



Project Information Document (PID)

Concept Stage | Date Prepared/Updated: 22-Jan-2020 | Report No: PIDC27692

**BASIC INFORMATION****A. Basic Project Data**

Country Philippines	Project ID P171897	Parent Project ID (if any)	Project Name Pasig-Marikina River Basin Flood Management Project (P171897)
Region EAST ASIA AND PACIFIC	Estimated Appraisal Date Nov 02, 2020	Estimated Board Date Mar 25, 2021	Practice Area (Lead) Water
Financing Instrument Investment Project Financing	Borrower(s) Department of Finance	Implementing Agency Department of Public Works and Highways	

Proposed Development Objective(s)

To improve flood management in the Pasig-Marikina River Basin.

PROJECT FINANCING DATA (US\$, Millions)**SUMMARY**

Total Project Cost	700.00
Total Financing	435.00
of which IBRD/IDA	400.00
Financing Gap	265.00

DETAILS**World Bank Group Financing**

International Bank for Reconstruction and Development (IBRD)	400.00
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Non-World Bank Group Financing

Counterpart Funding	35.00
Borrower/Recipient	35.00



Environmental and Social Risk Classification

High

Concept Review Decision

Track II-The review did authorize the preparation to continue

B. Introduction and Context

Country Context

1. The Philippines is a lower-middle income country with a population of about 109 million people (December 2019) and a population growth rate of about 1.7 percent. The country has experienced strong macroeconomic growth during the last decade. This has been manifested by low and stable inflation, reduced debt, a healthy current account surplus, high international reserves, and a stable banking sector. Economic growth has been robust in recent years, with real Gross Domestic Product (GDP) growing by an average of 5.7 percent between 1999 and 2018. The growth for 2019 was 5.9 percent. Growth over the years has especially been driven by household consumption, construction, and exports of goods and services.
2. In the World Risk Index for 2019, the Philippines ranks as the third-riskiest natural hazard-prone country in the world, after two small countries located in the Pacific. The social and economic cost of natural disasters in the country is increasing due to population growth, migration, unplanned urbanization, environmental degradation, and climate change. The country's vulnerability to adverse natural events creates risk to its recent achievements in poverty reduction and can reverse long-term growth. Across its 7,500 islands, the Philippines is exposed to multiple natural hazards including earthquakes, typhoons, flooding, storm surges, volcano eruptions, and tsunamis. About 74 percent of the population is vulnerable to natural disasters and 60 percent of total land area is exposed to multiple hazards.
3. The geographic location of the Philippines makes it prone to typhoons and climate change seems to exacerbate their impact. Typhoons and floods are the most devastating in terms of their economic and social impact, accounted for 80 percent of all deaths, 90 percent of the total number of affected people, and 92 percent of the total economic impact (PSA). The number and intensity of typhoons seems to be increasing, with increasingly devastating floods resulting in larger damages to properties, infrastructure, and agriculture. A total of 94 destructive typhoons struck the country in 2011-2015, about ten percent more than the number of typhoons in 2006-2010, with almost triple the cumulative cost of damages. The Philippines is expected to be among the countries that will suffer long-term and repetitive damage from extreme weather patterns, that will likely be exacerbated by climate change.
4. Strong growth in Metro Manila attracts an increasing number of migrants from rural areas in search of better jobs. Migrants who typically have low paying jobs are unable to afford decent housing and often end up as Informal Settler Families (ISF) living in hazards-prone zones. Typhoons and flooding, housing, and poverty are inextricably linked. Although natural disasters are indiscriminate in where they strike, they often take a disproportionate toll on the three million poor informal settlers, who live in less resilient structures and in areas prone to flooding. Worsening flood events exacerbate shelter deprivation and lack of decent shelter increases vulnerability to flooding. Typhoons could render thousands homeless at once, and conversely, lack of strong shelter in safe locations exposes people to flooding. The poor are most vulnerable, not only because of their exposure in high-risk locations and the low quality of their houses, but also because of their low adaptive capacity. Poor families are less able to prepare against floods compared to better-off families. The



livelihoods of many poor people are also affected by flood events, as many depend on the streets for their daily income and when streets are flooded, they cannot ply their trade.

