructed</td>
<td>2018</td>
</tr>
<tr>
<td>Influence Area</td>
<td>Baras, Jala-jala, Binangonan, Angono</td>
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<tr>
<td>Service Area Covered</td>
<td>50.2 sq.km. or 22,077 service connections</td>
</tr>
<tr>
<td>Raw Water Source</td>
<td>Laguna de Bay</td>
</tr>
<tr>
<td>Treatment Technology</td>
<td>Conventional Actiflo Settlers and Carb, Ozonation, Reverse Osmosis</td>
</tr>
<tr>
<td>Design Capacity</td>
<td>100 MLD</td>
</tr>
</tbody>
</table>

**Process Diagram:**

[Diagram of the process flow showing various stages of water treatment, including coarse and fine screening, intake pumping station, pre-ozoneation & actiflo settler, dual media filters, actiflo carb, lamella thickener, belt press, chlorination contact tank, and drinking water output.]
<table>
<thead>
<tr>
<th>Facility Name</th>
<th>East La Mesa Water Treatment Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility Location</td>
<td>La Mesa Watershed, Litex Road, Barangay Payatas B, Quezon City</td>
</tr>
<tr>
<td>Lot Area</td>
<td>50,000 square meters</td>
</tr>
<tr>
<td>Year Constructed</td>
<td>2012</td>
</tr>
<tr>
<td>Influence Area</td>
<td>San Mateo, Rodriguez and some portion of Marikina</td>
</tr>
<tr>
<td>Service Area Covered</td>
<td>37.73 square kilometer or 55,623 service connections</td>
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<tr>
<td>Raw Water Source</td>
<td>Angat-Ipo-La Mesa System</td>
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<tr>
<td>Treatment Technology</td>
<td>Conventional Treatment</td>
</tr>
<tr>
<td>Design Capacity</td>
<td>150 MLD</td>
</tr>
</tbody>
</table>

**Process Diagram:**

1. **Pre-Chlorination**
   - RAW WATER
2. **pH Adjustment**
   - COAGULATION
3. **Intermediate Chlorination**
   - FLOCCULATION
4. **Filtration**
   - SEDIMENTATION
5. **Post-Chlorination**
   - FILTRATION
6. **Treated Water**
   - pH CORRECTION
<table>
<thead>
<tr>
<th>Facility Name</th>
<th>Luzon Water Treatment Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility Location</td>
<td>No. 54, AFP Road, Barangay Matandang Balara, Quezon City</td>
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<tr>
<td>Lot Area (sq. m.)</td>
<td>6,000 sq. m.</td>
</tr>
<tr>
<td>Year Constructed</td>
<td>Reservoir (2012) Ultrafiltration Treatment Plant (2019)</td>
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<tr>
<td>Influence Area</td>
<td>Parts of Quezon City (Barangays Pasong Tamo, Sauyo, and Holy Spirit)</td>
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<tr>
<td>Service Area Covered</td>
<td>14,386 water service connection</td>
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<td>Raw Water Source</td>
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<td>Treatment Technology</td>
<td>Ultrafiltration</td>
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<td>Design Capacity (MLD)</td>
<td>20 MLD</td>
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</tbody>
</table>

Process Diagram:

![Process Diagram](image-url)
INDOOR:

1. Repair running toilets and leaky faucets
2. Turn off the tap when brushing your teeth, washing your hands and shaving
3. Take shorter showers
4. Don’t let the water run unabated while you wash dishes
5. When taking a bath, use dipper from pail instead of running water from shower
6. Collect the water you use for rinsing fruits and vegetables, then reuse it to water houseplants
7. Designate one glass for your drinking water each day or refill a water bottle. This will cut down on the number of glasses to wash
8. Teach your children to turn off faucets tightly after each use; and
9. Share water conservation tips with friends and neighbors.

OUTDOOR:

1. Water your plants and lawn early in the morning or late in the afternoon when it’s cooler. Don’t water your plants during windy days or high noon
2. Don’t water your lawn often. Never soak your lawn; grass does not need a lot of water
3. Use pail and dipper instead of sprinklers when watering plants
4. When cleaning your sidewalk or driveway, sweep the dirt with broom instead of removing the dirt with water
5. Reduce the amount of grass in your yard by planting shrubs, and ground cover with rock and granite mulching.
6. Use a pail and cotton rag when washing your car. Do not use a running hose and sponge
7. Immediately report to concerned concessionaire any water leaks from busted...
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