



Global foundations for reducing nutrient enrichment and oxygen depletion from land based pollution, in support of the

# Global Nutrient Cycle



## COMPONENT D:

# Development of Nutrient Reduction Strategies through Application of Quantitative Source-Impact Modeling and Best Practices in the Manila Bay Watershed

Prepared by: Partnerships in Environmental Management for the Seas of East Asia

## Component D: Doc: Final Report

Partners:



August 2018

## About the GEF-Global Nutrient Cycle Project

**Project objective:** to provide the foundations (including partnerships, information, tools and policy mechanisms) for governments and other stakeholders to initiate comprehensive, effective and sustained programmes addressing nutrient over-enrichment and oxygen depletion from land based pollution of coastal waters in Large Marine Ecosystems.

**Core project outcomes and outputs:**

- the development and application of quantitative modeling approaches: to estimate and map present day contributions of different watershed based nutrient sources to coastal nutrient loading and their effects; to indicate when nutrient over-enrichment problem areas are likely to occur; and to estimate the magnitude of expected effects of further nutrient loading on coastal systems under a range of scenarios
- the systematic analysis of available scientific, technological and policy options for managing nutrient over-enrichment impacts in the coastal zone from key nutrient source sectors such as agriculture, wastewater and aquaculture, and their bringing together an overall Policy Tool Box
- the application of the modeling analysis to assess the likely impact and overall cost effectiveness of the various policy options etc brought together in the Tool Box, so that resource managers have a means to determine which investments and decisions they can better make in addressing root causes of coastal over-enrichment through nutrient reduction strategies
- the application of this approach in the Manila Bay watershed with a view to helping deliver the key tangible outcome of the project – the development of stakeholder owned, cost-effective and policy relevant nutrient reduction strategies (containing relevant stress reduction and environmental quality indicators), which can be mainstreamed into broader planning
- a fully established global partnership on nutrient management to provide a necessary stimulus and framework for the effective development, replication, up-scaling and sharing of these key outcomes.

**Project partners:**

- Chilika Development Authority
- Energy Centre of the Netherlands
- Global Environment Technology Foundation
- Government of India - Lake Chilika Development Authority
- Government of the Netherlands
- Government of the Philippines
- Government of the United States
- Intergovernmental Oceanographic Commission of UNESCO
- International Nitrogen Initiative
- Laguna Lake Development Authority
- Partnerships in Environmental Management for the Seas of East Asia
- Scientific Committee on Problems of the Environment
- University of Maryland
- University of the Philippines
- University of Utrecht
- Washington State University
- World Resources Institute

**Implementing Agency:** United Nations Environment Programme

**Executing Agency:** UNEP- Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (GPA)



## **TERMINAL REPORT**

### **Global Foundations for Reducing Nutrient Enrichment and Oxygen Depletion from Land Based Pollution, in Support of Global Nutrient Cycle**

#### **COMPONENT D:**

#### **Development of Nutrient Reduction Strategies through Application of Quantitative Source-Impact Modeling and Best Practices in the Manila Bay Watershed**

**August 2018**

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## **List of Acronyms**

ABMP	Area-Based Management Plan
ASEAN	Association of Southeast Asian Nations
ATI	Agriculture Training Institute
BAI	Bureau of Agricultural Industry
BCCFI	Bataan Coastal Care Foundation, Inc.
BFAR	Bureau of Fisheries and Aquatic Resources
BMPs	Best Management Practices
BOD	Biochemical Oxygen Demand
BSWM	Bureau of Soils and Water Management
CvSU	Cavite State University
DAO	Department Administrative Order
DENR	Department of Environment and Natural Resources
DEPED	Department of Education
DILG	Department of Interior and Local Government
DOST	Department of Science and Technology
DPWH	Department of Public Works and Highways
DSS	Decision Support System
EHRC	Ecosystem Health Report Card
EMB	Environmental Management Bureau
FPA	Fertilizer and Pesticide Authority
GEF	Global Environment Facility
GIS	Geographic Information System
Global NEWS	Global Nutrient Export from Watersheds
GNC	Global Nutrient Cycle
GPNM	Global Partnership on Nutrient Management
HUCs	Highly Urbanized Cities
ICM	Integrated Coastal Management
IEMP	Integrated Environmental Monitoring Program
IIMS	Integrated Information Management System
IRBM	Integrated River Basin Management
IRR	Implementing Rules and Regulations
IWRM	Integrated Water Resources Management
LGU	Local Government Unit
LISCOP	Laguna de Bay Institutional Strengthening and Community Participation Project
LLDA	Laguna Lake Development Authority
LWUA	Local Water Utilities Administration
MBA	Manila Bay Area
MBAC	Manila Bay Advisory Committee
MBCC	Manila Bay Coordinating Committee
MBCO	Manila Bay Coordinating Office
MBEA	Manila Bay Environmental Atlas
MBEMP	Manila Bay Environmental Management Program

MBNLG	Manila Bay Network of Local Governments
MWCI	Manila Water Company Incorporated
MWSI	Maynilad Water Services Incorporated
MWSS	Metropolitan Waterworks and Sewerage System
NAMRIA	National Mapping and Resource Information Authority
NCR	National Capital Region
NEDA	National Economic Development Authority
NGO	Non-Government Organization
NLM	Nutrient Load Model
NMIS	National Meat Inspection Service
NSSMP	National Sewerage and Septage Management Program
OHI	Ocean Health Index
OPMBCS	Operational Plan for the Manila Bay Coastal Strategy
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PCG	Philippine Coast Guard
PD	Presidential Decree
PDB	Phosphate Detergent Ban
PDP	Philippine Development Plan
PEMSEA	Partnerships in Environmental Management for the Seas of East Asia
PGENRO	Provincial Government Environment and Natural Resources Office
PHILWAVES	Philippine Wealth Accounting and Valuation of Ecosystems
PNLG	PEMSEA Network of Local Governments for Sustainable Development
PNRI	Philippine Nuclear Research Institute
PO	People's Organization
PPA	Philippine Ports Authority
PROA	Pollution Reduction Opportunity Analysis
PRRC	Pasig River Rehabilitation Commission
PSC	Project Steering Committee
SC	Supreme Court
SDG	Sustainable Development Goals
SOC	State of the Coast
UMCES	University of Maryland Center for Environmental Studies
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UPLB	University of the Philippines Los Banos
UPNHRC	University of the Philippines National Hydraulic Research Center
UPMSI	University of the Philippines Marine Science Institute
UST	University of Santo Tomas
WLM	Waste Load Model
WQMA	Water Quality Management Area
WRI	World Resources Institute

## TERMINAL REPORT

### I. PROJECT BACKGROUND AND INFORMATION

**Project Component Title:** Development of nutrient reduction strategies through application of quantitative source-impact modeling and best practices in Manila Bay watershed (Component D)

**Responsible Agency:** Partnerships in Environmental Management for the Seas of East Asia

**Starting Date:** 01 April 2012

**Completion Date:** 30 April 2018

**Component D Overall Objective:** Demonstrate the application of tools and modeling techniques in the Manila Bay Watershed area to produce actual nutrient reduction strategies both for mainstream adoption in the area, and as a model for the development and application of nutrient reduction strategies in other regions.

**Total Budget and Co-financing:**

- GEF budget: USD 235,000
- Co-financing: USD 412,500

**Main Outcomes:**

- Strengthened decision support systems on nutrient issues in Manila Bay watershed as part of integrated approach to overall water quality.
- Agreement with government agencies and relevant stakeholders in Manila Bay watershed on nutrient reduction strategies to be implemented, including their effective insertion into integrated national water quality planning for the Bay area.
- Application and implementation of ecosystem nutrient health report card in Laguna de Bay, Manila, including as part of overall nutrient reduction strategies for Manila Bay watershed.
- Accessible up scaling and replication strategy shared interactively with countries, GEF projects and stakeholders for development and implementation of nutrient reduction strategies, both for other watersheds in the Manila Bay region as well as for other regions globally.

**Main Outputs:**

- Development and integration of indicators, information and reporting on nutrient issues and indicators in Manila Bay watershed into Manila Bay State of the Coasts reporting system.



- Compilation and analysis of best nutrient reduction practices for Manila Bay area engagement with key sectors.
- Application of source-impact modeling and best practices to produce draft nutrient reduction strategies for Manila Bay watershed.
- Adoption of nutrient reduction strategies as part of overall approach to water quality improvements in Manila Bay watershed.
- Application of ecosystem health card for nutrient over-enrichment and impacts for estuarine and delta areas developed in Laguna Lake, Philippines.
- Evaluation of lessons learned during the development of nutrient reduction strategies including work on ecosystem nutrient health card in Laguna Lake.

**Partners, Collaborators and Stakeholders:**

- National government agencies (central and regional offices):
  1. Department of Environment and Natural Resources (Manila Bay Coordinating Office; Environmental Management Bureau; Laguna Lake Development Authority; Pasig River Rehabilitation Commission; Manila Bay Site Management Offices in Regions 3, 4A and NCR)
  2. Department of Agriculture (Bureau of Fisheries and Aquatic Resources; Bureau of Soils and Water Management; Agriculture Training Institute; Fertilizer and Pesticide Authority; Bureau of Agricultural Industry; National Meat and Inspection Service)
  3. Metropolitan Waterworks and Sewerage System
  4. Local Water Utilities Administration
  5. Department of Public Works and Highways
  6. Department of Interior and Local Government
  7. Philippine Coast Guard
  8. Philippine Ports Authority
  9. Department of Science and Technology (Philippine Nuclear Research Institute, Philippine Atmospheric, Geophysical and Astronomical Services Administration)
  10. Department of Education
- Local governments:
  1. Province of Bataan
  2. Province of Cavite
  3. Province of Pampanga
  4. Province of Bulacan
  5. Province of Tarlac
  6. Province of Laguna
  7. Province of Rizal
  8. Province of Nueva Ecija
- Private sector:
  1. Manila Water Company, Inc.
  2. Maynilad Water Services, Inc.



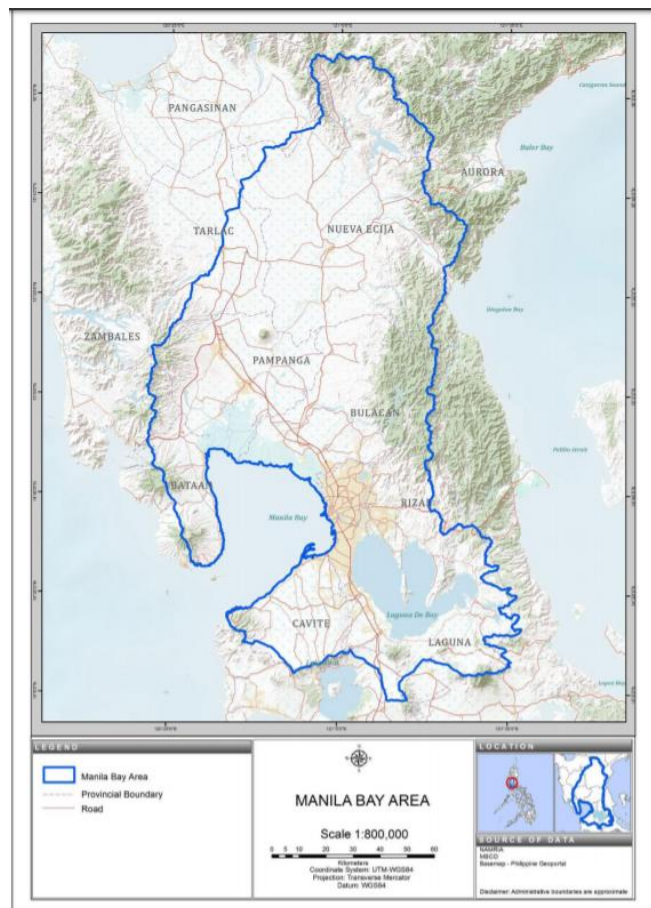
3. Bataan Coastal Care Foundation, Inc.
- Academe:
  1. University of the Philippines Marine Science Institute
  2. University of the Philippines Los Banos
  3. University of Santo Tomas
  4. Cavite State University
  5. University of Maryland Center for Environmental Studies
- International organization:
  1. World Resources Institute

### The Demonstration Site: Manila Bay Watershed

The Manila Bay Area (MBA) refers to Manila Bay and its surrounding watersheds found in the 3 administrative regions in the main island of Luzon in the Philippines: the National Capital Region (NCR), the Central Luzon Region (Region 3) and the Southern Tagalog Region (Region 4A). Its watershed is bounded by 4 coastal and 4 noncoastal provinces comprising of 178 local government units. Manila Bay has a total area of 1,994 km<sup>2</sup> and coastline of 190 km. The entire watershed area is drained by 16 major systems, which provide the Bay with freshwater inflow. The Pasig River, one of the major rivers draining into the Bay connects Manila Bay with Laguna de Bay, the largest freshwater lake in the country.

Due to its natural harbors and strategic location, Manila Bay is considered the gateway to the country's political, socioeconomic and cultural centers. Its natural endowments, geography, and land and sea attributes provide food, livelihood, recreation, tourist attractions, transportation/navigation, access to international trade routes, shoreline protection and many other goods and services. MBA significantly contributes a large percentage to the country's GDP, which is estimated at 62.7% in 2013.

Rapid urbanization has placed tremendous pressure on the Manila Bay's ecological balance, which affects more than 34 million people living along and within its watershed. Major



Source: MBEA 2015

problems include the deterioration of the quality of air and water, erosion, sedimentation and siltation, shoreline changes, overexploitation of fishery, forestry and water resources, habitat degradation and biodiversity loss.

To sustain MBAs' use value, the Manila Bay Environmental Management Project (MBEMP), which was implemented in 2000 to 2007 with PEMSEA's support, formulated the Manila Bay Coastal Strategy and its Operational Plan (i.e., Operational Plan for the Manila Bay Coastal Strategy or OPMBCS) with the involvement of various partners from the national and local governments, academe, civil society groups, private sector, media and other stakeholders.

In December 2008, the Supreme Court of the Philippines rendered a Writ of Continuing Mandamus requiring 13 national agencies, as a matter of statutory obligation, to perform certain functions related directly or indirectly to the clean-up, preservation and rehabilitation of Manila Bay and restore and maintain its waters to SB level (Class SB sea waters per Water Classification Tables under the Department of Environment and Natural Resources (DENR) Administrative Order No. 34 [1990]) to make them fit for swimming, skin-diving, and other forms of contact recreation.

(<http://sc.judiciary.gov.ph/jurisprudence/2008/december2008/171947-48.htm>).

The Supreme Court issued a resolution on 15 February 2011 further clarifying the mechanism for reporting of the concerned government agencies regarding progress made in the implementation of the OPMBCS where DENR was identified to spearhead its implementation and updating in consideration of emerging concerns confronting Manila Bay (<http://sc.judiciary.gov.ph/jurisprudence/2011/february2011/171947-48.htm>). Heads of the 13 agencies, in line with the principle of "continuing mandamus", were ordered to each submit to the Court a quarterly progress report of the activities undertaken in accordance with the Decision. The Manila Bay Advisory Committee (MBAC) was created to receive and evaluate the quarterly progress reports on the activities undertaken by the agencies in accordance with said decision and to monitor the execution phase.

The OPMBCS outlines the actions and specific projects that would result in the realization of the stakeholders' shared vision for Manila Bay and to the Court's order of cleaning up, rehabilitating and restoring the Bay's water to SB Class. The interventions under the OPMBCS are grouped into five (5) clusters/outcomes namely: (1) Liquid Waste Management; (2) Solid Waste Management; (3) Informal Settler Families (ISFs) and Illegal Structures Management; (4) Habitat and Resources Management; and (5) Partnership and Governance, which address the barriers and enabling concerns of the OPMBCS.

The selection of Manila Bay as demonstration site for the UNEP GNC Project was facilitated to contribute to addressing one of the major management concerns in the bay, i.e., nutrient loading, particularly in strengthening the decision support system in terms of nutrient information, policy options and indicators, as well as stakeholder involvement and capacity

building in modeling activities and application of best practices to the development of nutrient reduction strategies for the watershed. The project was designed to build on the results of previous efforts of various agencies and stakeholders in the rehabilitation of the Bay.

## **II. CONSOLIDATING OUTPUTS, GOOD PRACTICES AND LESSONS LEARNED**

The activities and outputs that have been completed to achieve the end-of-project targets for Component D are described below, comprising of 4 sub-components (see Annex 1 for the Project Results Framework). Opportunities for replication and upscaling to other river basins and watersheds in the East Asian Seas Region are also introduced taking into consideration the challenges and constraints encountered in project implementation and the good practices and lessons learned from the project.