Sectoral and Institutional Context

5. Metro Manila is among the world's most densely-populated cities, with around 15 million people in a highly urbanized area, exposed to natural disasters and climate change impacts, especially to frequent urban flooding. About 80 percent (1,700 mm) of the annual rainfall occurs during the typhoon season from June through October, when rain can be particularly intensive. Flood events are a recurrent problem in Metro Manila that causes flooding of roads, affecting traffic and movement of people, flooding in houses and buildings, as well as industry and businesses. In addition, Metro Manila has a higher sea level rise rate relative to the global mean, which will further aggravate flooding issues in low-lying areas.

6. On September 26, 2009, one of the most severe tropical storms in history, Ondoy (internationally named Ketsana), affected Metro Manila. There were over 700 fatalities, many in the Pasig-Marikina River Basin due to severe flash floods, and it caused substantial damage and losses, equivalent to about 2.7 percent of GDP. The adverse impacts on the productive sectors were largely due to damaged or lost inventories and raw materials. In addition, business operations were interrupted by access problems, power and water shortages, damaged machinery, and absent employees, which contributed to an overall reduction in production capacity.

7. After Ondoy, the Government, with technical and financial support of the World Bank, prepared a Flood Management Master Plan for Metro Manila and Surrounding Areas (hereafter the Master Plan). The Master Plan, approved by the NEDA Board on September 4, 2012, proposed a set of priority structural and non-structural measures to provide sustainable flood management and safely control major flood events in Metro Manila. The total estimated cost for the implementation of the Master Plan is around PhP 352 billion (US\$7 billion) over a 25-year period. The main elements of the Master Plan are:

- (a) structural measures to reduce flooding from river systems that run through the city;
- (b) structural measures to eliminate long-term flooding in the flood plain of Laguna de Bay, including land raising or another similar development, to protect the population living along the shore against high water levels in the lake;
- (c) structural measures to improve urban drainage;
- (d) non-structural measures such as flood forecasting and early warning systems and community-based flood risk management; and
- (e) recommendations for an improved institutional structure to deal with flood management in an integrated manner.

8. In order to improve the overall flood management conditions in Metro Manila all interventions under the above-referenced elements have to be implemented. Implementation of the Master Plan has started with some interventions, such as dredging and improvements to a small number of pumping stations, financed from government funds. However, the Government deemed it important to scale up such activities. To support the Government's plans, in FY18 the Bank approved the Metro Manila Flood Management Project that focuses on element (c) of the Master Plan¹. In addition, the Government received a Technical Assistance (TA) grant from the Australia – World Bank Philippines Development Trust

¹ Metro Manila Flood Management Project (P153814), with the total project cost of US\$500 million, financed by the Bank and Asian Infrastructure Investment Bank with US\$207.6 million each and by government with US\$84.8 million.



Fund (PH-PTF)² and Japan's Policy and Human Resources Development (PHRD) Trust Fund³, both administered by the World Bank, to prepare feasibility studies and designs of major priority interventions for the next major phase of the implementation of the Master Plan, in particular elements (a) and (d). The focus of the studies has been on (i) the design of a dam in the Marikina river, together with a complementary retention basin, as well as the necessary social and environmental studies; (ii) development of a flood forecasting and early warning system for the Greater Metro Manila Area; and (iii) development of institutional arrangements for sustainable flood management. All studies are expected to be completed by June 30, 2020.

9. Several agencies are involved in flood management at national and local level. The Department of Public Works and Highways (DPWH) is mandated to undertake country-wide planning, design, construction, and maintenance of infrastructure, such as national roads and bridges, flood control systems, water resources projects, and other public works. The Metro Manila Development Authority (MMDA), through its Flood Control and Sewerage Management Office, is mandated with the formulation and implementation of policies, standard, programs, and projects for integrated flood control, drainage, and sewerage services in Metro Manila. Presently, MMDA operates about 60 pumping stations, located throughout Metro Manila, including 23 major stations with capacity exceeding 1 m³/sec, and maintains the capacity of waterways. Local Government Units (LGU) implement smaller flood control projects and maintain small waterways and drains in their service area.

10. Although Metro Manila constantly has issues related to urban flooding, it also began to experience water scarcity since March 2019. Inadequate and intermittent water supply affects customers in many parts of Metro Manila. Delays in developing additional water sources and increasing demand for water due to population growth have contributed to the water supply crisis, which needs to be addressed along with flood reduction measures.

Relationship to CPF

11. The Philippine Development Plan for the period 2017 to 2022 highlights the serious issue of flooding in many parts of the country. Over time, flood prone areas have increased despite flood management initiatives, and frequency and intensity of flood occurrences are increasing. The PDP states that the government is committed to implement and expand flood management programs in order to mitigate flood risks.

12. The proposed project is included in the Philippines Country Partnership Framework for the period July 2019 to December 2023 (CPF, Report No. 143605-PH, approved on December 17, 2019). It is aligned with Focus Area #3: Addressing Core Vulnerabilities by Promoting Peace and Building Resilience, and Objective #10: Increased resilience to natural disasters and climate change.

C. Proposed Development Objective(s)

13. The proposed project development objective (PDO) is to “improve flood management in the Pasig-Marikina River Basin.”

Key Results (From PCN)

²Studies for Sustainable Flood Management (P145391), US\$3.2 million; closed on December 31, 2018.

³Preparation of a Program Towards Sustainable Flood Management in the Greater Metro Manila Area Project (P145237), US\$2.73 million. Current closing date is January 31, 2020, with a request for a five months extension being processed.



14. The proposed project seeks to achieve the following key results towards achieving the PDO:

- Adequate storage capacity installed in the Pasig-Marikina River Basin to reduce flood risks in Metro Manila (measured in Yes/No, based on mathematical modeling for safely conveying flood waters to Laguna de Bay and Manila Bay for a 100-year rainfall event and monitoring of system performance for actual flood events during the project period);
- Emergency Response Plan approved and disseminated to all relevant stakeholders (measured in Yes/No);
- People in the Pasig-Marikina River Basin satisfied with reduced vulnerability to flooding (measured as percentage, assessed through surveys);
- Direct project beneficiaries, of which female (both measured in number of beneficiaries) (former core indicator).

D. Concept Description

15. The Master Plan and the recent TA studies have determined, through mathematical modeling, that peak river flows entering Metro Manila during a rainfall event with a 100-year return period (design event) have to be substantially reduced so that the remaining water can be safely conveyed through the Pasig-Marikina River System, i.e. without causing flooding in urban areas. At the point of entering the city near the Montalban Bridge, the Marikina River drains an area of around 400 km², equivalent to at least five times the downstream urban area in the river basin. Considering that the catchment can generate a large water runoff and the low capacity of certain sections of the river within the city, flooding of certain parts of the river basin occurs already during rainfall events with a five-year return period. Ondoy, an extreme rainfall event with a return period of around 70 years, affected almost 5 million people, including about 3 million in the Pasig-Marikina River Basin, including many vulnerable people living in low lying areas.

16. The flood waters generated by the design event in the Pasig-Marikina River Basin would cause serious flooding in Metro Manila, with severe consequences for people, property, and the economy. DPWH, with the support of the TA consultants carried out an analysis of alternatives to determine the best solution for water diversion or storage during the design event. Firstly, various alternatives to achieve reduction in flood waters entering the city were assessed, based on technical, financial, social, and environmental considerations. Alternatives considered included a large dam, a cascade of smaller, but still large dams, and inter-basin transfer. The conclusion was that one dam was the preferred option over the cascade of dams. It would be better to put all design, construction, and supervision efforts in one dam, which would be cheaper than a cascade, have less impact on the environment, and have the lowest number of people to be resettled, while it would have the least risk of developing flood management infrastructure in an ancestral domain (see para. 44). Considering the large volume of water to be diverted, inter-basin transfer would be very expensive, and not economical, while it would result in serious flooding in the receiving basin. Secondly, four potential dam sites were assessed, again based on technical, financial, social, and environmental considerations. At each site, investigations, surveys, and drilling was carried out. The preferred site would result in the lowest dam construction cost, has the best foundation and abutment conditions, lowest number of Project Affected People (PAP), and shortest access road. The analysis also determined that the volume of water generated downstream of the dam would exceed the current river discharge capacity and would cause flooding in certain areas of the river basin. As such, the retention basin is an important structure to mitigate flooding for the design rainfall event.