### **D.1. Strengthened decision support system for Manila Bay watershed through improved nutrient data and information**

#### **Updated Manila Bay Integrated Information Management System (IIMS)**

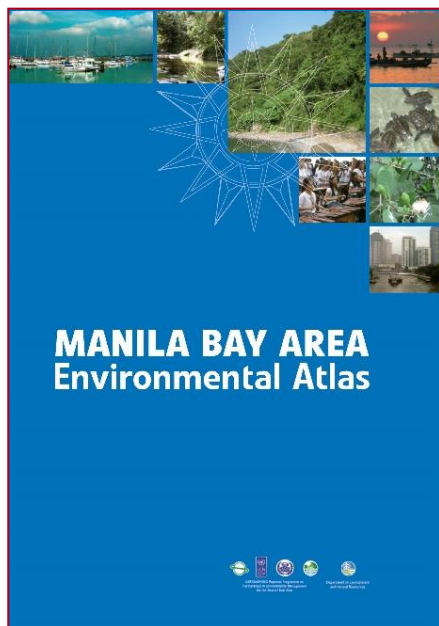
The IIMS, a relational environmental database, was developed by PEMSEA to capture relevant data for coastal and marine and river basin management, and provide value-added information and analyses to managers, decision-makers and planners and stakeholders. The MBA IIMS database, which was established by PEMSEA under MBEMP supported the development of a number of key outputs of the project including the Manila Bay Environmental Atlas (MBEA), the Initial and Refined Environmental Risk Assessment, the design of the Integrated Environmental Monitoring Program (IEMP), the conduct of the sensitivity analysis for oil spill contingency planning, the development of the Manila Bay Coastal Strategy and the conduct of environmental resource valuation for Manila Bay.

An assessment of the MBA IIMS was conducted in April to May 2012 to determine the status of IIMS operationalization at the DENR Regional Offices (Regions 3, 4A, NCR) and in the integrated coastal management (ICM) sites in the Provinces of Bataan and Cavite. The assessment also included a review of the availability and sources of data and information that are relevant to the GNC Project and actions to be taken in response to the identified issues and challenges in operationalizing the system. A two-stage integration workshop was conducted on 22-24 August and on 25-27 September 2012 to establish an integrated IIMS database for the Manila Bay watershed covering data from the 3 regions and the 2 provinces. The database integration workshops resolved the duplication of data between the individual databases, as well as applied the numbering of IIMS records based on the Philippine Standard Geographic Codes and classification of industries and establishments following the Philippine Standard Industry Classification. A status of data records in the MBA IIMS showing the number of records related to geospatial data, biological and bioresources data, social and economic data, demographic data, governance data, pollution sources data, water resources data and environmental quality that are relevant to the GNC Project was also prepared.

A Training on IIMS Query System and Linkage to GIS was conducted on 20-22 February 2013 to develop the skills of the participants from the DENR regional offices and local government ICM sites in generating purposeful outputs from the IIMS, for use in awareness building and decision making. The IIMS database was updated to include data from the Laguna Lake Development Authority's (LLDA) water quality monitoring program from 1999-2012, from UP Marine Science Institute's (UMSI) water quality data from field surveys undertaken in Manila Bay on 2010 and 2012, from the Pasig River Rehabilitation Commission's (PRRC) Unified Monitoring System and DENR and Department of Agriculture-Bureau of Soils and Water Management's (DA-BSWM) assessment of nonpoint source pollution from croplands of Manila Bay. The re-establishment of the MBA IIMS is part of the continuing assistance of PEMSEA to DENR, local government units and other stakeholders in support of the implementation of the Operational Plan for the Manila Bay Coastal Strategy.

Relevant data stored in the updated Manila Bay IIMS was utilized by UPMSI in running the hydrodynamic and water quality modelling to study the dynamics of hypoxia in Manila Bay, including the nutrient load model under Sub-component B4 of the GNC Project.

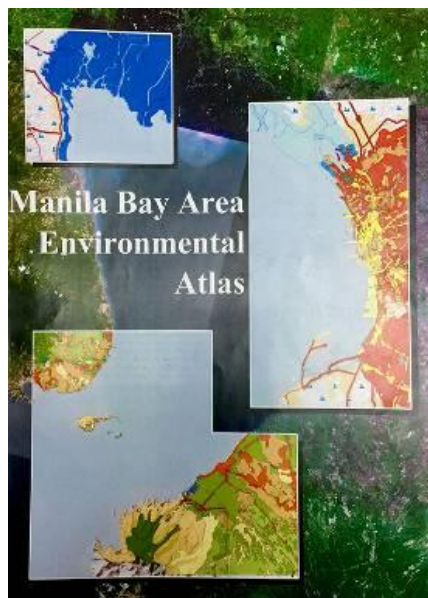
### Updated Manila Bay Environmental Atlas



PEMSEA and DENR published the Manila Bay Environmental Atlas in 2007 as one of the key outputs of the MBEMP. The Atlas is a compilation of data presented in thematic and composite maps, graphs and tables describing the characteristics and status or condition of the MBA. Each map is usually accompanied by a textual description of related findings, socioeconomic significance, risks and challenges that affect the MBA. Data and information from the IIMS, risk assessments and pilot Integrated Environmental Monitoring Program study were used in the preparation of the MBEA. Data and information on Pasig River water quality, water quality of selected river mouths, bathing beaches, shellfish and data from bay-wide monitoring under the IEMP and sediment quality are included in the Atlas.

<http://www.pemsea.org/publications/reports/manila-bay-area-environmental-atlas>

The Second Edition of the Manila Bay Environmental Atlas was published by DENR-Manila Bay Coordinating Office (MBCO) and the National Mapping and Resource Information Authority (NAMRIA) in 2015, which provides an update on the status of the resources and environment; documenting the results of the implementation of major programs of the OPMBCS related to partnership and governance, water pollution and resources and habitat; the initiatives of the academe, private sector and other stakeholders; and the impacts of climate change, i.e.,



typhoon, flooding, storm surge and sea level rise, in the Manila Bay region. The second edition contains significant information on water quality of 16 major river systems in the Manila Bay watershed as part of the monitoring program of the Environmental Management Bureau (EMB) of DENR through its regional offices (Regions 3, 4A and NCR), and the independent monitoring activities of PRRC, LLDA and DA-BSWM. Physico-chemical parameters measured included biochemical oxygen demand, dissolved oxygen, total suspended solids, nitrate-nitrogen, total phosphorus and heavy metals while for biological parameters, total coliform and fecal coliform content of the water were measured. Technical support to the development of the second edition was provided by PEMSEA as part of the GNC project through participation in the Technical Working Group.

[http://mbco.denr.gov.ph/wp-](http://mbco.denr.gov.ph/wp-content/uploads/2016/08/Manila-Bay-ATLAS-2nd-Edition.pdf)

[content/uploads/2016/08/Manila-Bay-ATLAS-2nd-Edition.pdf](http://mbco.denr.gov.ph/wp-content/uploads/2016/08/Manila-Bay-ATLAS-2nd-Edition.pdf)

### **State of the Coasts Reports of the Provinces of Bataan and Cavite**

The State of the Coasts (SOC) is a reporting system developed by PEMSEA primarily to assess the progress and impacts of ICM implementation by local governments. The reporting system enables documentation and measurement of the effectiveness of policy and management interventions, which are captured in the 35 core indicators that are in alignment with relevant international commitments and targets, e.g., Aichi Targets of the Convention on Biological Diversity, UN Framework Convention on Climate Change, UN Sustainable Development Goals and the regional Sustainable Development Strategy for the Seas of East Asia. It is designed as a standard monitoring tool that would allow comparison and consolidation of progress across multiple ICM sites over a specific time.

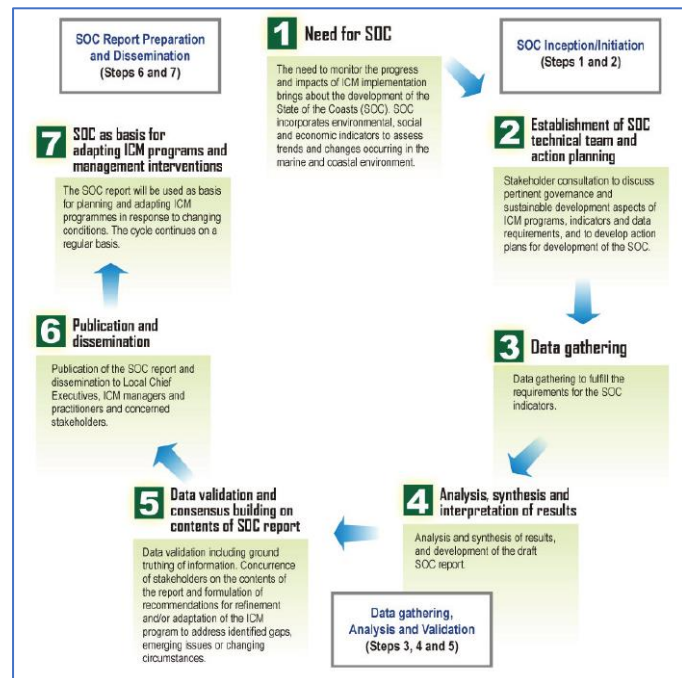
Two provinces in the Manila Bay watershed, Bataan and Cavite, developed and implemented their respective ICM programs in 2000 and 2004, respectively. As part of PEMSEA's effort to scale up ICM in the Manila Bay area in support of OPMBCS implementation, the Provinces of Bulacan and Pampanga likewise initiated their respective ICM programs following the same framework and process that Bataan and Cavite adopted.

The development of the SOC reports of Bataan and Cavite under the GNC project involved a stakeholder-based approach in data gathering and consolidation, analysis and interpretation and validation of the ratings for the 35 indicators. The SOC reporting system was also introduced to the Provinces of Bulacan and Pampanga.

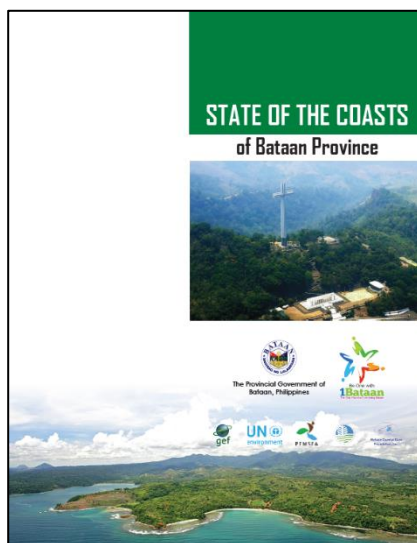
The SOC reports of the Provinces of Bataan and Cavite which cover the period 2000-2015 and 2012-2015, respectively, indicated significant progress in improving the ICM governance



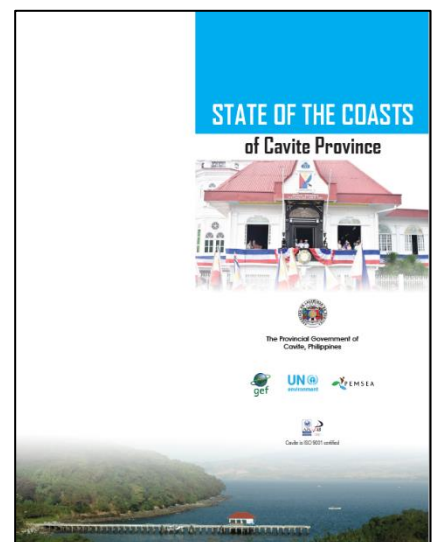
mechanisms (i.e., presence of enabling policies and legislation, institutional and multisectoral mechanisms, stakeholder participation and awareness building, capacity building, and financing). The SOC reports also identified areas for strengthening, particularly in the implementation of management programs related to habitat and biodiversity conservation, water use, fisheries and sustainable livelihood and pollution reduction and waste management in coordination with the relevant sectors and agencies. In relation to pollution reduction, both provinces indicated the need to strengthen local capacity for environmental quality monitoring, including exploring partnerships for the establishment of centralized sewage/septage treatment systems to reduce domestic wastes loading into major river systems and into the Bay.



Source: SOC Guidebook 2011



<http://www.pemsea.org/publications/reports/state-coasts-bataan-province>



<http://www.pemsea.org/publications/reports/state-coasts-cavite-province>

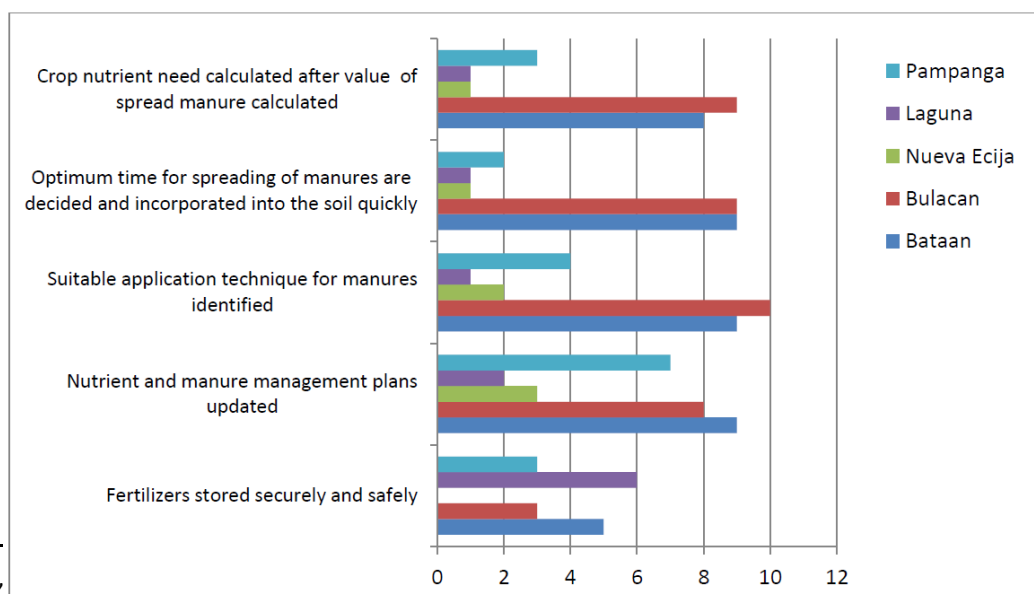
**Good practices/lessons learned in nutrient management in the agricultural sector in the Manila Bay watershed**

A documentation of the good practices and lessons learned in nutrient management in the agricultural sector in the Manila Bay watershed was commissioned by PEMSEA under the GNC Project through the Agricultural Training Institute (ATI) of the Department of Agriculture. The study covered 5 provinces in the Manila Bay watershed, i.e., Bataan, Bulacan, Nueva Ecija, Pampanga and Laguna where the Appreciative Inquiry method was applied during the key informant interviews involving 62 farmers and fishers from 13 municipalities in the 5 provinces. The data gathered were analyzed through the following themes and categories on nutrient management practices as cited by Cessti et al. (2003)<sup>1</sup>:

- Nutrient management – measures to help manage nutrients in soil
- Management of sedimentation – measures to control the volume and flow rate of surface water runoff, to keep the soil in place and reduce soil transport
- Pesticides management – measures to manage pesticide application
- Animal waste management – measures to manage the animal wastes that may affect soil nutrients
- Management of livestock and poultry production – measures done to reduce impacts of grazing on water quality
- Irrigation management – measures to help improve water use efficiency in the farm
- Aquaculture management – measures done to maintain water quality

The following factors were identified that may have affected the farmer's decision to adopt good management practices:

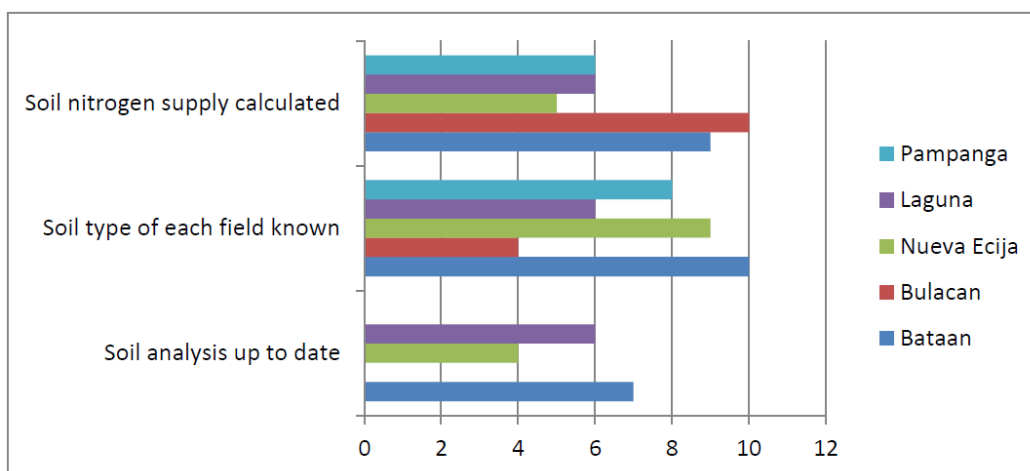
- Influence of the local government offices, peers, suppliers/dealers through technical assistance, trainings and agricultural extension services rendered
- Openness to new technologies/learnings
- Improvement in community activities such as coastal resources management program
- As recipients of agricultural benefits and incentives which they can use in their farms.



<sup>1</sup> Cessti, *Manila Bay experience. A report by the Environmental and Social Development Unit for Europe and Central Asia, The World Bank, Washington DC.*



#### Good practices in fertilizer and manure management



#### Good practices in soil management

Report on this study was submitted by ATI for recognition by the Philippine Extension Network, Inc. for the Outstanding Research Paper on Extension Award.

### Philippine policies and legislations relevant to nutrient management

A review document was developed focusing on the policies, legislations and rules and regulations relevant to nutrient management including the issues and challenges in addressing nutrient management as applied to the Manila Bay region.

The review document highlighted the evolution of the institutional mechanism for the administration of environmental policies in the Philippines over the past 5 decades, i.e., from the establishment of the National Pollution Control Commission in 1964, to the National Environmental Protection Council in 1977 and the Environmental Management Bureau (EMB) of DENR in 1987. It also highlighted the enactment of Presidential Decree (PD) 1151 and 1152 in 1977, which provided the comprehensive policy framework for the development and passage of specific laws and legislations, guidelines, procedures and standards to address urgent and specific environmental concerns.

For pollution control and waste management, the Implementing Rules and Regulation (IRR) of PD 984 (Pollution Control Decree of 1976) passed in 1978 established the standards for air and water quality, and the permitting system for the construction and operation of pollution control devices. Some of the environmental standards contained in the 1978 IRR have undergone several revisions. DENR Administrative Order (DAO) No. 34 Series of 1990 provides the

guidelines for water usage and classification and water quality criteria for freshwater and marine and coastal waters amending Sections No. 68 and 69 of the IRR for PD 984. DENR Administrative Order No. 35 Series of 1990 on the other hand describes the revised effluent standards for different water quality parameters. Water quality is assessed based on the set beneficial uses as defined in DAO 34. As such, all parameters that define the desired water quality per water body classification must be met to maintain its designated water classification.

Despite the extensive legislation and regulations that provided the legal bases for policies and programs related to environmental management, the laws are not efficiently enforced and have limitations as regard addressing nutrient management. Water quality standards do not include nutrients. In the Manila Bay Area, the two water concessionaires, the Manila Water Company, Inc (MWCI) and Maynilad Water Services, Inc. (MWSI) are only required under the Clean Water Act to comply with the guidelines on sanitation of the Department of Health and the Effluent Standards of DENR. The same standards apply for domestic, commercial or industrial effluents.

The enactment of Republic Act 9275 or the Clean Water Act of 2004, which covers all water bodies and requiring the application of abatement and control of pollution from land-based sources and repealing PD No. 984 could provide the overall framework for the management of nutrient pollution. In 2016, twelve years after the passage of the Clean Water Act, new water quality guidelines and effluent standards were released by DENR (DAO No. 8 Series of 2016) superseding the guidelines and standards contained in DAO 34 and 35 Series of 1990.

The new set of guidelines comply with Sections 19e and 19f requiring DENR to adopt and promulgate the water quality guidelines and general effluent standards. The inclusion of nitrate and phosphate in the water quality guidelines for primary parameters is anticipated to compel concerned entities to set up facilities to treat and manage nutrients in waste water and to include nutrients in the monitoring of water quality.

<https://pab.emb.gov.ph/wp-content/uploads/2017/07/DAO-2016-08-WQG-and-GES.pdf>.

The water quality guidelines are applicable to all water bodies (freshwater, marine waters and groundwater) and may be used for classifying water bodies, determining time trends, evaluating stages of deteriorations or enhancement in water quality, and as basis for taking positive actions in preventing, controlling, or abating water pollution and designating water quality management areas. The general effluent standards on the other hand are applicable to all point sources of pollution regardless of volume or industry category, which discharge to a receiving body of water or land

**D.2. Building the foundations and agreement with government agencies and stakeholders on nutrient reduction strategies to be implemented in the Manila Bay watershed, including their integration into regional water quality aims**

Activities and outputs included compiling and analyzing best practices; development and application of source-impact modeling; and development and agreement on final reduction strategies based on modeling and best practices and water quality aims. These outputs were highly dependent on the outputs of Component B of the GNC project, particularly subcomponent B4 on the development of regional models for the Manila Bay watershed.

#### **D.2.1. Building the foundations for nutrient reduction strategies: application of first version source-impact models and best practices**

At the initial stages of the project, PEMSEA facilitated the conduct of technical workshops to explore the scope, outputs and expectations and synergies among existing pollutant loading and modelling efforts in the Manila Bay watershed, particularly those implemented by BSWM, LLDA, the Philippine Nuclear Research Institute (PNRI) of the Department of Science and Technology (DOST), UPMSI and the University of the Philippines National Hydraulic Research Center (UPNHRC).

The modelling efforts of the various agencies in the Manila Bay watershed and key results are described below, including the collaboration and support provided to LLDA and UPMSI through the GNC Project in the conduct of modeling studies, to facilitate the identification of strategic policy options and recommendations to reduce nutrient pollution.

**BSWM:** Two studies were spearheaded by the BSWM to generate baseline data for the estimation of the pollution loading in Manila Bay from agricultural sources. The first project, Assessment of Nonpoint Source Pollution from Croplands of the Manila Bay System, estimated the total nitrogen and phosphorus loading from fertilizer use and rice production in 18 sampling sites in central and southern Luzon. Results indicated that the nutrient loading from croplands for rice, corn, sugarcane and coconut were within the accepted limits. The second project, Application of Stable Isotopes to the Assessment of Pollution Loading from Various Sources in the Pampanga River System into the Manila Bay, Philippines, was implemented in coordination with EMB and PNRI. The study measured the nutrient load in water (e.g., nitrate and total phosphate) and the presence of heavy metals (e.g., arsenic, cadmium, chromium, cobalt, lead, mercury and nickel) from 38 sites in the Manila Bay watershed within two sampling periods — once during the dry season and another during the wet season.

**UPNHRC:** UPHNRCH supported the development and analysis of modeling tools as part of a decision-support system for managing the environmental quality of the Manila Bay-Laguna Lake watershed system. The project focused on describing the hydrology of the watersheds, the hydrodynamics and hydraulics of the bay/lake system, and the transport of nutrients, salinity, sediments or contaminants from the watershed to the bay/lake system. The models are designed to provide information and scientific bases for developing policies and strategies for integrated coastal management as well as to assess the consequences, effects or impacts of possible actions and alternative management schemes imposed on the bay through model

simulation studies. Field surveys and water quality sampling were the primary sources of data, while existing data, maps and reports on water quality and related physical characteristics served as secondary data sources.

**PNRI:** PNRI conducted a study estimating pollutant source contribution from the agriculture sector of the Pampanga River basin using carbon and nitrogen isotopes. In collaboration with the MBCO and BSWM, the project assessed the nutrient contribution of domestic, livestock and cropland activities in central Luzon to Manila Bay. The Pampanga River basin, which covers Angat and Bulacan rivers, and other river systems in the provinces of Nueva Ecija, Bulacan and Pampanga, was chosen as the study's main source of data since it is the biggest source of nutrient runoff to Manila Bay. Soil/sediments, particulate organic matters and plant samples were collected and sent to New Zealand for stable isotope analyses. The model revealed that domestic and cropland sources dominantly contribute to the nutrient inputs in the Pampanga River basin.

**LLDA:** PEMSEA, in collaboration with LLDA conducted a study to determine the corresponding Biochemical Oxygen Demand, Total Phosphorous and Total Nitrogen loadings from major point sources (industry, domestic, agriculture and forest) in the Manila Bay, Pasig River and Laguna de Bay watershed for years 2008, 2010, 2015 and 2020, using the Waste Load Model (WLM) of the LLDA's Decision Support System (LLDA-DSS). The study delineated fifty-eight (58) sub basins within the watersheds of Pasig River and Laguna de Bay, as well as smaller basins in the National Capital Region, Bulacan and Cavite that directly drain to Manila Bay. The WLM measured the amount of substances produced by human activities (i.e., domestic, agricultural and industrial) and the amount of substances that end up in the coast or lake after passing through treatment facilities, sewer systems or natural process in surface waters. Results of the study indicated that domestic sources of BOD and nutrients contributed the highest pollution loading followed by industrial and commercial sources, agriculture and forest land.



<http://www.pemsea.org/publications/reports/total-pollutant-loading-study-laguna-de-bay%E2%80%93pasig-river%E2%80%93manila-bay-watershed>

**UPMSI:** PEMSEA collaborated and supported UPMSI's study on Understanding the Dynamics of Hypoxia and Eutrophication in Manila Bay through hydrodynamic and water quality modeling in support of Subcomponent B4 of the GNC Project. The study included the conduct of primary data gathering to describe the status of Manila Bay in terms of water quality (hypoxia and eutrophication) and how the situation changes over time; conduct data analysis of results from previous surveys and modeling and incorporate available data for use in the model and scenario building to describe the dynamics of hypoxia in Manila Bay. The results of the study complemented previously reported widespread hypoxia in the bay wherein the areas affected are influenced by the season: i.e., during the dry season, hypoxia is limited at the middle of the Bay while a wider area of the Bay is hypoxic during the wet season. It also suggested that hypoxic episodes in the bay can be limited if the nutrient loading problem is addressed, hence necessitating the identification and implementation of better management strategies to decrease and prevent nutrient loading into the bay. The preliminary results of the nutrient load model developed for Manila Bay under the GNC Project was also shared.

#### **Supreme Court – Manila Bay Advisory Committee**

A collaborative presentation to the Supreme Court's Manila Bay Advisory Committee entitled "Rehabilitation and Management of Manila Bay: Changing Times and Changing Circumstances" was made by DENR-MBCO, PEMSEA, UPMSI, UPNHRC, LLDA, DA-BSWN and DOST-PNRI on 14 November 2014 with the aim of communicating to the MBAC the importance of modeling, the goals of the modeling efforts and the implications of the results from the modeling efforts of the various agencies to policy and decision making. The collaborative presentation particularly highlighted the following:

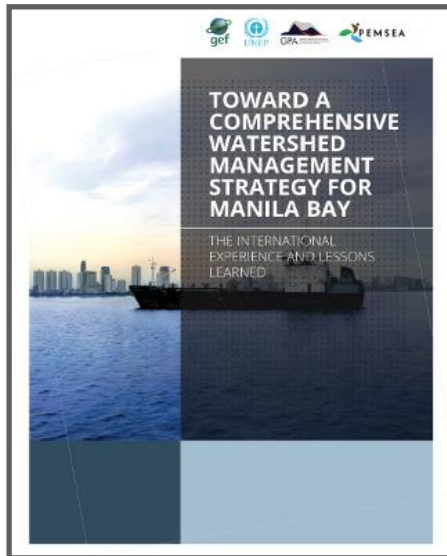
- Nitrogen and phosphorus loadings to Manila Bay are forecast to increase under a "business as usual" which will likely result in increasing levels of eutrophication and hypoxia in the Bay.
- Point and nonpoint sources of nitrogen and phosphorus loadings to Manila Bay include domestic sewage, aquaculture, agricultural run-off and wastewater discharges from industry.
- The impact of atmospheric deposition of nitrogen in Manila Bay requires further assessment.
- As sewer connections increase, nitrogen and phosphorus loadings to the Bay are expected to increase as a consequence of less retention/purification in drainage systems and rivers discharging to the Bay.
- Existing and planned sewage treatment facilities improve water quality by bringing down BOD and microbial content. However, these systems are not designed to remove nutrients.
- Tertiary treatment of domestic sewage will help reduce the nutrient loadings, but continuing population growth poses a major challenge to improving ecological conditions in the Bay.

Suggestions on the way forward for consideration by the SC-MBAC included the following:

- Convene a high-level meeting with Mandamus Agencies to discuss the strategic options, including setting representative and measurable targets toward improving the ecosystem health of Manila Bay and reporting progress towards those targets.
- Promote strategic approaches, financial commitments and investments for affecting improvements to the ecosystem health of the Bay (e.g., pollutant loading allocations to domestic and agricultural sectors; phosphate-free detergents; air emission reductions; water management) and the desired socioeconomic impacts.
- Revisit the objectives, targets, timelines identified in the Manila Bay Operational Plan, taking advantage of new information on conditions in Manila Bay and innovative modeling and forecasting tools and instruments that are now available.
- Fully engage the universities and scientific community as partners in the rehabilitation and management of Manila Bay.

### **Manila Bay Clean up Strategies, Policy Analysis and Case Studies**

To learn from international experience on the restoration and protection of major water bodies, the World Resources Institute (WRI) was engaged in the development of a set of preliminary recommendations for strategies and tools for use in the restoration of Manila Bay based on the efforts of other countries and initiatives, including relevant case studies, successes and failures, and lessons learned, with emphasis on nutrient control policies for urban and agricultural sectors.



The report entitled, “Toward a Comprehensive Watershed Management Strategy for Manila Bay: The International Experience and Lessons Learned” details selected international frameworks and policy approaches for controlling water pollution and restoring major water bodies, including successes and failures. Policy options that can be used to address pollution from various sectors were also identified. Preliminary recommendations in creating a comprehensive watershed-based strategy for improving the water quality in Manila Bay include a combination of management (e.g., implementation of OPMBCS) and technical approaches (e.g., pollution reduction opportunity analysis that can serve as a decision-support tool in the setting of load allocations), including the application of technical tools (e.g., phosphate detergent ban; water

quality trading) to reduce discharges of a given pollutant. Observations on the contribution of domestic wastewater and agriculture to Manila Bay’s degradation and the need for monitoring and modeling to better inform planning and decision making are also included in the report.

<http://www.pemsea.org/publications/toward-comprehensive-watershed-management-strategy-manila-bay-international-experienc-0>

## D.2.2. Development and application of the final source-impact models for Manila Bay in developing nutrient reduction strategies

### Manila Bay Nutrient Load Model

One of the major outputs of Sub-component B4 of the GNC Project is the development of a high-resolution nutrient-source impacts models for Manila Bay watershed that can be applied under Component D in a policy relevant context and to help guide cost effective nutrient reduction planning.

The nutrient load model that UPMSI developed is patterned after the Global NEWS models and scaled down to the watershed level and modified to suit the local setting of Manila Bay. The model, which covers a bigger study area and a wide range of temporal scenarios complemented various watershed and pollution load studies conducted in the Manila Bay watershed that have temporal and spatial limitations. The NLM was designed to evaluate the baseline status of the bay based on the nutrient loading from the watershed while the scenario building feature was used to evaluate the impacts of different load reduction options that may be applied to the bay.

Details of the scenarios are shown in the table below.

<i>Parameter</i>	<i>Baseline01</i>	<i>Scenario01</i>	<i>Scenario02</i>	<i>Scenario03</i>	<i>Scenario04</i>
<b>Population projection</b>	Normal (as projected by PSA or FAO)	Normal (as projected by PSA or FAO)	Normal (as projected by PSA or FAO)	<b>Half of the population growth rate</b>	<b>Half of the population growth rate</b>
<b>P regulation</b>	None	<b>Total P ban on dishwashing and laundry detergents</b>	None	None	None
<b>Sewage connections</b>	10% in the provinces 30% in Manila	10% in the provinces 30% in Manila	Improving sewage connections (50%)	10% in the provinces 30% in Manila	Improving sewage connections (50%)
<b>Sewage treatment</b>	Full secondary treatment	Full secondary treatment	<b>Full tertiary treatment</b>	Full secondary treatment	<b>Full tertiary treatment</b>

The different load reduction scenarios that were tested focused on some key questions:

- What is the impact of improved sewage treatment (up to tertiary treatment)?
- What is the effect of population growth rate?
- What is the impact of the implementation of a ban on the phosphorus content in detergents?