17. The costs of the proposed Pasig-Marikina River Basin Flood Management Project (PMRBFMP; P171897) are preliminary estimated at US\$700 million and the project would have a six and half year implementation duration. Following the recommendations of the Master Plan, the project would contribute to both elements (a) and (c), in an



articulated package of structural and non-structural measures to substantially address the flooding issues in the Pasig-Marikina river basin area. The project will have three components.

Component 1: Major Structural Interventions to Manage Flood Waters (US\$620 million)

18. Flood management infrastructure is needed to temporarily store flood waters so that the remaining flood waters can be conveyed into Laguna de Bay and Manila Bay without causing flooding of urban areas. The proposed infrastructure comprises the large Marikina Dam and a retention basin between the Montalban and San Mateo Bridges, both identified in the Master Plan as priority structures. The construction of the structures will take about five years, starting in project year two (PY2).

19. *Marikina Dam.* The proposed Marikina Multi-Purpose Dam is an 81 meter high concrete gravity dam with a 350 meter long crest to be constructed across a gorge of the Marikina River. The total gross storage capacity is about 90 million m³, including 9.3 million m³ for water supply and 7.5 million m³ dead storage for sediment accumulation. The spillway capacity of the dam is designed for the Probable Maximum Flood (PMF) of around 6,300 m³/sec.

20. The dam would be constructed within the Valley Fault System containing two active faults close to the dam, i.e. West Valley Fault and East Valley Fault with distance of 5.4 km and 9.5 km respectively to the dam site with the estimated earthquake magnitude of 6.2-7.2. The design has considered the required strength and stability of the maximum earthquake as the consequences of a dam failure would be extreme due to the large population and infrastructure value concentrated downstream.

21. The primary function of the proposed dam should be flood management, which is a public good, and public resources should be used for this. The dam is designed to reduce the maximum river discharge of a 100-year rainfall event in the catchment by about 85 percent from an inflow of 3,460 m³/sec to an outflow of about 600 m³/sec by temporary storing flood waters for regulated discharge after the storm event. This will require the reservoir to be almost empty during the rainy season to capture floods. The dam will have large gates to release 1,500 m³/sec in order to empty the dam quickly after a flood event.

22. About 10 percent of the net reservoir area can be used all year round for water supply to augment up to 5 m³/sec or over ten percent of the current water supply to Metro Manila, to address the water shortage in the city as mentioned above. Towards the end of the rainy season the reservoir will be kept full, so that the full reservoir volume can be available for water supply from January to May. The infrastructure investments for the water supply (intake tower, pipelines, etc.) would be expected to be made by the private sector.

23. *Retention Basin.* The proposed Marikina Dam alone would not be sufficient to completely eliminate flooding in the basin for the design rainfall event, as the volume of water generated downstream of the dam would exceed the current river discharge capacity. Additional infrastructure will be needed to handle the design 100-year rainfall event. The Master Plan identified a retention basin as a priority structure. The retention basin would boost the climate resilience and adaptation of the structural interventions due to its natural adaptive and regenerative capacity. The study financed by the PHRD grant focused on a retention basin between the San Mateo and Montalban Bridges. Mathematical modeling showed that the capacity of the retention basin would have to be around 12 million m³ to reduce floods for the design rainfall event, in conjunction with the proposed Marikina Dam. About 140 ha of land was identified between the two bridges on the right bank of the river. The retention of flood waters in retention basin would result in a discharge downstream of the retention basin that together with additional inflows into the Pasig-Marikina River downstream of the retention basin can safely be discharged to Laguna de Bay and Manila Bay.