Results of the NLM confirmed that domestic sources (i.e., domestic sewage from houses) are the major source of nutrient load into the bay as compared to the agricultural sector, including



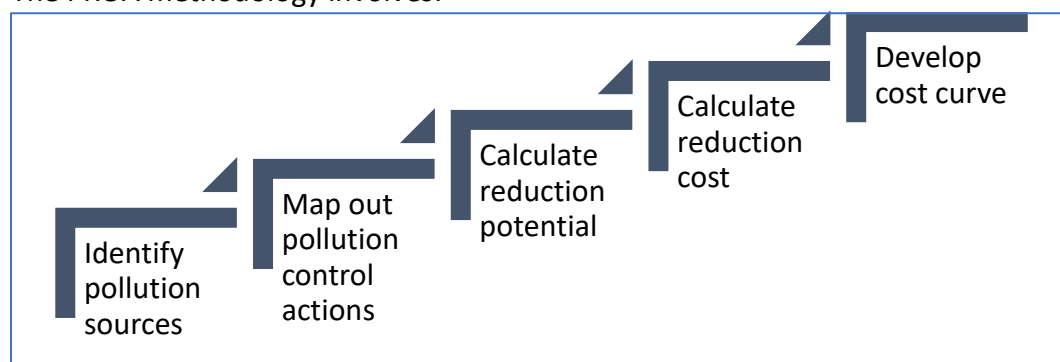
livestock and poultry. Detailed results of the NLM are covered in Sub-component B4 of the GNC project. In terms of policy recommendations, the study presents an overview of the current ecological condition of Manila Bay and provides ideas for feasible solutions through policies and/or investments. Alongside improving sewerage infrastructure and treatment, decentralizing the highly dense urban areas and imposing a ban on phosphorus content in detergents are among the identified policy options.

### **Pollution Reduction Opportunity Analysis for the Manila Bay Watershed, Cavite and Pampanga Province**

As one of the technical approaches recommended by WRI in Sub-component D.2.1 to facilitate the identification of nutrient reduction and restoration strategies and given the delay in the implementation of Sub-component B4, PROA models for the Manila Bay watershed, Pampanga Province and Cavite Province were developed in collaboration with WRI.

A PROA is a rapid assessment that estimates the potential of available control measures to reduce discharged nitrogen and phosphorus loads and the annualized cost per kilogram of annual reduction for each of the measures.

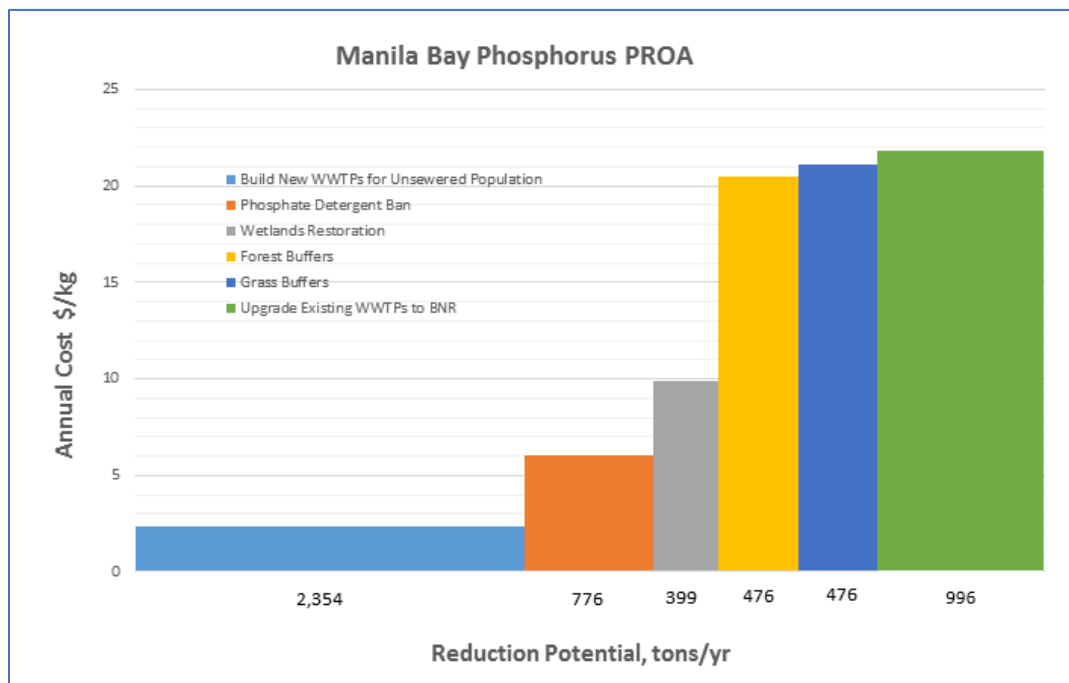
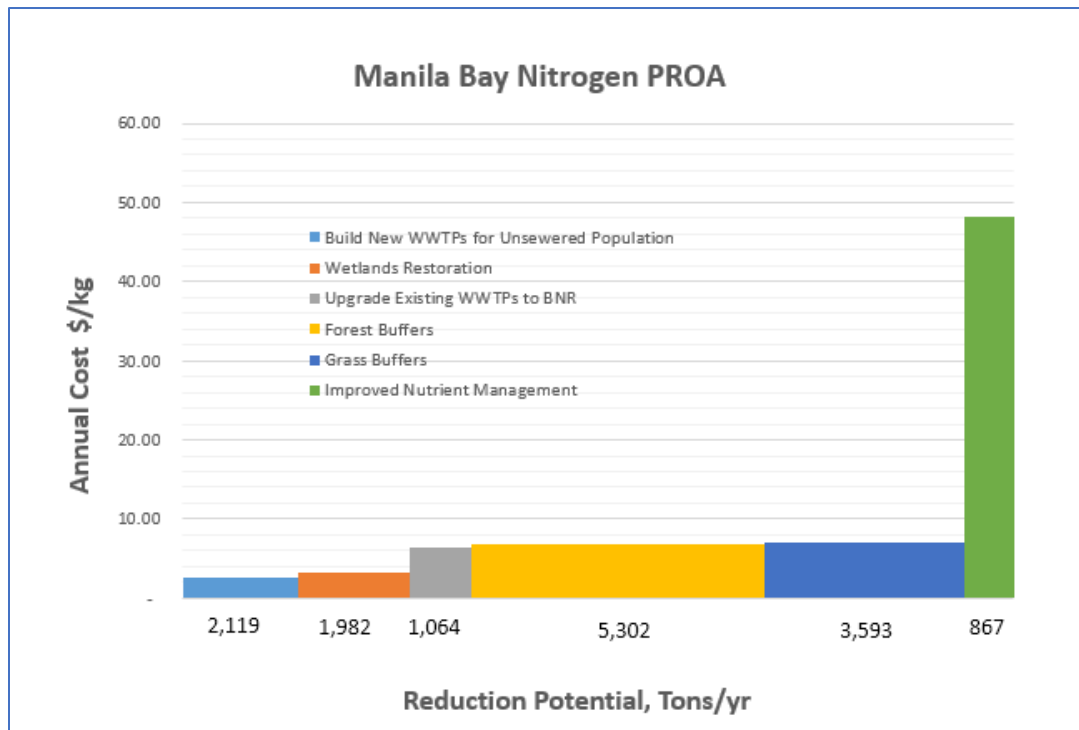
The PROA methodology involves:



The PROA graph represents a simple but powerful bar chart that clearly indicates where the best solutions may lie. Six PROAs were produced -- nitrogen and phosphorus PROAs for the Manila Bay watershed, as well as nitrogen and phosphorus PROAs for the Provinces of Pampanga and Cavite. The PROA also describes the data input sources used, as well as the assumptions made in constructing the PROAs.

#### *Results of PROA Assessment*

Nitrogen and phosphorus PROAs for Manila Bay watershed are shown below:



Reduction potential for Nitrogen: The PROA indicates that there is significantly more reduction potential in the agricultural sector than the wastewater sector in the Manila Bay watershed. Forest and grass riparian buffers have the greatest potential for reducing nitrogen discharges in the agricultural sector. Constructed and/or restored wetlands also have significant potential.

The largest reduction opportunity in the wastewater sector is the construction of new wastewater treatment plants to serve currently unsewered urban populations. Upgrading existing wastewater treatment plants serving the urban sewered population also has significant potential. However, it is smaller than that for new wastewater treatment plants because the unsewered population in the Manila Bay watershed is significantly larger than the sewered one. Overall in the watershed, new wastewater treatment plants result in about twice the reduction potential of upgrading existing ones.

**Reduction potential for Phosphorus:** Unlike with nitrogen, there is significantly more phosphorus reduction potential in the wastewater sector than the agricultural sector. Contributing factors are probably the low phosphorus fertilizer use compared to nitrogen, and the relatively low mobility of phosphorus in the environment. As with nitrogen, the largest reduction potential in the wastewater sector, and overall, is the construction of new wastewater treatment plants to serve currently unsewered urban populations. The second largest potential is provided by upgrading existing wastewater treatment plants.

A phosphate detergent ban (PDB) is not far behind WWTP upgrades. A PDB would significantly reduce the phosphorus concentration in domestic sewage (for this analysis, it was assumed that the reduction would be 2.75 mg/L).

The wastewater treatment plants currently serving the sewered urban populations were not designed for phosphorus removal. Therefore, reductions in influent phosphorus concentrations and loads would translate directly into reductions in discharged concentrations and loads. If these WWTPs were later upgraded for phosphorus removal, the benefits of the PDB would be replaced by removal by the WWTPs.

The same calculation was applied to sewage generated by urban unsewered populations whose sewage is discharged more-or-less directly to surface waters. A PDB would reduce the phosphorus concentrations and loads (again assuming a reduction in the phosphorus concentration of 2.75 mg/L) to these waters. As with urban sewered populations, the PDB benefit would be replaced if new WWTPs with phosphorus removal capabilities were built to serve the unsewered urban population.

The benefit of a PDB is expected to be lower in unsewered rural areas because of the low mobility of phosphorus in the natural environment due to factors such as its low solubility and adherence to soil particles. The PROA model assumed that only 50 percent of the phosphorus from laundry detergents would be delivered to surface waters.

More certainty can be attached to the nutrient reduction benefits of a phosphate detergent ban than to the other options. There is no doubt that it would have an immediate benefit throughout the watershed.

A key point to understand about the graphs is that the reduction potentials of the six options cannot simply be added together to obtain a total potential. The agricultural options in both the

nitrogen and phosphorus PROAs are applied to the same sources of loads, hence should be considered as alternative measures with different efficiencies. The wastewater options, on the other hand, are applied to different nitrogen and phosphorus sources, urban sewer and urban unsewered populations, and the reduction potential can be added. The reductions of a PDB can also be added, but then must be reduced as existing wastewater treatment plants serving urban sewer populations are upgraded and new ones serving urban unsewered populations are built.

The unit costs in all of the PROAs are from the Reference Database and based on international experience. None are specific to the Manila Bay watershed; therefore, great care must be taken in drawing conclusions about cost-effectiveness. The same options and BMPs were used in all of the PROAs, hence the unit costs, and the height of the bars are the same in every PROA. The annualized unit costs of control options are shown below in \$/kg/year.

<b>Option</b>	<b>Nitrogen \$/kg/year</b>	<b>Phosphorus \$/kg/year</b>
Build New WWTPs for Unsewered Urban Population	2.60	2.34
Wetlands Restoration	3.30	9.90
Upgrade Existing WWTPs for Nutrient Removal	6.43	21.84
Forest Buffers	6.82	20.46
Grass Buffers	7.04	21.12
Phosphate Detergent Ban (Urban areas, rural areas)*	--	3.58 / 7.16
Improved Nutrient Management	48.18	--

\* Different because of 1.0 and 0.5 delivery factors in urban and rural areas, respectively.

Building new wastewater treatment plants to reduce the unsewered urban population has the lowest unit cost for nitrogen and phosphorus. The reason is that nutrient removal would be only one of the reasons for reducing the amount of untreated sewage being discharged, others being protection of public health and reducing the discharge of oxygen-demanding substances to surface waters. Hence, only a portion of the capital costs are assigned to nitrogen and phosphorus in the PROA. It should be stressed that this option provides very important public health and environmental benefits in addition to reducing nutrient discharges.

The PROAs are the initial output of the PROA model. Because of the lack of local data, the preliminary PROA analysis relied heavily on international reference data. Hence, several

assumptions had to be made in all areas—wastewater treatment plant capital and operating costs and nutrient removal efficiencies; agricultural Best Management Practices (BMPs), their costs and efficiencies; and information and data on phosphate detergent bans. The reference data should be considered as proxy data for this first iteration of the PROAs. The PROA results must be recognized as very much a product of the proxy data and the assumptions, both of which should be replaced in the long run with local data to improve the reliability of the model. The identified choices should therefore be reviewed by local experts and changed as needed to better match the PROAs to local conditions and preferences.

Finally, outputs from the Nutrient Load Model (NLM) on existing nitrogen and phosphorus loads was used as inputs to the PROA analysis. However, detailed NLM data, such as assumed coefficients for fertilizer nitrogen and phosphorus loss rates were not used. More work is needed to more completely link the NLM and PROA analyses and adjust the PROA model to better conform to NLM inputs and assumptions.

While caution is needed in interpreting the results of these PROAs, and far-reaching decisions based on these preliminary results should be avoided, they may still provide some preliminary insight into where the most cost-effectiveness measures might lie. Then, as more local data is collected and the scientific understanding of nutrient pollution sources and their impacts on Manila Bay increases over time, the PROAs can be steadily improved.

The PROA concept and framework, including its application in the development of long- and short-term nutrient management strategies in Manila Bay and elsewhere in the Philippines were introduced to relevant local agencies and partners in a series of planning meetings conducted in 2016. To facilitate future application of PROA, a PROA Development and Application Guidebook for use by local stakeholders was also developed.

#### **D.2.3. Development and adoption of final integrated nutrient reduction strategies**

The Supreme Court Decision provides the necessary backdrop for mainstreaming the tools developed and outputs generated from the GNC Project where many stakeholders and partners were engaged in their development and application.

At the bay-wide level, the updated OPMBCS and the soon-to-be formulated Manila Bay Sustainable Development Master Plan provide opportunities for mainstreaming the GNC project's recommendations on nutrient management to support the implementation of plans and programs on pollution reduction identified in the OPMBCS over the next 5 years.

At the local government level, the networking efforts and commitment of the 8 provinces (Bataan, Bulacan, Cavite, Laguna, Nueva Ecija, Pampanga, Rizal and Tarlac) in the Manila Bay watershed provide opportunities for introducing the application of tools and methodologies developed from the GNC Project.

## **Operational Plan for the Manila Bay Coastal Strategy: Implementing the Supreme Court Order to Cleanup, Rehabilitate and Preserve Manila Bay**

While the waters of the bay remain below the SB level, much has been done to minimize pollution loading into the Bay resulting from the implementation of two cycles of the OPMBCS: 2000-2010 and 2011-2015.

The DENR MBCO reported the following consolidated accomplishments by the Mandamus Agencies in 2011-2015, which can provide the necessary guidance in identifying aspects where the GNC Project's outputs can build on:

- Liquid waste management: Monitoring of 11,363 industries where 48% were assessed to have discharge permits; issuance of notice of violation for non-compliant establishments; provision of sanitation services and sewerage connection by MWSS through the water concessionaries where 15% of the population is connected to sewer lines and sewerage system and 31% is provided with sanitation services; designation of 4 Water Quality Management Areas in NCR (San Juan River System), Region 4A (Imus-Ylang-ylang-Rio Grande-Canas River System) and Region 3 (Marilao-Meycauyan-Obando River System) as required by the Clean Water Act.
- Solid waste management: 108 of the 178 (61%) local government units within the Manila Bay watershed area have approved 10-Year Solid Waste Management Plans; 110 (62%) of LGUs have functional materials recovery facility; cases have been filed in the Ombudsman against 13 LGUs for still operating open dumpsites.
- Informal settler families and illegal structures management: LGUs failed to contain the growth of the informal settler families along the waterways. As of December 2016, the rate of increase from 2011 baseline data is much faster than the relocation rate. There was a huge increase of informal settler families (about 342%) for the period 2011-2016.
- Habitat and resources management: greening/vegetation of a total of 150,662 hectares targeted under the National Greening Program to reduce soil erosion and agricultural runoffs until 2022; mangrove rehabilitation covering 1,003 which surpassed the 1994 mangrove cover of 794 hectares; six mangrove areas have been identified as ecotourism sites in the NCR, and Regions 4A and 3.
- Partnership and governance: conduct of scientific studies and adaptive management to strengthen planning and policy formulations -- among the studies conducted included those reported by BSWM, PNRI, UPNHRC under D.2.1; formulation or area-based management plans (ABMPs) for the following 13 river systems draining into Manila Bay:

NCR	REGION III	REGION 4A	AREA-BASED MANAGEMENT PLAN
1. Malabon-Tullahan-Tinajeros River System	1. Marilao-Meycauyan-Obando	1. Imus-Ylang-ylang-Rio Grande River (Cavite)	MARILAO MEYCAUAYAN OBANDO RIVER SYSTEM
2. Paranaque-Las Pinas-Zapote River System	2. Talisay	2. Maragondon River (Cavite)	PAMPANGA RIVER SYSTEM
3. Pasig-Marikina-San Juan River System	3. Bulacan-Angat Watershed	3. Labac River (Cavite)	TALISAY RIVER SYSTEM
	4. Nueva Ecija (Pampanga River Basin Upstream)	4. Sta. Cruz River (Laguna)	
	5. Pasak River, Porac Gumain, Pasig-Potrero River	5. Boso-boso River (Rizal)	

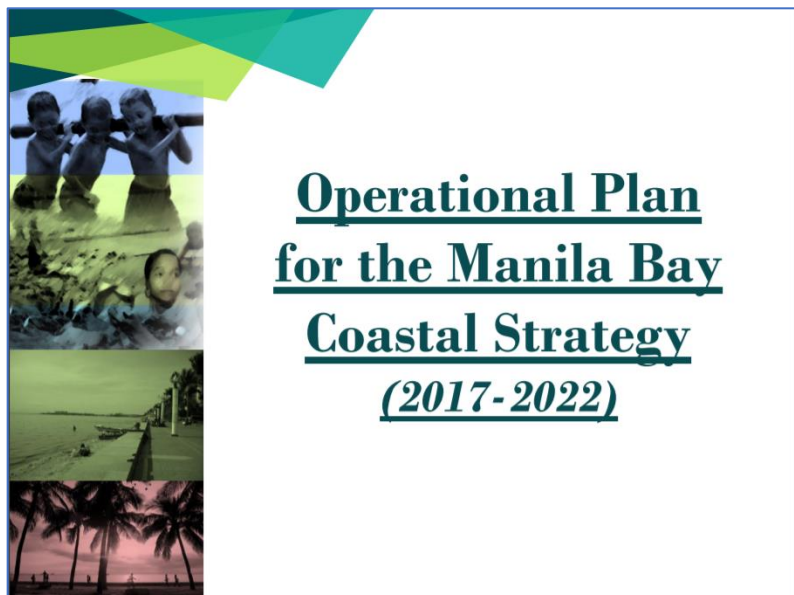
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ater quality monitoring equipment has been installed at 4 locations in NCR. Four additional equipment will be installed in identified sites in Region 3 (Pampanga, Bulacan, Bataan) and Region 4A (Cavite).

- Bathymetric survey of the Manila Bay Area is being undertaken in collaboration with NAMRIA. Over 50% of the Manila Bay Area has been surveyed and expected to be completed by December 2018.

- The OPMBCS 2017-2022 was developed, presented to the MBAC on 05 May 2017, and submitted to the Supreme Court on 13 June 2017. DENR convened the first meeting of the Manila Bay Coordinating Committee (MBCC) on 10 August 2017 to re-affirm the commitments of all the mandamus and concerned agencies in the implementation of the 2017-2022 OPMBCS.

<http://mbco.denr.gov.ph/OPMBCS2017-2022.pdf>



- The Manila Bay Day organized every 18<sup>th</sup> of December by DENR has been serving as a platform to recognize the contribution of local government units in the attainment of OPMBCS targets. Compliance assessment is carried out by the Regional Interagency Committee headed by the DILG in identifying awardee LGUs.



## **Manila Bay Sustainable Development Master Plan**

The National Economic Development Authority (NEDA) is overseeing the formulation of the Manila Bay Sustainable Development Master Plan and supporting institutional framework that will guide decision-makers in the approval of programs/projects/activities for implementation in the Manila Bay that are consistent with national, regional and local development plans. The Government of Netherlands is providing technical assistance in the formulation of plan along with a Technical Committee composed of representatives from various stakeholders to review the outputs of the Study Team. PEMSEA was invited to serve as one of the members of the Technical Committee.

The Master Plan is expected to contain the following information:

- Stakeholder profiles and the determination of physical and climatological attributes of the Bay;
- Analysis of key problems/issues as well as opportunities faced by the national/local authorities and constituents in the area;
- Identification of gaps with regard to, among others, infrastructure requirements, sustainability/management of environment and natural resources;
- Development of potential measures to address the gaps/problems identified;
- Action Plan incorporating recommendations to best achieve results intended by the master plan including a presentation on a suitable financing/funding plan to address the budgetary requirements corresponding to the development interventions necessary to be implemented; and
- Communications plan for effective coordination among concerned stakeholders.

<http://www.neda.gov.ph/tag/manila-bay-sustainable-development-master-plan/>

<http://www.neda.gov.ph/2017/04/05/terms-of-reference-tor-for-the-formulation-of-the-manila-bay-sustainable-development-master-plan-mbsdmp/>

## **Manila Bay Governor's Forum**

In recognition of the critical role of local governments in local implementation of management programs and approaches (i.e., ICM ABMPs, WQMAs) that directly contribute to the rehabilitation of the Manila Bay Area and its major rivers, the Province of Cavite with support from PEMSEA through the GNC Project spearheaded the organization of a forum involving the 8 provinces in the Manila Bay watershed to discuss possible strategies and collaborative actions to contribute to rehabilitating Manila Bay in support of OPMBCS implementation. A series of preliminary meetings involving the 8 provinces and relevant national agencies and partners including DENR, DILG, DPWH and the Supreme Court were held to discuss the focus and outputs of the forum, particularly the creation of a Manila Bay Network of Local Governments (MBNLG).

The Province of Cavite hosted the conduct of the Manila Bay Governor's Forum, which was held on 23 March 2017 in Tagaytay City, Philippines. To set the context of the forum, a presentation

focusing on the “Challenges and Opportunities to Clean up, Rehabilitate and Restore Manila Bay” was delivered by Dr. Gil Jacinto of UPMSI, highlighting the environmental status of Manila Bay, the responses of mandamus agencies and the role and possible responses of local government units. The presentation tackled the objectives and outputs of the Manila Bay Nutrient Load Model highlighting the contribution of the provinces to the nitrogen and phosphorus loading to Manila Bay. Recommended responses included the following:

- Promote the use of P-free detergents
- Regular inventory per province of the major sources and load of pollutants which are located on a map.
- A better and regular inventory of backyard livestock farms and consider waste treatment (communal) of wastes generated from these activities
- Citizen-science as a way to heighten awareness on the issues surrounding Manila Bay
- An environmental report card per province be considered

The main highlight of the forum was the signing of the Memorandum of Understanding creating the MBNLG by the Governors of the 8 provinces. The network is guided by the principle that *“eight provinces are better than one”* and is envisioned to contribute to national, regional and international targets for sustainable development. It also aims to reiterate the commitment to work hand-in-hand to implement actions at the provincial and network levels particularly focusing on the following:

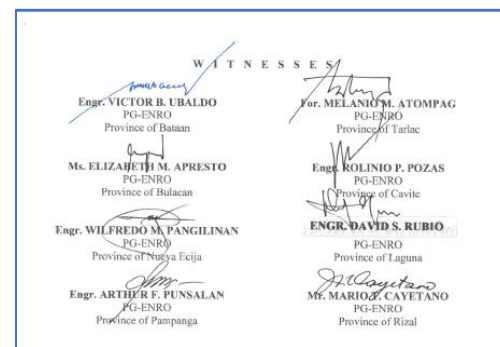
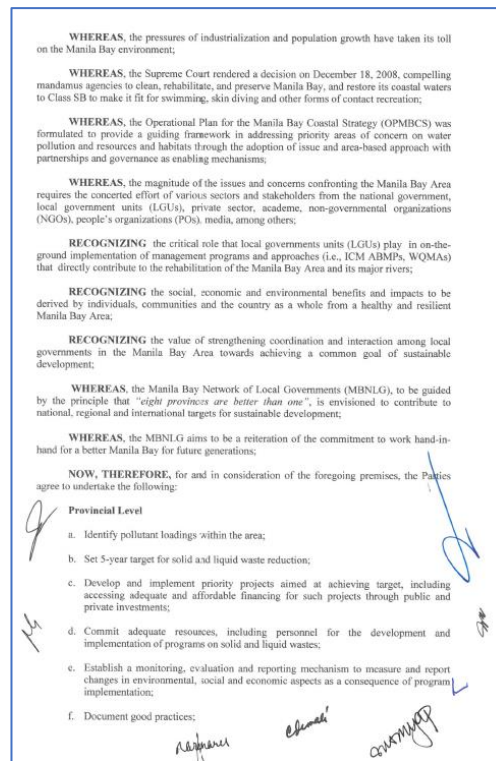
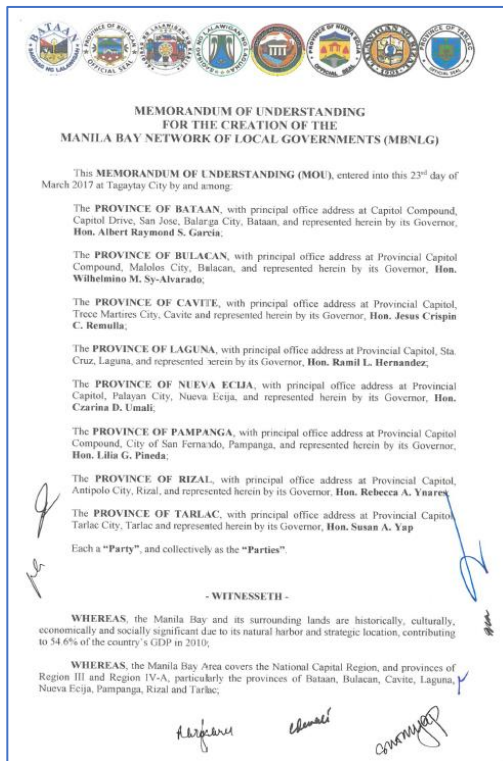
#### Provincial level

- Identification of pollutant loadings within their respective provinces
- Setting 5-year targets for solid and liquid wastes reduction
- Developing and implementing priority projects aimed at achieving targets, including accessing adequate and affordable financing for such projects through public and private investments
- Commit adequate resources, including personnel for the development and implementation of programs on solid and liquid wastes
- Establish a monitoring, evaluation and reporting mechanism to measure and report changes in environmental, social and economic aspects as a consequence of program implementation
- Document good practices
- Participate in annual forum of the network
- Participate and represent the network in national, regional and international forum

#### Network level

- Identify and register pollution reduction targets
- Organize partnership roundtables to promote pollution investment projects with public and private sector investors
- Organize capacity development initiatives to address needs and gaps

- Meet annually to share knowledge and experiences and review progress, challenges and impacts of collaboration with national and international agencies and programs
- Represent the network in national, regional and international forum on sustainable development to share local experiences, good practices and lessons learned in program implementation.



<https://www.pressreader.com/philippine-s/manila-bulletin/20170322/281711204470159>  
[https://article.wn.com/view/2017/03/22/Manila Bay governors forum held today](https://article.wn.com/view/2017/03/22/Manila_Bay_governors_forum_held_today/)  
 2<sup>nd</sup> Cavite Water Summit



The Province of Cavite organized the 1<sup>st</sup> Cavite Water Summit in 2015 with the theme, “Meeting our Future Water Needs”, which served as platform for discussing issues and concerns on water resources management in the province. The 2<sup>nd</sup> Cavite Water Summit with the theme, “Water Security for All: Pathways, Innovations and Outcomes”, was held on 9-10 November 2017.

The 2017 Cavite Water Summit saw the launching of the SOC report of Cavite Province that PEMSEA helped develop with support from the GNC Project. The Provincial Government Environment and Natural Resource Office (PGENRO) provided the highlights of the report and emphasized the areas that require actions from various stakeholders. PGENRO further highlighted that the report is the first publication of the province with an international reach.

The Summit also witnessed the signing of the Cavite Water Management Declaration where commitments over the next 3 years were made in promoting integrated water resources management to achieve sustainable water supply and sanitation. As a member of the PEMSEA Network of Local Governments, the declaration supported Cavite’s bid to achieving the SDG 6 targets by improving governance and implementing management programs for efficient water use and conservation.

The Summit also provided the opportunity for Dr. Christopher Cox to meet with selected head of departments and local government unit representatives to introduce UNEP’s programs on nutrient management.



<http://cavite.gov.ph/home/pg-enro-holds-cavite-water-summit-2017/>

<http://cavite.gov.ph/home/tag/cavite-water-summit-2017/>

<http://www.pemsea.org/news/cavite-prepares-sustainable-water-management-amidst-growing-population>



### **D.3. Development and application of ecosystem health report card in Laguna de Bay**

The development and application of the ecosystem health report card (EHRC) in Laguna de Bay was built on the Lake Chilika (India) model report card and the Chesapeake Bay experience. The process of report card development involved a series of consultations workshops that highlighted the collaboration of experts within and outside the East Asian region. The initiative was jointly implemented by PEMSEA and LLDA in partnership with external experts from UPMSI, University of the Philippines-Los Baños (UPLB), University of Santo Tomas (UST), the Bureau of Fisheries and Aquatic Resources (BFAR) and the science communication team from the Integration and Application Network of the University of Maryland Centre for Environmental Science (UMCES).

UMCES 5-step process in developing the report card:

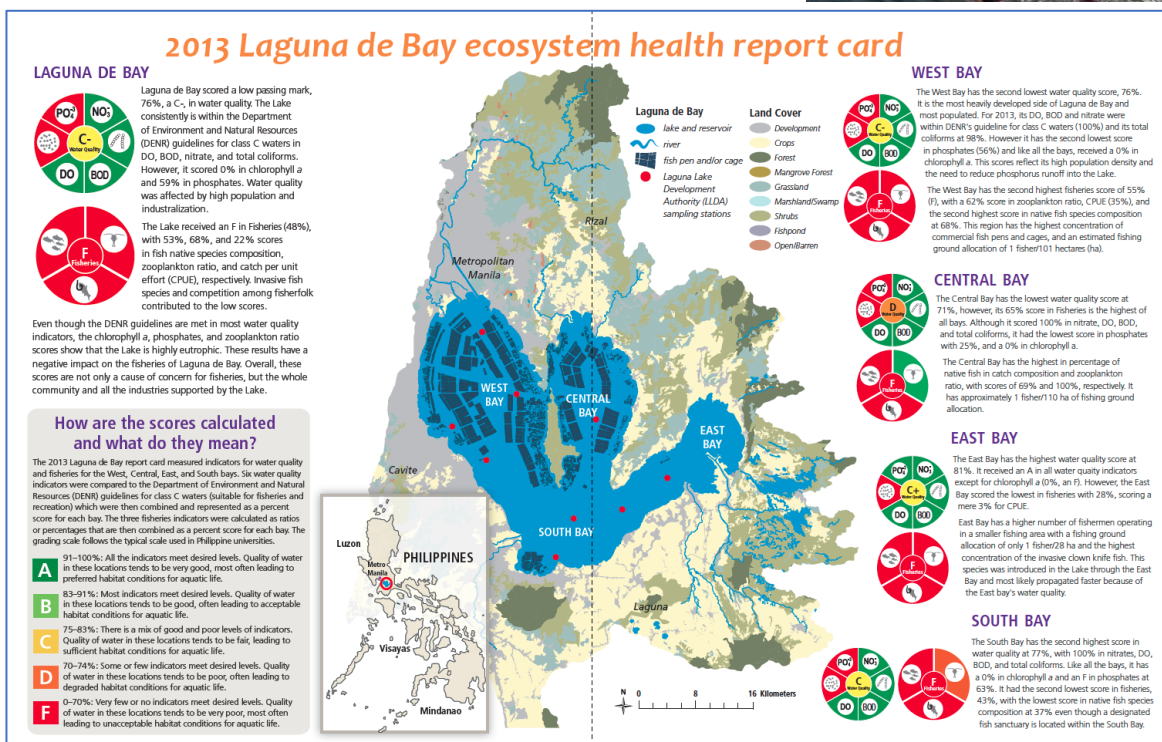
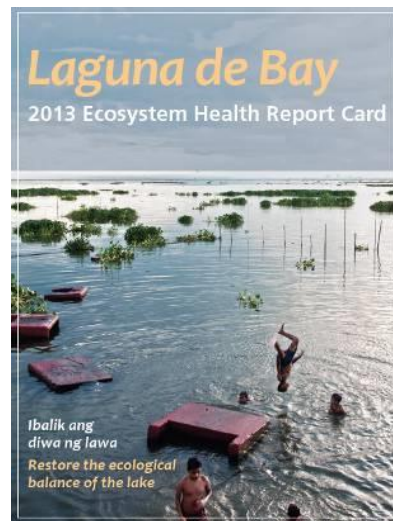


The EHRC is considered a transformative assessment and communication product that compares environmental data to scientific and management thresholds and is delivered to a wide range of audiences on a regular basis. The Laguna de Bay EHRC was designed to easily convey information to decisionmakers and stakeholders on the state of health of the lake environment. The report card measured indicators for water quality and fisheries to assess the overall quality of the lake ecosystem. The assessment was based on data for 2013, which came up with an overall ranking of 'C-' in water quality and 'F' in fisheries indicators. The results from the assessment are intended to inform policy and investment planning on the best



management practices for improving the environmental quality of the lake, and thus the score rating over time.

On 5 February 2016, the report card was launched during the Stakeholders Forum on Nutrient Management that was co-hosted by the Global Partnership on Nutrient Management. The event was held at LLDA's headquarters in Quezon City, Philippines and chaired by the then Secretary Nerius Acosta, Presidential Adviser for Environmental Protection and LLDA General Manager. In addition to the Project Steering Committee (PSC) members of the GNC Project, the launching was attended by representatives from the national agencies, the private sector, the local government units, community-based organizations and civil society groups, the academe and the media.



Commitments to continue working collaboratively to implement actions and management interventions in improving the health of Laguna de Bay were expressed by the different stakeholders. In the context of Manila Bay, improvements in the overall quality of the lake will translate into lesser pollutant loading into the bay.



<http://www.pemsea.org/publications/reports/laguna-de-bay-2013-ecosystem-health-report-card>

<http://www.ilda.gov.ph/dox/ldb-scorecard/ldb-report-card.pdf>

[http://www.ilda.gov.ph/index.php?option=com\\_content&view=article&id=731](http://www.ilda.gov.ph/index.php?option=com_content&view=article&id=731)

<http://pemsea.org/news/ecosystem-health-report-card-launched-laguna-de-bay-philippines>

<https://www.pressreader.com/philippines/the-philippine-star/20170202/282218010518772>

[https://www.philstar.com/business/science-and-](https://www.philstar.com/business/science-and-environment/2017/02/02/1668038/starscience-saving-laguna-de-bay)

[environment/2017/02/02/1668038/starscience-saving-laguna-de-bay](https://www.philstar.com/business/science-and-environment/2017/02/02/1668038/starscience-saving-laguna-de-bay)

[http://ian.umces.edu/enewsletter/project/ecosystem health report card for laguna de bay, philippines/](http://ian.umces.edu/enewsletter/project/ecosystem%20health%20report%20card%20for%20laguna%20de%20bay,%20philippines/)

<https://www.thegef.org/news/paralyzed-growth-lake-under-siege>

### **Sustaining the ecosystem health report card**

The successful formulation of the first ecosystem health report card in Laguna de Bay can be attributed to the following factors:

- Strong support from LLDA which is mandated (by virtue of Republic Act 4850) to ensure the preservation, development and sustainability of the Laguna de Bay and its 21 major tributary rivers.
- Existence of a functional monitoring program that monitors effluent discharges from industries, commercial establishments, institutions and clustered residential units thru the environmental user fee system and monitoring of surface water quality in the lake and rivers.
- Availability of time series monitoring data that are included in the annual water quality report and environmental monitor report of the Bay and its tributaries.
- Partnership opportunities with various organization and stakeholders to share data and information as well as supporting and enhancing the capacity of concerned LLDA personnel to implement the reporting system.



- Availability of experiences and expertise from other areas (Chilika Lake and Chesapeake Bay) that served as model and guide in the development of the Laguna de Bay report card.
- Opportunities for widely disseminating the Laguna de Bay experience in international forum (e.g., Presentation of the report card by LLDA at the 2015 East Asian Seas Congress, November 2015, Danang, Vietnam; by UMCES at the 11<sup>th</sup> EMECS Conference, August 2016, St. Petersburg, Russia; by LLDA at the 16<sup>th</sup> World Lake Conference, November 2016, Bali, Indonesia).

The following recommendations are key to sustaining the ecosystem health report card in Laguna de Bay and serve as model for replication in other key water bodies in the Philippines and other countries in the East Asian Region:

- Institutionalizing the reporting mechanism within LLDA: To realize the full potential of the ecosystem health card, strong commitment of LLDA is necessary to institutionalize the reporting mechanism and mainstream it into the regular program of the Administration on environmental reporting. This requires an assessment of the organizational, resource, manpower and other requirements to facilitate the development of the succeeding report cards.
- Data management: LLDA has a good database management system for storage of the data generated from its regular monitoring program as well as various special projects (e.g., LISCOP, PHILWAVES, etc.) that it has implemented or is currently implementing. However, a mechanism is necessary to gather and consolidate data and good practices from the initiatives of other institutions and agencies that are implementing projects within LLDA's administrative jurisdiction comprising of 5 provinces, Metro Manila and Laguna de Bay. Documenting evidences of management response can serve as additional input to showing progress.
- Capacity building: As part of the institutionalization of the ecosystem health report card, external expert's assistance will be needed during the transition phase, particularly in the data analysis, identification of relevant indicators and thresholds based on available data and provision of guidance in building consensus on the scores/grades.
- Inclusion of socioeconomic indicators: Consideration to include social and economic indicators in future reports to show how improvements in ecological indicators is impacting the overall well-being of Laguna de Bay and the people and also in response to the identified root causes of the identified threats in Laguna de Bay which include population, poverty and governance.
- Dissemination: Translating the highlights of the report card in easily understood language and format to communicate the status of the lake to the public with the aim of

engaging the public in contributing to the solutions toward improving the condition of the bay.

- Performance metrics: Utilize the report card for assessing the level of performance of LLDA and local governments in maintaining the Class C water quality classification of the lake and to convey the message where their individual and collective actions are required to improve the condition of the bay.
- Citizen science: Encouraging the involvement of the public in the various aspects of the reporting, including data gathering for indicators or parameters that do not require technical training (e.g., measuring turbidity using Secchi disk) and taking advantage of the social media in raising awareness and support for the management of the bay.
- Linking the report card to OPMBCS implementation: Utilize the report card as reference document in reporting LLDA's contribution in the clean-up and rehabilitation of Manila Bay.

#### **D.4. Accessible upscaling and replication strategy interactively with GEF Projects, countries and stakeholders for development and implementation of nutrient reduction strategies**

##### **Challenges and Constraints**

The following challenges and constraints have been identified in the upscaling and replication of processes and products developed under Component D of the GNC project. These challenges are not insurmountable. They require the continuing, coordinated commitment and effort on the part national agencies (e.g., DENR) and local governments (e.g., provincial governments), under the framework of the OPMBCS and the Manila Bay Coordinating Committee.

##### **D.1. Strengthened decision support system for Manila Bay watershed through improved nutrient data and information**

- Improved access to data from national agencies (other than DENR) and relevant local government offices.
- Monitoring of nutrients as part of regular monitoring programs in the river systems and marine waters of the Bay.
- Data consolidation in consistent data format and units of measure, and incorporation of available data from various offices into the IIMS.
- Enhanced capacity of government staff to screen and classify data, including maintaining and operationalizing the IIMS.
- Policy direction of DENR on mainstreaming IIMS into the regular function of DENR at the 3 regional offices and central office.

D.2. Building the foundations and agreement with government agencies and stakeholders on nutrient reduction strategies to be implemented in the Manila Bay watershed, including their integration into regional quality aims

- Improved coordination among different modeling projects being implemented in Manila Bay.
- Access to data specific for Manila Bay to run the PROA; the PROA developed for this project relied heavily on the use of international reference data as proxy data; PROA results are preliminary and cannot be used to make definitive decisions about strategies to adopt or actions to implement related to nutrient reduction and management.
- On-the-ground experience in nutrient reduction and management through pilot projects and demonstration of best management practices.

D.3. Development and application of ecosystem health report card in Laguna de Bay

- Policy/administrative support from LLDA Administration to upscale and replicate the report card as a planning, decision-making and communication tool.
- Enhanced interaction among scientific community/institutions and the general public in the development and preparation of the report card.
- Enhanced collaboration/involvement of local governments to assess the socio-economic benefits of policy and management interventions in sub-basins of the Laguna de Bay.

### **Good Practices and Lessons Learned**

The following are some of the good practices and lessons learned from the GNC project in Manila Bay:

Strengthening the nutrient information baseline: The assessment of the Manila Bay IIMS provided an indication of the level of data and information available on nutrients including the actual situation of IIMS operationalization at the DENR regional offices and ICM sites. The re-establishment of the Manila Bay IIMS where data from LLDA's water quality monitoring program from 1999-2012, UPMSI's water quality data from field surveys undertaken in Manila Bay on 2010 and 2012, PRRC's Unified Monitoring System and DENR and DA-BSWM's assessment of nonpoint source pollution from croplands of Manila Bay is a good start in consolidating available information to update the Manila Bay IIMS. While there are other databases on Manila Bay, such as the Manila Bay Database Resources (consisting of a comprehensive collection of data about Manila Bay collected under Subcomponent B4 of the GNC Project) and the Integrated Manila Bay Database Management System (an online system for reporting, monitoring and evaluating the performance of local governments in carrying out their Key Performance Indicators set by the Supreme Court), the IIMS remains the most comprehensive with geospatial data, biological and bioresources data, social and economic data, demographic data, governance data, pollution sources data, water resources data and environmental quality. The potential of the IIMS is yet to be maximized, pending its uptake and full use by DENR.

- Documentation of good nutrient management practices by farmers: The project has facilitated the engagement of a range of stakeholders during its implementation. The assessment of good practices in nutrient management by 62 farmers and fishers from 13 municipalities from the 5 provinces in the Manila Bay watershed has ensured that the perspective of the farmers/fishers/agricultural sector is well captured. The study suggested that decision to adopt good nutrient management practices is influenced by support received from local government offices, peers, suppliers/dealers through training and agricultural extension services rendered; their openness to new technologies; involvement in ICM activities and being recipients of agricultural benefits and incentives which they can use in their farms.
- Complementation of various reporting mechanisms: Indicator-based reporting mechanisms such as the SOC and EHRC can complement and mutually reinforce each other to maximize their value and benefits to planning and decision making. While data availability has dictated the extent and coverage of these reporting mechanisms, customizing them to suit the local conditions ensured their on-the-ground practical application.
- Synergies in modelling efforts: The project has endeavored to bring together various agencies that are implementing projects and programs on nutrient loading and ecosystem modeling in the Manila Bay watershed to foster synergy and collaboration among project implementers. Different models may still be used among projects, since each project has different scope, biases and preferences. However, common values for projection rates (e.g., population growth, climate change impact, agricultural production) as well as integrated maps may be used. The agreement to establish a common platform to share and compare data (e.g., factors, coefficients, assumptions, models) among projects is beneficial for future modeling efforts in the Bay.
- Providing strategic policy options and recommendations to pertinent government agencies: The results and recommendations from the nutrient load model and PROA provide some preliminary insights into where the most cost-effectiveness measures might lie in reducing nutrient loading into Manila Bay. Although the results are preliminary, particularly for the PROA since it relied heavily on international reference data due to lack of local data to run the model, this points to the need for improving the reliability of the model through collection of local data and the scientific understanding of nutrient pollution sources and their impacts on Manila Bay. The identified choices should therefore be reviewed by local experts and changed as needed to better match the PROAs to local conditions and preferences
- Harnessing the power of local governments: The creation of the MBNLG comprising of 8 provinces in the Manila Bay watershed can serve as an effective platform for knowledge sharing and collaborative planning among local governments to address issues and challenges on pollution reduction at the provincial and bay-wide level.

Operationalization of the network requires coordination and support from external partners until such time that the network can transform into a sustainable mechanism.

- Engaging a champion to lead the advocacy on the Manila Bay clean up. Under the Local Government Code, the responsibility to manage the coastal and marine areas and environmental management in general within their respective jurisdiction has been devolved to local governments. The role of local governments in the Manila Bay clean up and rehabilitation is therefore crucial. Local chief executives who understand the issues and can advocate for the implementation of actionable plans and programs for the short- and long-term management of Manila Bay is key. The Governor of Cavite who led the convening of the Manila Bay Network of Local Governments and the 2<sup>nd</sup> Cavite Water Summit is a potential champion.
- Learning by doing: The development of the Laguna de Bay EHRC has benefited from the experiences of Chilika Lake and Chesapeake Bay and from the technical expertise of various partners from the academe. The transfer of experiences from mature programs to new and emerging programs in the region can alleviate the challenges in developing the report card both at the technical and institutional levels.
- Communicating science and complex information in simple forms that can be easily understood by the public can be facilitated through the ecosystem health report card. It is also an effective way to promote accountability by identifying solutions and actions that each stakeholder can take on to contribute to the management of Laguna de Bay and its watershed.
- Fostering collaboration and partnerships: In all of the activities that were implemented under the GNC Project, collaboration and partnerships among and between institutions, experts, relevant sectors and various stakeholder groups within the Manila Bay watershed and selected countries in the East Asian region clearly stood out. The capacity that has been developed and access to tools and databases will facilitate the replication and upscaling of the project and further refinement and validation of the proposed strategies in nutrient reduction and management.

### **Opportunities for Upscaling and Replication**

Opportunities that will promote upscaling and replication of the GNC Project outputs, good practices and recommendations to other river basins and watersheds in the Philippines and East Asian Seas Region are grouped below into: 1) policy, institutional and legislative support specific for the Philippines, and 2) establishing enabling mechanisms for replication and scaling up.

#### **Policy, institutional and legislative support specific for the Philippines**

- **Supporting national, regional and local development plans:**

**Philippine Development Plan 2017-2022:** The GNC Project's objectives, outputs and outcomes directly contribute to the strategic direction of the Philippine Government toward establishing the foundation for sustainable development. The Philippine Development Plan 2017-2022 provides recommendations and actions for ensuring ecological integrity, clean and healthy environment (e.g., improving environmental quality by strengthening enforcement of environmental laws especially on air, water, and land quality management) and accelerating infrastructure development (e.g., implementing infrastructure programs and projects on water resources such as pursuing institutional reforms by streamlining processes in involved agencies to encourage and guide investments in water supply, sewerage, and sanitation). <http://pdp.neda.gov.ph/wp-content/uploads/2017/01/PDP-2017-2022-07-20-2017.pdf>

**Manila Bay Sustainable Development Master Plan:** The GNC Project outputs also contribute to the objectives of the Manila Bay Sustainable Development Master Plan, which is in line with the Philippine Government's objective to formulate master plans and roadmaps to ensure that the implementation of programs and projects on infrastructure development are harmonized and well-coordinated. Opportunities to communicate the results of the GNC project can be made through the partner agencies (e.g., national agencies, local governments, academe, NGOs/POs, private sector), including PEMSEA, that have been invited to serve as members of the Technical Committee. The Technical Committee together with the Steering Committee, represented by the NEDA Board Committee on Infrastructure – Technical Board, will function as Advisory Board that will be tasked to review the outputs of the Study Team.

**Operational Plan for the Manila Bay Coastal Strategy 2017-2022:** The updated OPMBCS provide opportunities for mainstreaming the outputs, good practices and recommended actions from the GNC Project in the implementation of activities that would result to the following outputs specific to the liquid wastes cluster and are relevant to the GNC Project:

- Determining industrial, commercial, and institutional (e.g. healthcare facilities) establishments discharging waste water into the Manila Bay in compliance with the general effluent standards;
- Connecting water-served population to sewerage and sanitation services;
- Enforcing monitoring and compliance to the General Effluent Standards;
- Issuance of policy on pollution prevention and control, including completion of the mathematical model;
- Enforcement of marine environmental protected laws, rules and regulations (PD 979, RA 9993 and other laws/regulations addressing marine pollution) within Manila Bay;
- Reducing pollution load from livestock and poultry;
- Determination of nutrient load from crop lands within the Manila Bay region;

- Maintaining volume of nutrient loading from aquaculture farms in the Manila Bay region within the water quality criteria;
- Monitoring of water bodies and assessing water quality parameters in compliance with the water quality guidelines (DAO 2016-08);
- Designating principal rivers draining into Manila Bay as WQMA with Governing Board created; and
- Adopting water bodies/Estero within the Manila Bay region.

Furthermore, opportunities for mainstreaming are possible under the partnership and governance/institutional arrangements cluster of OPMBCS particularly on the following:

- Integration of all existing Manila Bay database systems (MBDS, MiShare, WQRCS) integrated into one front-end system (iMBDS);
- Establishment and operationalization of a decision support system for Manila Bay;
- Establishment of Area-Based Management sites (outside WQMA areas) and monitoring the implementation of the ABM plans; and
- Establishment of Monitoring and Evaluation system.

- **Legislative support**

#### **DENR DAO 2016-08 (Water Quality Guidelines and General Effluent Standards)**

The new water quality guidelines and effluent standards were released by DENR in 2016. These guidelines and standards supersede the guidelines and standards contained in DENR DAO 34 and 35 Series of 1990 and include nitrate and phosphate as primary parameters. This provides the opportunity to strengthen water quality monitoring of relevant agencies to include nutrients, as well as compel concerned entities to set up facilities to treat and manage nutrients in waste water.

In support of the legislative agenda of the PDP 207-2022 and in addressing risks to environmental sustainability, the 17<sup>th</sup> Congress of the Philippines is reviewing relevant bills and resolutions such as the Resolution Directing the Senate Committee on Environment and Natural Resources to conduct of environmental audit of relevant national agencies and local government units in relation to their compliance to existing environmental laws. This comes in light of the continued ecosystem decline and environmental pollution, with the end view of introducing measurable indicators and targets and encouraging public accountability of all government officials. The bill is sponsored by Senator Loren Legarda.

- **Institutional arrangements**

Coordination for the implementation of the OPMBCS is facilitated through MBCO with the inter-agency Manila Bay Coordinating Committee and Manila Bay Advisory

Committee of the Supreme Court providing the oversight role and policy guidance. The regular meetings of the MBAC and the reconvening of the MBCC in 2017 (last meeting was held in 2009) can serve as high level platforms for introducing recommended policy reforms on nutrient management based on the recommendations from the GNC Project.

## **Establishing enabling mechanisms**

- **Capacity development and knowledge sharing**

Training and knowledge sharing workshops were organized with support from the GNC Project where the application of various tools and methodologies (e.g., nutrient load modeling, PROA, SOC, EHRC) were introduced to partners and collaborators from countries in the East Asian Seas Region. These included the following:

- Technical and Policy Workshop on Sustainable Nutrient Management in support of the Asian Platform of GPNM conducted on 18 November 2015 in Danang, Vietnam as part of the International Conference of the East Asian Seas Congress 2015. The workshop showcased the main technical deliverables of the GNC Project and mainstreaming of the nutrient management agenda within countries of the Asia sub-region through the Asian Regional Nutrient Management Platform of the GPNM.
- Orientation Training on the Application of a Nutrient Load Model conducted on 19 October 2016 in Manila, Philippines involving participants from the Philippines, Indonesia, Lao PDR and Vietnam. The structure of the nutrient load model for Manila Bay and its possible application to other sites were discussed. Action plans were developed for implementing the nutrient load model in the 4 countries particularly focusing on building the database to run the NLM model.
- Workshop on the Development of Pollution Reduction Opportunity Analysis for Manila Bay conducted on 20 October 2016 in Manila, Philippines involving participants from the Philippines, Indonesia, Lao PDR and Vietnam. The process of PROA development in Manila Bay and its application to other river basins and other institutions in the East Asian Seas Region were discussed.
- Regional Workshop on Ocean Health Index conducted on 13-14 March 2017 in Manila, Philippines involving representatives from seven (7) countries (Cambodia, China, Indonesia, Philippines, Thailand, Timor Leste and Vietnam).



Discussion on the application of OHI in strengthening the application of NLM and EHRC in policy and investment planning were undertaken.

Current and planned initiatives in the East Asian Seas Region on integrated river basin management provide opportunities for on-the-ground application of the tools and methodologies that were previously introduced to the various countries in the region through the training workshops conducted. These include the following:

- Batangas Bay (Philippines) Watershed Rehabilitation and Sustainable Development Project in line with the implementation and functional scaling of the ICM program of the province under the GEF/UNDP/PEMSEA Project on Scaling up the Implementation of the Sustainable Development Strategy for the Seas of East Asia. The project focuses on determining pollutant loadings from various sources in the watershed area, the identification of pollutant load reduction strategies, including socioeconomic benefits and costs, and the development of an investment plan. A pilot scale demonstration project will be undertaken to test alternatives for reducing the discharges of animal wastes from backyard operations. In addition, potential livelihood opportunities will be explored as part of the rehabilitation strategy for the watershed. The project covers eight (8) municipalities/cities spanning the watershed. Training and application of the nutrient load model will be conducted to support the development of the rehabilitation and investment plan.
- GEF/UNDP/ASEAN Project on Reducing Pollution and Preserving Environmental Flows in the East Asian Seas through the Implementation of Integrated River Basin Management (IRBM) in ASEAN Countries. The project aims improve integrated water resources management (IWRM), reduce pollution loads from nutrients and other land-based activities, sustain freshwater environmental flows and reduce climate vulnerability through demonstrations and replications, planning and strengthening of IRBM in 7 countries in the East Asian Seas (i.e., Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines and Vietnam) through the implementation of 3 component activities, i.e., baseline assessment of Source to Sea management continuum; governance for improved IRBM and knowledge management and learning.

- **Financing**

The Philippine Clean Water Act of 2004 mandates the Department of Public Works and Highways (DPWH) to prepare and implement a National Sewerage and Septage Management Program (NSSMP) requiring 17 highly urbanized cities (HUCs) to provide sewerage and septage services to minimize the adverse impacts of domestic wastewater discharges on water quality and water resources in general. The NSSMP aims to improve water quality and protect public health in urban areas of the Philippines by 2020. It was estimated that the 17 cities would need PhP 26.3 billion to undertake sewerage and

septage projects. The NSSMP adopts a bottom-up, demand-driven project development process by providing national government support and incentives.

[http://www.dpwh.gov.ph/dpwh/references/guidelines\\_manuals/NSSMP](http://www.dpwh.gov.ph/dpwh/references/guidelines_manuals/NSSMP)

DPWH indicated that the funds, set as subsidy, were unspent due to lack of interest from the 17 HUCs. In October 2017, PhP 650 million for sewerage projects was unspent. The HUCs are hesitant to apply for the subsidy because of the high cost of constructing sewerage systems. DPWH clarified that these cities are hampered by the lack of political will, the slow passage of pertinent local ordinances, conflicts between local governments and water districts, and a lack of funding for feasibility studies. An increase in the national government's subsidy to 50% for sewerage project, including septage projects and allowing other cities and first-class towns to avail of funding support is anticipated to encourage more local governments to apply. Technical support to the local governments is urgently needed to assist them in accomplishing the NSSMP application form and in the conduct of prefeasibility studies.

<http://newsinfo.inquirer.net/939521/p650m-for-sewerage-projects-in-cities-unused>

- **Local government's networking**

The MBNLG can be tapped to champion the nutrient management challenge. Linking this network to other more established networks such as the PEMSEA Network of Local Governments (PNLG) for Sustainable Development comprising of local government members that are implementing ICM from 12 countries in the East Asian Seas Region can provide the mentoring support and elevate the status of the MBNLG at the regional and international level. The Ansan Declaration, which the Province of Cavite signed as a member of the PNLG, requires the members to commit to implementing management programs that would contribute to achieving the SDG targets related to clean water and sanitation (SDG 6), climate action (SDG 13), sustainable cities (SDG 11) and life below water (SDG 14).

- **Monitoring and reporting trends and compliance**

Countries in the East Asian Seas region have committed to scale up ICM covering 25% of the regional coastline by 2021. The ICM scaling up process provides tremendous opportunities to scale up the application of the SOC reporting and EHRC as part of the monitoring and reporting mechanism for the ICM sites.

There are also champion local governments such as the Provinces of Batangas and Cavite in the Philippines where a functional environment laboratory (Batangas Environment Laboratory) is existing and setting up of new one (Cavite Water Testing Laboratory) is being undertaken. Capacity building support is needed to further strengthen (Batangas) and build capacity (Cavite) of these local governments to operationalize and sustain their environmental monitoring programs.

Overall, the GNC Project has established the necessary enabling mechanisms, albeit with recognized challenges and constraints, in contributing to existing and planned efforts toward addressing nutrient management at the local, national, regional and global levels.

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### III. Financial Report

Reporting Period: 01/01/2017 to 30/06/2018

Cumulative amount already transferred from UNEP to PEMSEA as of this reporting date: USD 181,888

Sub-Components	Original Budget (USD)	Total Expenditures as of June 2018	Activities/Outputs Supported by the GNC Project	Co-financing Contribution (in-cash and in-kind)
<b>D.1</b>				
Strengthening the decision support system for Manila Bay watershed through improved nutrient data and information	45,000	39,723.93	<ul style="list-style-type: none"> <li>• Assessment of Manila Bay IIMS; integration workshops and training</li> <li>• Development of 2nd edition Manila Bay Environmental Atlas</li> <li>• Publication and dissemination of State of the Coasts Reports of the Provinces of Bataan and Cavite</li> <li>• Documentation of good practices in nutrient management in the agricultural sector in Manila Bay watershed</li> <li>• Documentation of Philippine policies and legislations relevant to nutrient management</li> </ul>	<ul style="list-style-type: none"> <li>• In-cash <ul style="list-style-type: none"> <li>○ PEMSEA (\$ 22,601)</li> </ul> </li> <li>• In-kind (~USD 400,000 for the period March 2012 – June 2018) <ul style="list-style-type: none"> <li>○ PEMSEA (staff time in coordinating the various activities of the Project between March 2012-June 2018, including use of office facilities)</li> <li>○ Staff time of the following offices, agencies and groups through participation in various consultation workshops and activities of the project, including providing expert advice, comments and suggestions to strengthening project outputs and implementation:</li> </ul> </li> </ul>
<b>D.2</b>				
Building the Foundations and Agreement with government agencies and stakeholders on nutrient reduction strategies to be	135,000	130,672.00	<ul style="list-style-type: none"> <li>• Technical workshops on various modeling efforts in Manila Bay</li> <li>• Publication and dissemination of the report, “Total Pollutant Loading Study in the Laguna de Bay-Pasig River-Manila Bay Watershed”</li> <li>• Support to UPMSI’s study on the dynamics of hypoxia and</li> </ul>	

implemented in the Manila Bay watershed, including their integration into regional water quality aims			<p>eutrophication in Manila Bay and nutrient load model application</p> <ul style="list-style-type: none"> <li>• Publication and dissemination of the report, “Toward a Comprehensive Watershed Management Strategy for Manila Bay”</li> <li>• Development of Pollution Reduction Opportunity Analysis (PROA) for the Manila Bay watershed, Cavite and Pampanga Province, including convening of technical workshops</li> <li>• Convening of the Manila Bay Governor’s Forum; signing of the Memorandum of Agreement establishing the Manila Bay Network of Local Governments</li> <li>• Convening of the 2<sup>nd</sup> Cavite Water Summit</li> </ul>	<ul style="list-style-type: none"> <li>▪ Department of Environment and Natural Resources: Manila Bay Coordinating Office, River Basin Control Office, Environmental Management Bureau, Laguna Lake Development Authority, National Mapping Resource and Information Authority, Pasig River Rehabilitation Commission, Regional Offices (National Capital Region, Region 3 and 4A)</li> <li>▪ Department of Agriculture: Bureau of Fisheries and Aquatic Resources; Bureau of Soils and Water Management; Agriculture Training Institute; Fertilizer and Pesticide Authority; Bureau of Agricultural Industry; National Meat and Inspection Service</li> <li>▪ Local Governments: Provinces of Bataan, Cavite, Bulacan, Laguna, Nueva Ecija, Pampanga, Rizal, Tarlac</li> </ul>
<b>D.3</b>				
Development and application of an ecosystem health report card on nutrients in Chilika Lake and Laguna de Bay	25,000	41,606.00	<ul style="list-style-type: none"> <li>• Expert Group Meeting and Inception Workshop to develop indicators to assess ecosystem health (Odisha, India; June 2012)</li> <li>• Expert Group Meetings to develop the Laguna de Bay ecosystem health report card</li> <li>• Stakeholders consultation workshop</li> <li>• Launching of the report card</li> <li>• Publication and dissemination of the report card</li> <li>• Sustainability plan</li> </ul>	

<b>D.4</b>				
Consolidation of lessons learned for replication, holding of workshop for dissemination and up-scaling	30,000	23,854.53	<ul style="list-style-type: none"> <li>• Support to various capacity building and knowledge sharing events (e.g., Asia Oceania Geosciences Society American Geophysical Union (AOGS-AGU) (WGPM) Joint Assembly 2012; ECSA 55 Conference, September 2015; East Asian Seas Congress, November 2015; Regional Training on the Application of Nutrient Load Model, October 2016; Workshop on PROA development, October 2016; 8<sup>th</sup> International Symposium on Marine Pollution and Ecotoxicology, June 2016; Regional Workshop on Ocean Health Index, March 2017)</li> <li>• Replication and upscaling strategy</li> </ul>	<ul style="list-style-type: none"> <li>▪ University partners: UP Marine Science Institute, UP Los Banos, University of Santo Tomas, Cavite State University</li> <li>▪ Private sector partners: MWCI, MWSI, BCCF</li> <li>▪ Other national agencies: DILG, DPWH, DOST, PCG, PSA, PIA, DTI, DEPED, MMDA, LWUA</li> </ul>
<b>TOTAL COST</b>	<b>235,000</b>	<b>235,856.46</b>		

Signature of a duly Authorized Officer:



Name: Mary Ann de la Pena

Position: Finance Specialist

Date: 30 July 2018



## Annex 1. Project Results Framework

<b>Outcome 1:</b> Strengthened decision support systems on nutrient issues in Manila Bay watershed as part of integrated approach to overall water quality in region.				
<b>Output</b>	<b>Indicator</b>	<b>Baseline</b>	<b>Target</b>	<b>Results/Outputs</b>
Strengthened information on reporting on nutrient issues in Manila Bay watershed	<ul style="list-style-type: none"> <li>Report with presentation of consolidated baseline data for nutrient reduction analysis along with indicators on nutrient sources and impacts</li> <li>Report on nutrient over-enrichment status as well as nutrient policies, regulations and best practices</li> </ul>	<p>Wide ranging information available but lack of overview of nutrient status and indicators.</p> <p>No current inventory of single source of best practices: information dispersed.</p>	<ul style="list-style-type: none"> <li>Strengthened Integrated Information and Management System, including insertion of nutrient over-enrichment and reduction issues in State of the Coasts Report</li> <li>Nutrient baseline substantially improved along with awareness of importance and raised awareness of project aims/importance</li> <li>Development and application of appropriate stress reduction and environmental quality status indicators</li> <li>Baseline established as to what best practices are available and key sectors engaged on importance of tackling nutrient issues as part of</li> </ul>	<ul style="list-style-type: none"> <li>Manila Bay Integrated Information Management System established</li> <li>Manila Bay Environmental Atlas second edition published and disseminated by DENR MBCO</li> <li>State of the Coasts Reports of the Provinces of Bataan and Cavite published and disseminated</li> <li>Assessment of good practices and lessons learned in nutrient management in the agricultural sector in Manila Bay watershed completed in collaboration with ATI</li> <li>Review of Philippine policies and legislations related to nutrient management completed</li> </ul>

			overall water quality efforts	
Output	Indicator	Baseline	Target	Results
Establishing the foundations for nutrient reduction strategies in the Manila Bay watershed based on source-impact modeling and best practices	<ul style="list-style-type: none"> <li>• Workshop and case studies on modeling/best practices work</li> <li>• Agreements with stakeholders on process towards nutrient reduction strategies with illustrative stress reduction and environmental quality indicators</li> <li>• Outline of nutrient reduction strategies produced before workshop and agreed with stakeholders</li> </ul>	Strong policy commitment for comprehensive clean-up of Manila Bay, including addressing root causes of poor water quality, albeit lack of specificity on role of nutrient over enrichment	Demonstration of efficacy and policy relevance of first version of models developed under Component B or Manila Bay. Support among stakeholders for taking forward nutrient reduction strategies based on application of modelling	<ul style="list-style-type: none"> <li>• Total Pollutant Loading Study in the Laguna de Bay-Pasig River-Manila Bay watershed published and disseminated</li> <li>• Toward a Comprehensive Watershed Management Strategy for Manila Bay: The International Experience and Lessons Learned published and disseminated</li> <li>• Technical Workshops on Nutrient Loading and Ecosystem Modeling in the Manila Bay watershed conducted focusing on the preliminary outputs of the nutrient loading and ecosystem response models of UPMSI, LLDA and UPNHRC.</li> <li>• Measures to rehabilitate Manila Bay presented to the Manila Bay Advisory Committee of the Supreme Court of the Philippines</li> </ul>
Development and application of the final source-impact models for Manila Bay in developing nutrient reduction	<ul style="list-style-type: none"> <li>• Workshop with agreements with different stakeholders on nutrient reduction strategies to be implemented, along with appropriate indicators</li> <li>• Experts from all appropriate agencies, scientific bodies and key sectors, trained in</li> </ul>	Baseline provided by previous outputs	Effective development and application of source-impact modeling and policy tool box	<ul style="list-style-type: none"> <li>• Orientation Training on the Application of Nutrient Load Model and Workshop on the Development of Pollution Reduction Opportunity Analysis conducted in collaboration with UPMSI and WRI</li> <li>• Series of consultation workshops for the development of Manila Bay PROA conducted.</li> </ul>

strategies	application and use of source-impact modeling/tool box <ul style="list-style-type: none"> <li>• Report to DENR Technical Working Group</li> </ul>			
Development and adoption of final integrated nutrient reduction strategies	<ul style="list-style-type: none"> <li>• Final draft nutrient reduction strategies submitted to DENR Technical Working Group for final agreement</li> </ul>			<ul style="list-style-type: none"> <li>• Manila Bay Network of Local Governments established through the signing of a Memorandum of Agreement involving the 8 provinces in the Manila Bay watershed during the Manila Bay Governor's Forum</li> <li>• Challenges and opportunities to clean up, rehabilitate and restore Manila Bay presented and discussed during the Manila Bay Governor's Forum</li> <li>• Cavite Water Summit convened where the Cavite Declaration on Water Management to Achieve Sustainable Water Supply and Sanitation was signed</li> <li>• PROA models for Manila Bay and the Provinces of Cavite and Pampanga including the User's Guide and Reference Database on technologies and costs completed in collaboration with WRI</li> </ul>
<b>Output</b>	<b>Indicator</b>	<b>Baseline</b>	<b>Target</b>	<b>Results</b>
Development and application of ecosystem nutrient	<ul style="list-style-type: none"> <li>• Stakeholder workshop in Laguna Lake attended by all leading stakeholders/agencies/sectors</li> <li>• Draft management for</li> </ul>	Baseline set by work in Lake Chilika and earlier LOICZ work, as well	Ecosystem health card embracing nutrient budget model and implementation plan for Laguna Lake, including stress reduction	<ul style="list-style-type: none"> <li>• Laguna de Bay ecosystem health report card published and disseminated</li> <li>• Report card launched in conjunction with the 4<sup>th</sup> PSC meeting in Manila, Philippines in February 2016</li> </ul>

health report card to Lake Laguna, Manila Bay	<ul style="list-style-type: none"> <li>• applying report card</li> <li>• Agreed ecosystem health report card for Laguna Lake published and disseminated on web based platform containing stress reduction and environmental quality status indicators,</li> <li>• Management plan for implementation of report card in Laguna Lake areas, including as part of broader nutrient reduction strategies</li> </ul>	as current reporting system for Laguna Lake	and environmental quality status indicators, and contributing to overall nutrient reduction strategies for Manila Bay watershed	<ul style="list-style-type: none"> <li>• Sustainability plan on the application of ecosystem health report card completed</li> </ul>
<b>Output</b>	<b>Indicator</b>	<b>Baseline</b>	<b>Target</b>	<b>Results</b>
Replication and upscaling strategy	<ul style="list-style-type: none"> <li>• Report following small feedback workshop, published on implications and potential for replication and upscaling and disseminated on the web-based platform for catalytic exchange among stakeholders, including policy makers and GEF projects.</li> </ul>		Effective testing and development of source-impact modeling and policy toolbox with conclusions clearly drawn as to potential for upscaling and replication by end of project as contribution to overall project outcomes and sustainability at Component A replication and upscaling.	<ul style="list-style-type: none"> <li>• Replication and upscaling strategy and lessons learned from the implementation of Component D incorporated into the final report</li> </ul>

## Annex 2. List of major activities, outputs and publications

Sub-component	Major Activities	Major Outputs
<b>D.1</b>		
Strengthening the decision support system for Manila Bay watershed through improved nutrient data and information	<p><u>Integrated Information Management System</u></p> <ul style="list-style-type: none"> <li>Assessment of the Manila Bay Area Integrated Information Management System conducted in April – May 2012</li> <li>Manila Bay IIMS Integration Workshops conducted on August 22-24 and September 25-27, 2012</li> <li>Training on IIMS Query System and Linkage to GIS conducted on 20-22 February 2013</li> <li>Updating of the IIMS database to include data from the Laguna Lake Development Authority's (LLDA) water quality monitoring program, University of the Philippines Marine Science Institute (UPMSI) water quality data from field surveys undertaken in Manila Bay in 2010 to 2012 and DENR and Department of Agriculture-Bureau of Soils and Water Management's assessment of nonpoint source pollution from croplands of Manila Bay system</li> <li>IIMS data used in UPMSI's hydrodynamic and watershed modeling</li> </ul> <p><u>Manila Bay Environmental Atlas</u></p> <ul style="list-style-type: none"> <li>Concept paper for the updating of MBEA prepared</li> <li>Planning workshops with MBCO conducted on 27 June 2013 and November and December 2013 on the updating of the Atlas to delineate the linkages with the Manila Bay IIMS and SOC Reports of the provinces, including its collaborative effort with the National Mapping and Resource Information Authority for the preparation of thematic maps and inclusion of the updated Atlas into the Philippine Geoportal</li> <li>Consultation workshops on the updating of the Manila Bay Atlas conducted on May 12, 2014, May 28, 2014, September 14, 2014</li> <li>Write shops on the updating of the MBEA conducted on 29-30 September 2014 and 28-30 October 2014</li> </ul>	<ul style="list-style-type: none"> <li>Report on the Assessment of the Manila Bay Area IIMS Database</li> <li>Updated Manila Bay Area IIMS</li> <li>2<sup>nd</sup> edition of Manila Bay Environmental Atlas published in 2015</li> </ul>

	<p><u>State of the Coasts Report</u></p> <ul style="list-style-type: none"> <li>• Inception workshops on the preparation of SOC for Bataan conducted on January 25, 2013 and for Cavite on 4 September 2013</li> <li>• Stakeholder consultation and validation workshops conducted for Bataan on November 19, 2013; February 25, 2014; March 20, 2014; December 4, 2014; June 30, 2015 and for Cavite on February 10, 2014; January 14, 2015</li> <li>• Write shops conducted in 2016</li> </ul> <p><u>Good Practices/Lessons Learned in Nutrient Management in the Agricultural Sector in the Manila Bay Watershed</u></p> <ul style="list-style-type: none"> <li>• MOU signed with the Department of Agriculture - Agriculture Training Institute (ATI) in May 2013 to undertake a documentation and compilation of the various good practices/lessons learned in nutrient management in the agricultural sector in the Manila Bay watershed, covering chemical fertilizers, animal wastes and aquaculture.</li> <li>• Survey questionnaire prepared and field surveys conducted at selected provinces in the Manila Bay watershed (i.e., Bataan, Bulacan, Pampanga, Laguna and Nueva Ecija) involving 62 respondents from the 5 provinces</li> <li>• Report submitted as entry for Outstanding Research Paper on Extension Award under the Philippine Extension Network, Inc.</li> </ul> <p><u>Philippine Policies and Legislations Relevant to Nutrient Management</u></p> <ul style="list-style-type: none"> <li>• Philippine policies and legislations relevant to nutrient management drafted and disseminated to DENR Environmental Management Bureau and Regional Offices, Metropolitan Waterworks and Sewerage System, Manila Water Company, Inc. and Maynilad Water Services, Inc. for comments.</li> <li>• Draft final report on Philippines Policies and Legislations Relevant to Nutrient Management completed</li> </ul>	<ul style="list-style-type: none"> <li>• State of the Coasts Reports of the Provinces of Bataan and Cavite published in 2017</li> <li>• Report on the Assessment of Good Practices and Lessons Learned in Nutrient Management in the Agricultural Sector in Manila Bay Watershed</li> <li>• Report on Review of Philippine Policies and Legislations on Nutrient Management</li> </ul>
<b>D.2</b>		
Building the Foundations and Agreement with government agencies and	<p><u>Pollutant Loading and Modeling Efforts in Manila Bay</u></p> <ul style="list-style-type: none"> <li>• Meeting with UPMSI conducted on February 7, 2014 to discuss the planning and organization of the technical workshop on modeling</li> <li>• Meeting on the Manila Bay modelling study of UP National Hydraulics Research Center conducted on September 11, 2014</li> </ul>	<ul style="list-style-type: none"> <li>• Technical Workshop Reports on Nutrient Loading and Ecosystem Modeling in the Manila Bay focusing on the</li> </ul>

<p>stakeholders on nutrient reduction strategies to be implemented in the Manila Bay watershed, including their integration into regional water quality aims</p>	<ul style="list-style-type: none"> <li>• First and second technical workshops on nutrient loading and ecosystem modeling in the Manila Bay watershed conducted on April 10, 2014 and October 8, 2014 focusing on the preliminary outputs of the nutrient loading and ecosystem response model that UPMSI, LLDA, UP National Hydrological Research Center, BSWM and other agencies are working on</li> <li>• Presentation to the Supreme Court – Manila Bay Advisory Committee entitled, Rehabilitation and Management of Manila Bay: Changing Times and Changing Circumstances was made by DENR-MBCO, PEMSEA, UPMSI, UPNHRC, LLDA, DA-BSWM and DOST-PNRI during their meeting on November 14, 2014.</li> </ul> <p><u>Support to LLDA on Total Pollutant Loading Study</u></p> <ul style="list-style-type: none"> <li>• Total Pollutant Loading Study in the Laguna de Bay-Pasig River-Manila Bay Watershed for the period 2015, 2020 and 2025 completed in collaboration with LLDA</li> </ul> <p><u>Support to UPMSI on the Development and Application of Manila Bay Nutrient Load Model</u></p> <ul style="list-style-type: none"> <li>• Understanding the Dynamics of Hypoxia and Eutrophication in Manila Bay through Hydrodynamic and Watershed Modeling (August 2012 – January 2013)</li> <li>• Development of Regional Models for Coastal Effects under Different Physical Regimes using Regional Data for Manila Bay (May 2015 – November 2015)</li> <li>• Meeting with Albert Bleeker, WRI and UPMSI to discuss the feasibility of interfacing the calculator function of the nutrient policy toolbox with the Manila Bay modeling component conducted on 28 March 2016</li> </ul> <p><u>Manila Bay Clean up Strategies, Policy Analysis and Case Studies</u></p> <ul style="list-style-type: none"> <li>• Manila Bay clean up strategies, policy analysis and case studies completed in collaboration with WRI</li> </ul>	<p>preliminary outputs of the nutrient loading and ecosystem response models of UPMSI, LLDA and UPNHRC.</p> <ul style="list-style-type: none"> <li>• Presentation to the Manila Bay Advisory Committee of the Supreme Court of the Philippines on measures to rehabilitate Manila Bay</li> <li>• Report on Total Pollutant Loading Study in the Laguna de Bay-Pasig River-Manila Bay watershed published in 2013</li> <li>• Progress reports which are consolidated into Subcomponent B4's outputs</li> <li>• Toward a Comprehensive Watershed Management Strategy for Manila Bay: The</li> </ul>
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	<p><u>Development of Pollution Reduction Opportunity Analysis (PROA) for Manila Bay</u></p> <ul style="list-style-type: none"> <li>• Kick off meeting for the development of Manila Bay PROA conducted on March 29, 2016 in collaboration with WRI and UPMSI</li> <li>• Meeting with agencies/stakeholders to discuss data availability and access for the development of the Manila Bay PROA conducted on March 30 and April 15, 2016</li> <li>• Draft and final PROA models for Manila Bay and the Provinces of Cavite and Pampanga developed, including the User's Guide and reference database on technologies and costs, in collaboration with World Resources Institute</li> </ul> <p><u>Policy forum: Manila Bay Governor's Forum</u></p> <ul style="list-style-type: none"> <li>• Planning meetings for the organization of the Manila Bay Governor's Forum conducted on October 25, 2016; November 4, 2016; November 8, 2016; November 14, 2016, February 15, 2017 in collaboration with the Provincial Governments of Cavite and Pampanga</li> <li>• Manila Bay Governor's Forum conducted on March 23, 2017 involving the 8 provinces in the Manila Bay watershed, including the Supreme Court and concerned national agencies to present and discuss the policy options for nutrient reduction in Manila Bay</li> <li>• MOU establishing the Manila Bay Network of Local Governments signed</li> </ul> <p><u>Policy Forum: 2<sup>nd</sup> Cavite Water Summit</u></p> <ul style="list-style-type: none"> <li>• 2<sup>nd</sup> Cavite Water Summit with the theme, "Water Security for All: Pathways, Innovations and Outcomes", conducted on November 9-10, 2017</li> <li>• Cavite Declaration on Water Management to Achieve Sustainable Water Supply and Sanitation signed</li> </ul>	<p>International Experience and Lessons Learned published in 2015</p> <ul style="list-style-type: none"> <li>• PROA models for Manila Bay and the Provinces of Cavite and Pampanga</li> <li>• PROA User's Guide and Reference Database on technologies and costs</li> <li>• MOU establishing the Manila Bay Network of Local Governments involving the 8 provinces in the Manila Bay watershed</li> <li>• Presentation on challenges and opportunities to clean up, rehabilitate and restore Manila Bay</li> <li>• Cavite Declaration on Water Management to Achieve Sustainable Water Supply and Sanitation</li> </ul>
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	<ul style="list-style-type: none"> <li>• Cavite SOC Report launched</li> </ul>	
<b>D.3</b>		
Development and application of an ecosystem health report card on nutrients in Chilika Lake and Laguna de Bay	<p><u>Chilika Lake Ecosystem Health Report Card</u></p> <ul style="list-style-type: none"> <li>• Expert Group Meeting and Inception Workshop to Develop Indicators to Assess Coastal Ecosystem Health organized by Chilika Lake Development Authority and conducted on June 25-27, 2012</li> <li>• Chilika Lake 2012 Ecosystem Health Report Card published and disseminated</li> </ul> <p><u>Laguna de Bay Ecosystem Health Report Card</u></p> <ul style="list-style-type: none"> <li>• Workshop on the Development of Ecosystem Health Report Card for Laguna Lake conducted on December 12-13, 2013 in collaboration with UNEP, LLDA, University of Maryland Center for Environmental Science and Chilika Development Authority.</li> <li>• Series of meetings with LLDA conducted on the issuance of a Memorandum Order on the Creation of a Technical Working Group on the Development of Laguna de Bay Ecosystem Health Report Card and development of work plan for the completion of the report card.</li> <li>• Second Workshop on the Development of Ecosystem Health Report Card for Laguna de Bay conducted on June 2-3, 2015 with the participation of the LLDA TWG, University of Maryland Center for Environmental Science and external experts from the University of the Philippines-Marine Science Institute, University of the Philippines-Los Baños, University of Santo Tomas, Bureau of Fisheries and Aquatic Resources</li> <li>• Stakeholders dissemination workshop on the Laguna Lake Ecosystem Health Report Card conducted on 28 October 2015</li> <li>• Laguna de Bay Ecosystem Health Report Card launched and GPNM Stakeholders Forum conducted on February 5, 2016</li> <li>• Sustainability plan for the application of the ecosystem health report card in Laguna de Bay developed</li> </ul>	<ul style="list-style-type: none"> <li>• Chilika Lake Ecosystem Health Report Card published in 2013</li> <li>• Memorandum Order No 2014-53 creating the LLDA Technical Working Group</li> <li>• Laguna de Bay Ecosystem Health Report Card published in 2016</li> <li>• Sustainability Plan on the Application of EHRC in Laguna de Bay</li> </ul>
<b>D.4</b>		
Consolidation of lessons learned for replication, holding	<p><u>Capacity development and knowledge sharing</u></p> <ul style="list-style-type: none"> <li>• Technical and Policy Workshop on Sustainable Nutrient Management in support of the Asian Platform of GPNM conducted on 18 November 2015 in</li> </ul>	<ul style="list-style-type: none"> <li>• Terminal report incorporating challenges and constraints, good practices and lessons</li> </ul>

<p>of workshop for dissemination and up-scaling</p>	<p>Danang, Vietnam as part of the International Conference of the East Asian Seas Congress 2015</p> <ul style="list-style-type: none"> <li>• Orientation Training on the Application of a Nutrient Load Model conducted on 19 October 2016 in Manila, Philippines involving participants from the Philippines, Indonesia, Lao PDR and Vietnam</li> <li>• Workshop on the Development of Pollution Reduction Opportunity Analysis for Manila Bay conducted on 20 October 2016 in Manila, Philippines involving participants from the Philippines, Indonesia, Lao PDR and Vietnam</li> <li>• Regional Workshop on Ocean Health Index conducted on 13-14 March 2017 in Manila, Philippines involving representatives from seven (7) countries (Cambodia, China, Indonesia, Philippines, Thailand, Timor Leste and Vietnam)</li> <li>• Support to UPMSI staff to attend the Asia Oceania Geosciences Society and American Geophysical Union Western Pacific Geophysics Meeting on 13-17 August 2012 in Singapore to present the results of the nutrient load estimates for Manila Bay using population data</li> <li>• Support to UPMSI staff to attend the ECSA 55 Conference on 6-9 September 2015 in London, UK to present the results of the Study on Nutrient Loading to Manila Bay from Domestic and Agricultural Activities</li> <li>• Support provided to DENR-MBCO staff to attend the 8<sup>th</sup> International Conference on Marine Pollution and Ecotoxicology on 20-24 June 2016, in Hong Kong to present the Pasig River Unified Monitoring Program</li> </ul> <p>Replication and upscaling strategy</p> <ul style="list-style-type: none"> <li>• Challenges and constraints, good practices and lessons learned from the implementation of Component D incorporated into the final report, including opportunities for replication and upscaling</li> </ul>	<p>learned from the implementation of Component D, including opportunities for replication and upscaling</p>
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