Component 2: Supporting Activities to Optimize Flood Management (US\$30 million)

24. Structural and non-structural measures will be undertaken in the river basin's watershed. There is considerable degradation of sections of the watershed and future land conversion and deforestation and climate change could result in an increase in total run-off volume, total peak discharge, and sediment loads. To address this, a watershed management program is proposed. The key sub-components would include: (i) technical studies towards sub-basin restoration strategies; (ii) catchment rehabilitation, including limited reforestation; (iii) sediment management, including construction of sediment traps at strategic locations upstream of the dam; and (iv) water quality monitoring. The activities will be linked to the Forestry Management initiatives of Department of Environment and Natural Resources (DENR) in partnership with LGUs and private stakeholders.

25. Activities to be carried out downstream of the dam include the development of a flood forecasting and early warning system, inundation mapping, and emergency response planning. Rainfall events exceeding a 100-year return period may result in flooding of certain areas in the river basin. The proposed activities will inform decision makers what the consequences of higher than design rainfall events are and when to provide warning to affected communities.

26. The proposed project will improve the development and capacity of small farmers and indigenous people living in the project area to maintain acceptance of the project activities and avoid degradation and other negative consequences that could affect flood management. A community-driven development model is proposed, supporting provision of alternate housing options and sustainable livelihood activities. This will be achieved through training and support to beneficiary communities and implementation of community development and livelihood improvement projects related to agriculture, housing, and ecotourism selected with active participation of the beneficiary communities.

Component 3: Project Implementation, Management and Coordination (US\$50 million)

27. The component will provide support for the operation of DPWH's Unified Project Management Office – Flood Control Management Cluster (UPMO-FCMC) with respect to the management and coordination of the project, including: (i) payment of incremental operating costs; (ii) provision of office equipment and materials; (iii) provision of training and carrying out of knowledge sharing and peer-to-peer learning activities; (iv) monitoring and evaluation of the project; and (v) managing a grievance redress mechanism (GRM).

28. Various teams of consultants will be recruited to support project implementation. A highly qualified consulting team for remaining design aspects, construction supervision, and quality assurance will be recruited, proposed to be done before project effectiveness. The firm's assignment would be for the duration of the project. Smaller consulting teams will be recruited to support the PMO with safeguards management and development and implementation of a communication strategy. As part of the environmental and social management, an environmental and social (E&S) capacity development program for DPWH could be incorporated in the project design. A detailed communication strategy and plan will have to be developed to adequately inform the downstream and surrounding population about the project, the benefits and risks, as well as possibly controversial issues like having a dam near an earthquake fault. Communication should start during preparation, including the development of a frequently asked questions brochure. Finally, the project will recruit an international panel of experts on dams and possibly an E&S panel of international experts, to be financed from project funds.



Legal Operational Policies	Triggered?
Projects on International Waterways OP 7.50	No
Projects in Disputed Areas OP 7.60	No

Summary of Screening of Environmental and Social Risks and Impacts

This project would have a relatively large footprint in areas with high social sensitivity and significant environmental baseline value. The social risk is High, the environmental risk Substantial, but the rating is increased to "High" due to the dam-safety related risk level. The overall project risk is High. All ESS, except ESS9, are considered relevant, and the project will need to prepare a number of assessment and management tools to describe, analyze, and characterize ES risks and impacts, and develop appropriate, effective ES management responses during further preparation.

CONTACT POINT

World Bank

Joop Stoutjesdijk
Lead Irrigation and Drainage Specialist

Borrower/Client/Recipient

Department of Finance
Rommel Herrera
Director, Multilateral Assistance Division
rherrera@dof.gov.ph

Implementing Agencies

Department of Public Works and Highways
Emil Sadain
Under Secretary
sadainemail@yahoo.com

FOR MORE INFORMATION CONTACT

The World Bank
1818 H Street, NW
Washington, D.C. 20433
Telephone: (202) 473-1000
Web: <http://www.worldbank.org/projects>



APPROVAL

Task Team Leader(s):

Joop Stoutjesdijk

Approved By

Practice Manager/Manager:

Country Director: