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PROCEEDINGS OF TWINNING WORKSHOP ON TOTAL MAXIMUM DAILY LOAD (TMDL)

Manila, Philippines
18–21 May 2009

GEF UNDP UNOPS PEMSEA

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A. INTRODUCTION

i. The Twinning Workshop on Total Maximum Daily Load (TMDL) was held at the Crowne Plaza Galleria Manila Hotel, Philippines, from 18 to 21 May 2009. The workshop was co-organized by PEMSEA and the Korea Maritime Institute (KMI)/PEMSEA Twinning Secretariat, supported by the Ministry of Land, Transport and Maritime Affairs (MLTM) of Republic of Korea, and hosted by Department of Environment and Natural Resources (DENR) of the Philippines.

ii. The Workshop was attended by participants from Indonesia, People's Republic of China, and the Philippines. Resource persons for the workshop were from RO Korea and the United States. Representatives from the United Nations Industrial Development Organization (UNIDO) and United States Agency for International Development (USAID) were also invited as observers.

iii. The workshop aimed to: 1) share good practices and challenges on Integrated River Basin and Coastal Area Management (IRBCAM); and 2) develop TMDL capacity among IRBCAM sites as a means of strengthening pollution reduction planning and implementation.

iv. The full list of participants and the workshop programme are attached as Annexes 1 and 2, respectively.

B. OPENING CEREMONY

i. On behalf of PEMSEA, Prof. Raphael P.M. Lotilla, Executive Director, PEMSEA Resource Facility (PRF), welcomed the participants to the workshop and expressed his gratitude to Director Seon-Tae Kim of MLTM (RO Korea) as well as Undersecretary Demetrio Ignacio of DENR (Philippines) for their participation. He expressed his appreciation to MLTM, KMI and the Twinning Secretariat for their continued support to the series of twinning workshops and to the DENR for hosting this workshop. He emphasized the importance of IRBCAM considering the close interaction between land and sea which has been recognized in various international conferences and reports on coastal management. He also reiterated the benefit of the Twinning Arrangements on IRBCAM which accelerate development and implementation of IRBCAM at the pollution hotspots in the seas of East Asia through forging partnerships and mutual learning among the Twinning Network Sites. He encouraged all the participants including the PRF staff to actively interact and learn the activities of respective sites and deepen the understanding on IRBCAM, especially on TMDL. Finally, he wished the workshop success.

ii. On behalf of MLTM, Director Kim expressed his gratitude to Prof. Lotilla and Undersecretary Ignacio. He also expressed his appreciation to PEMSEA, KMI

and the Twinning Secretariat for co-organizing the workshop and DENR of the Philippines for hosting the workshop. He further conveyed his thanks to Prof. Chul-Hwan Koh from Seoul National University (RO Korea) and all the participants including the experts from Chesapeake Bay Programme (U.S.A). He emphasized the importance of the series of Twinning Workshops which have been conducted since 2005 as venues for promoting information sharing and cooperation on IRBCAM among the sites which have been facing similar challenges on coastal and ocean environment such as water pollution and deterioration of marine ecosystems and habitats. He hoped that the experiences and lessons learned through establishment of the Total Pollution Load Management System (TPLMS) in Masan-Chinhae Bay, RO Korea, could help other Twinning Sites improve coastal and marine environment. He reiterated MLTM's continuous support and commitment to PEMSEA including Twinning Arrangements, PEMSEA's obtaining legal personality, hosting the East Asian Seas Congress 2012 in Yeosu, RO Korea, and implementation of the Sustainable Development Strategy for the Seas of East Asia (SDS-SEA). He highlighted the establishment of the PEMSEA Twinning Secretariat in June 2008 at KMI and stated full support for the Secretariat to promote and facilitate information exchanges and cooperation among participating countries/sites. He expected fruitful discussions throughout the workshop and useful recommendations that may serve as a guide for promoting the Twinning Arrangements.

iii. On behalf of the Philippine DENR, Undersecretary Demetrio Ignacio expressed his sincere gratitude to PEMSEA, KMI and the PEMSEA Twinning Secretariat for organizing this important workshop in Manila. He also extended his appreciation to MLTM for the financial support for the conduct of the workshop. He highlighted that the Supreme Court of the Philippines passed a decision in 2008 mandating 12 government agencies to perform certain functions relating directly or indirectly to the clean up, rehabilitation, protection and preservation of Manila Bay, and that DENR in particular was directed to fully implement the Operational Plan for the Manila Bay Coastal Strategy, which serves as a road map for the management and protection of Manila Bay and its watershed areas. He stated that this Twinning Workshop on TMDL is timely considering the various efforts of government agencies and local governments units in rehabilitating Manila Bay. He expressed his confidence that the workshop would provide an opportunity for the representatives from the various local government agencies and officials not only in Manila Bay but also in the Marilao-Meycauayan-Obando (MMO) River Basin as well as Jakarta Bay and Bohai Sea to make one step forward towards formulating an effective pollution reduction strategy for their respective areas. In line with this, he appreciated that representatives from the Chesapeake Bay and Masan-Chinhae Bay, who are experts in designing and implementing TMDL, are providing the necessary support. He encouraged the members of the Twinning Network to take advantage of this opportunity to discuss and learn from these experts and share experiences on pollution reduction with other sites. Finally, he congratulated the organizers for making the event possible and wished the workshop success.

iv. The Opening Ceremony Programme is attached as Annex 3.

C. ORGANIZATIONAL MATTERS

i. Dr. Chul Hwan Koh from the Seoul National University of RO Korea served as the Chair of the first day of the workshop.

ii. Mr. David Nemazie from the University of Maryland Center for Environmental Science (U.S.A.) served as the facilitator from the second to fourth day of the workshop.

1.0 OBJECTIVES AND STRATEGIES FOR TWINNING ARRANGEMENTS

1.1 Dr. Jong-Doeg Kim, Head of the PEMSEA Twinning Secretariat presented the SDS-SEA implementation and the Strategy for Twinning Arrangements. He provided the background of the Twinning Arrangement on IRBCAM, explaining how it is placed in the GEF/UNDP/UNOPS Project for Implementation of the Sustainable Development Strategy for the Seas of East Asia (SDS-SEA). The three main elements of the Twinning Arrangements, namely: 1) capacity development for establishing an enabling environment for IRBCAM through training and technology transfer, among others; 2) building championships of the Local Chief Executives through study tours to developed sites, etc.; and 3) forging partnerships by sharing knowledge and experiences, such as Twinning Workshops and establishing a website and releasing a newsletter were introduced. The establishment of the PEMSEA Twinning Secretariat, hosted by KMI and funded by MLTM, in June 2008 was highlighted as one of the progresses made.

2.0 OVERVIEW OF COASTAL STRATEGY IMPLEMENTATION IN POLLUTION HOTSPOTS

2.1 Overviews of the coastal strategy implementation in Manila Bay, Jakarta Bay and Bohai Sea were reported.

Overview of the Operational Plan for the Manila Bay Coastal Strategy

2.2 An overview of the Operational Plan for the Manila Bay Coastal Strategy (OPMBCS) was introduced by Dr. Vicente Tuddao, Jr., River Basin Control Office, DENR, Philippines. The results of the risk assessment and ongoing monitoring programme, which demonstrate a serious environmental state, such as decrease in mangrove covered areas, heavy metal contamination in shellfish, and high fecal coliform in the water among others, were presented. It was informed that the three main components of the OPMBCS are: 1) water pollution; 2) habitats and resources; and 3) partnerships and governance. Relating to pollution reduction, one of the objectives is to reduce by 50 percent the discharge of raw sewerage, septage and untreated wastewater by 2015. It was emphasized that the decision of the Supreme Court on Manila Bay in 2008 mandated all the concerned agencies to implement the OPMBCS in accordance with their functions for clean up, rehabilitation, protection and preservation of the Bay.

Overview of Coastal Strategy Implementation Plan of Jakarta Bay

2.3 Ms. Heni Agustina, Ecosystem Rehabilitation Division of the Ministry of Environment, Indonesia, presented the Coastal Strategy Implementation Plan of Jakarta Bay. She introduced the environmental status of Jakarta Bay, including heavy load of solid waste to Jakarta Bay, i.e., around 500,000 tons per year, and high pollutant load from 13 rivers which is mainly from domestic/human wastewater. Securing budget for environmental investment such as pollution reduction was identified as a challenge since the prioritized programmes of the government are mainly on poverty alleviation and human health. Under the Strategy for Jakarta Bay Integrated Management, several programmes and initiatives have been implemented including: 1) the clean river programme; 2) the industrial pollution reduction programme; 3) the solid waste reduction programme through 3Rs (Reduce, Reuse and Recycle); and 4) building a partnership agreement on pollution and degradation control of Ciliwung River Basin among the governments of Java Barat Province, Regency/City of Bogor, Depok City and DKI Jakarta Province through the coordination of the Ministry of Environment.

Overview of Sustainable Development Strategy and Implementation Plan of Bohai Sea

2.4 The status and progress of the Sustainable Development Strategy (SDS) of Bohai Sea was presented by Dr. Zhang Zhifeng, National Marine Environmental Monitoring Center, PR China. During the past years, capacity of urban sewage treatment has improved and the ecosystem-based river basin management and Industry Cleaner Production projects have been established in the three river basins, namely Liaohe, Haihe and Yellow rivers. Despite the efforts of the sewage treatment capacity enhancement, apparent decrease in polluted area in Bohai Sea has not been observed. In order to accelerate pollution reduction under the framework of the SDS of Bohai Sea, the following actions have been implemented: 1) upgrading urban wastewater treatment capacity; 2) encouraging ecosystem-based management of river basin and coastal areas; and 3) capacity building on marine environment monitoring and assessment by SOA. Some identified future challenges include: 1) pollution from nonpoint sources including agriculture and atmospheric deposition; 2) cooperation among stakeholders to ensure consistent monitoring, management and research; and 3) quantification of environmental carrying capacity of Bohai Sea.

3.0 INTEGRATED APPROACHES TO RIVER BASIN AND COASTAL AREA MANAGEMENT AMONG MATURE PROGRAMS

3.1 Two examples of mature programs on river basin and coastal area management were presented, namely Chesapeake Bay Programme, U.S.A., and Masan-Chinhae Bay Program, RO Korea.

The Chesapeake Bay Programme

3.2 Dr. Robert Summers, Deputy Secretary, Maryland Department of the Environment, U.S.A., presented the status of the implementation of the Chesapeake Bay Programme. He emphasized that the Clean Water Act (CWA) provides the basic institutional mechanisms for regulating discharges of pollutants to waters in the U.S. and that the law enables the U.S. Environment Protection Agency (EPA) to delegate its duties such as issuance of permissions, administration and enforcement of the CWA to state governments. He indicated that, in line with the focus of the CWA, it evolves from point source to nonpoint source and municipal stormwater, the National Pollution Discharge Elimination System (NPDES) Permits also changes its focus from treatment of municipal and industrial wastewater to pollution control measures for large- and medium-sized stormwater systems. In 1990s, the CWA increased emphasis on watershed approach including TMDLs, while NPDES Permits focused on pollution control measures for animal farms. After the Chesapeake Bay Agreement of 1983 which set the stage for the collaborative multi-state/federal partnership, the quantitative nutrient reduction goals have been appropriately revised based on the assessments of the environment of the Bay. In its environmental performance report titled “The Bay Barometer,” it is clearly shown that the environmental goals of the Bay have not been met even over 25 years of efforts, having 38 percent of the health and 81 percent of the restoration of the Bay achieved. In 2008, the Chesapeake Bay Executive Council formally acknowledged that the 2010 goal would not be met and directed the Chesapeake Bay Programme Office to lead an interstate effort to: 1) complete the TMDL by January 2011; 2) set short-term, two-year milestones for accelerating nutrient reduction; and 3) establish contingency plans that must be implemented if milestones will not be achieved.

The Masan-Chinhae Bay Programme

3.3 Dr. Jae-Young Lee, MLTM, presented an overview of the Total Pollutant Load Management System (TPLMS) National Plan of Masan-Chinhae Bay, the first plan of its kind in RO Korea. He explained that the severe environmental problems such as massive reclamation and heavy sewage discharge in the late 1970s followed by the designation as a Special Management Area (SMA) in 2000 under the Marine Environment Pollution Prevention Act led to the development of TPLMS of the Bay. In 2008, the TPLMS was established. It consists of four main strategies: 1) ensuring incremental and sustainable management based on management priority; 2) application of the precautionary approach and establishment of an integrated watershed management system; 3) establishment of firm scientific platform to support decision-making processes; and 4) encouraging participation of and cooperation with local stakeholders. To enable effective implementation and fast improvement of the environment of the Bay, management priority is set as follows in the TPLMS: 1) Chemical Oxygen Demand (COD) is the first priority followed by total phosphorous (TP) and total nitrogen (TN) in terms of controlling the pollutants; and 2) investment for land-based point sources is the first priority followed by ecosystem restoration and dredging. The TPLMS focuses on the water quality index of: 1) COD in the first phase (2007-2011); 2) COD, TP and TN in the second phase (2012-2016); and 3) human and

ecosystem health in the third phase (2017-2021). To ensure the adaptive management of the TPLMS Action Plan, the first assessment on the Plan is scheduled to be completed by July 2009. He emphasized the importance of public participation and education programme for ensuring the successful implementation of the TPLMS.

4.0 LESSONS AND EXPERIENCES LEARNED AND NEEDS ON PROMOTING IRBCAM

4.1 The following lessons and experiences on IRBCAM, especially on pollution reduction in the mature Programmes were highlighted during the open discussion in response to the queries and concerns on the pollution hotspots:

a. In order to promote pollution reduction, it is essential to put in place the fundamental pollution measures, such as basic sewage treatment and industrial discharge control, including regulatory enforcement control and financial assistance. In the case of the Chesapeake Bay Programme, national and local financial support has been mobilized to continue promoting pollution reduction.

b. In order to witness the positive changes in the environment of the river and coast in a relatively short period of time, it is necessary to keep the attention of and commitment from the policymakers on: 1) addressing large pollutant sources first; and 2) a particular basin as an exemplary case for pollution reduction.

c. The strategy for pollution reduction of Chesapeake Bay Programme adopted three main components: 1) establishing the agreement among local governments along the Bay; 2) taking regulatory measures to control the discharge from the pollution resources; and 3) providing financial support for promoting pollution reduction.

d. The funding support for pollution reduction from the national government has been playing an important role in the Chesapeake Bay Programme. The local governments can now access loans from the national government with zero percent interest, which significantly helps promote investment and take necessary measures for further restoration of the Bay.

e. In the case of RO Korea, two government agencies, i.e., MLTM and the Ministry of Environment established a joint fund to manage the wastewater from industries. Sixty percent of the fund comes from the national government, twenty percent from the local government, and twenty percent from other sources such as NGOs, etc.

f. The public participation and education programme are important elements for implementing pollution reduction and rehabilitation of the river and coast. In the case of the Masan-Chinhae Bay, the warning report on the status of the environment of the Bay through mass media, series of public consultations and various education programmes enhanced public

awareness and led to the strong movement for the rehabilitation of the Bay including the introduction of the TPLMS.

g. The responsible agency needs to consider various aspects, including viable technology and available funding, among others, to set a feasible effluent standard from pollutant sources.

4.2 The need to develop a funding mechanism which would enable pollution hotspots to promote pollution reduction was raised. In this light, it was pointed out that obtaining the regulations and laws related to the funding mechanisms, such as Maryland's Bay Restoration Fund will be useful for the pollution hotspots to seek the possibilities of establishing similar funds.

5.0 WORKSHOP ON TOTAL MAXIMUM DAILY LOAD (TMDL)

Workshop 1: Environmental profile of selected river basins for the development of pollution reduction strategies and investment plans

Environmental Profile of Marilao-Meycauayan-Obando (MMO) River Basin

5.1 Mr. Exuperio Lipayon, Pollution Control Division of DENR Region III, Philippines, presented on the existing water quality condition of the MMO river system. The MMO river system is categorized as Class C, which is suitable for: 1) fishery water for the propagation and growth of fish and other aquatic resources; 2) recreational water Class II; and 3) industrial water supply Class I. He reported the results of the regular monitoring on biochemical oxygen demand (BOD), chromium, lead and cadmium in the Marilao and Meycauayan rivers, which shows noticeable difference among the monitoring stations. Among the 862 pollution sources identified in the MMO river system, the top three industries which cover almost 50 percent of the total point sources are: 1) rubber and plastic (198); 2) food products and beverages (117); and 3) basic metals (110). He mentioned that the major sources of the pollutants are therefore already identified. He further explained that some monitoring stations are planned to be set up within this year, expecting more data to be utilized for the development of the TMDL.

Environmental Profile of Ciliwung River Basin

5.2 Mr. Hermono Sigit, River Division of the Ministry of Environment, Indonesia, reported on the environmental profile of Ciliwung River Basin. A series of land use maps demonstrate that the watershed areas have been rapidly urbanized, which induces erosion and sedimentation. He indicated that the water quality has deteriorated due to the heavy load from solid waste as well as wastewater from domestic/human activities. There is big discrepancy today between the current water quality class and target of the Ciliwung River Basin. For example, the current water quality class of Jakarta does not meet any existing class; and the current water quality class of Depok and some parts of Bogor is Class IV, whereas the target is Class II. As an effort for water pollution control in Ciliwung River Basin, coordination has been initiated to address transboundary issues, such as sharing the data of the sampling points among different agencies,

integrated data and information management, etc., which is described in the master plan of the Ciliwung River Basin.

Workshop 2: Chesapeake Bay approach to pollution reduction

Chesapeake Bay Experiences in the Development and Implementation of a Pollution Reduction Strategy

5.3 Mr. David Nemazie, University of Maryland Center for Environmental Science, U.S.A., presented the Chesapeake Bay experience in the development and implementation of a pollution reduction strategy. He explained the discontent of the people and society on the environmental situation of Bay although they have been putting efforts on various activities, such as Bay-wide nutrient reduction using the watershed approach, ecosystem-based management for living resources, meaningful educational experiences and land conservation. He mentioned that even world-class models for developing TMDL must be verified and that people should not over-rely on the model. He emphasized that the environment of the Chesapeake Bay has changed drastically over the last 100 years and that it will take nutrient reduction actions from all sectors to fully recover. To ensure the appropriate target set and adaptive management, tracking of "on-the-ground" progress and "in-the-water" results is critical. He also pointed out that Bay grasses are important in the restoration process because of the positive tipping point they cause in the recovery of the Bay, which contributes to the resilience of Chesapeake Bay.

Chesapeake Bay Experience in the Development and Implementation of an Investment Strategy and Plan for Pollution Reduction

5.4 Dr. Robert Summers introduced the Chesapeake Bay experience in the development and implementation of an investment strategy and plan for pollution reduction. He explained the benefit of the cost-effective analysis by showing an example that the Maryland State found out only 8 percent of the total cost for the good agricultural management practice can reduce 54 percent of nitrogen and 62 percent of phosphorus in the State. He emphasized that available budget should be used wisely to realize the greatest possible benefits. He presented many kinds of programmes with funding support from the State, including various agricultural cost-share programmes and construction grants programmes for public wastewater treatment systems. He briefed on the Maryland's Bay Restoration Fund, established by State law in 2004, which allows Maryland to achieve additional nutrient reductions by: 1) providing grants to upgrade major wastewater treatment plants with enhanced nutrient removal technologies; 2) providing grants/loans to upgrade onsite septic systems in the critical areas with nitrogen removal technologies; and 3) providing grants to farmers for planting cover crops on agricultural land. Furthermore, Chesapeake Bay 2010 Trust Fund was introduced to the workshop as the newest fund established in 2008, which aims to advance Bay restoration goals by focusing limited financial sources on the most effective nonpoint source pollution control projects. He highlighted that allocation of the Trust Fund targeted needs under a science-driven process that is flexible enough to take full advantage of future opportunities and technical developments. He also emphasized that BayStat, a statewide tool designed to

assess, coordinate and target Maryland's Bay restoration programs and to inform the citizens on progress, is a powerful tool established in 2007 that allows them to apply the identified Allocation Principles toward the best use of the Trust Fund.

Workshop 3 to 5: Developing Watershed TMDL

Basics of TMDL and Guidance on Developing Watershed TMDL

5.5 Dr. Gene Yagow and Dr. Karen Kline, Virginia Polytechnic Institute and State University, U.S.A., delivered the following educational modules on developing watershed TMDL which they specifically developed for the workshop:

a. TMDL Overview;
b. Data Needs and Sources;
c. Data Analysis for Problem Identification;
d. TMDL Development Approaches;
e. Simulating Important Hydrologic and Pollutant Processes;
f. Model Selection Considerations;
g. Stakeholder and Public Involvement; and
h. Allocation and Implementation Planning.

After the introduction of the overview of TMDL covering a definition of terms and the whole process of development and implementation of the TMDL programme, basic necessary data and possible data sources at respective sites were explained. It was informed that TMDL can be developed although many technical challenges arise from lack of data, e.g., by selecting a model that allows coarser data input. In order to identify the pollution problem of the watershed targeted, there is a need to: 1) inventory available data; 2) analyze land use including history of extreme events and major changes; 3) identify major pollutants and sources; and 4) quantify pollutants loads which are necessary steps to be taken. It was explained that TMDL development has several approaches, including: 1) narrative; 2) data-driven; 3) modeled; and 4) an alternative which we should carefully choose considering strength and weakness of each approach, availability of data, time and budget constraints and capacity for development among others. The modeling or simulation of hydrologic and pollutant processes can be simple or complex depending on the needs of respective sites. In selecting a model, it is important to consider relevance such as capability and issues at hand, credibility, usability and utility for watershed planning. The possible benefits of intensive stakeholder involvement were introduced, such as improved quality and quantity of data supporting TMDL, greater public understanding of and support for TMDL, and increased likelihood of effective implementation of pollutant controls. The process of stakeholder involvement provides mutual education not only for stakeholders but also experts on TMDL. It is important to provide several options based on the science for pollution load allocation among various sectors and implementation measures to enable the stakeholders agree on and work for the TMDL programmes.

5.6 As an initial step for developing TMDLs at respective sites, the participants were requested to consider three possible major pollutants and three pollutant sources for each pollutant at their river basins and bays. Seven groups were created to work on this issue, namely: 1) MMO; 2) Ciliwung River; 3) Pasig River; 4) Manila Bay; 5) Jakarta Bay; 6) Bohai Sea; and 7) Chesapeake Bay. The outputs of the work for respective river basins and bays are attached as Annex 4.

Application of TMDL in the U.S. and in Chesapeake Bay

5.7 Dr. Robert Summers presented the application of TMDL in the U.S. and in Chesapeake Bay, including the background and progress made on the development of TMDL in the U.S. The Federal Clean Water Act (CWA) of 1977 requires that TMDLs must be developed for impaired waters. The development of TMDL is an ongoing effort in the U.S.; to date, 37,248 TMDLs have been developed and approved and 39,340 causes of impairment have been addressed. The approach of Maryland to develop TMDL takes the following steps: 1) public notification of impending TMDL development; 2) TMDL development process including monitoring/data solicitation, data analysis/GIS, calibration, management scenarios, load allocations, coordination with stakeholders, and TMDL report; 3) review/public notice/public comment and response; and 4) TMDL plan submission to EPA for review and approval. Once TMDL is established, pollutant reduction strategies are developed and implemented to achieve TMDL requirements together with concurrent water quality monitoring and assessment to track progress. With the Chesapeake Bay Programme, water quality criteria is determined in line with the water quality conditions necessary to protect the designated uses, namely: 1) migratory fish spawning and nursery use; 2) shallow water bay grass use; 3) open water fish and shellfish use; 4) deep water seasonal fish and shellfish use; and 5) deep channel seasonal refuge use. He explained the importance of the change/evolution of the models for developing TMDL as appropriate in order to reconfirm management actions needed to fully achieve the water criteria.

6.0 LESSONS AND EXPERIENCES LEARNED IN DEVELOPING TMDL

6.1 The following lessons and experiences in developing TMDL were shared in response to the queries and concerns from the pollution hotspots:

a. In order to prioritize the target of TMDL among various concerns, public health is considered as the first priority, and the others are selected in line with the results of the risk assessment.

b. Balancing/coordinating the allocation of pollution load and responsibilities between upstream and downstream has been a big challenge even for Chesapeake Bay.

c. Based on the experiences of the Chesapeake Bay Programme, the stakeholders tend to select “equitable” allocation of the allowable pollutant load among various sectors.

d. To ensure implementation after the development of TMDL, it is necessary to involve stakeholders from the initial stage as well as to show the benefit of their changing behavior for supporting pollution reduction.

e. There is no case that the existing data are complete enough to develop TMDL based on the most detailed/refined model. Therefore, it is important to start developing TMDL with available data, while searching other available data from related institutions, e.g., university and research institute, and start collecting necessary data in the watershed targeted, if possible, within available budget, techniques and human resources.

7.0 INITIAL GROUP PLANNING FOR TMDL DEVELOPMENT

7.1 Based on the information shared on the status on the IRBCAM in Manila Bay, Jakarta Bay and Bohai Sea, the following 10 major steps/tasks for developing TMDLs at respective sites were developed by the team composed of experts from the Chesapeake Bay Programme and the PEMSEA Resource Facility:

1. Assemble TMDL Teams, such as:
   a. Resource Team composed of local environmental and natural resources agency personnel, designated watershed project manager, etc.;
   b. Technical Advisory Committee composed of the people who are knowledgeable about the pollutant sources and how they might be controlled, and will help to verify the pollutant load calculations; and
   c. Steering Committee composed of local government leaders, civil society leaders, or other people willing to take leadership roles in improving water quality in the watershed.

2. Develop a strategy for engaging local stakeholders who will:
   a. Assist with the inventory of pollutant sources for each priority pollutant; and
   b. Provide input on developing the list of potential pollutant control measures.

3. Collect watershed characterization data, including:
   a. Land use;
   b. Water quality monitoring;
   c. Flow monitoring;
   d. Daily or monthly precipitation; and
   e. Pollutant point source inventory (for each of three priority pollutants at respective sites).

4. Assemble watershed digital data layers for mapping, including:
   a. Major streams and tributaries;
   b. Watershed boundary;
   c. Monitoring points;
   d. Point source discharge locations;
   e. Land use distribution; and

f. Local government boundaries.

5. Delineate sub-watersheds, based on some combination of:
   a. Major tributaries;
   b. Monitoring points;
   c. Local government boundaries; and
   d. Distinct land uses or pollutant sources.

6. Develop an initial list of potential pollutant control measures for each priority pollutant.

7. Establish water quality goals by setting standards based either on:
   a. Numeric criterion (i.e., concentration); and/or
   b. Habitat criterion (i.e., reestablish fish species).

8. Perform initial calculations of existing pollutant loads from each source for each priority pollutant as follows:
   a. Permitted industrial sources – Pollutant #1
      i. Size of the business (based, for example, on number of employees, amount of annual product, etc.) Sp
      ii. Average monitored daily flow (Qp)
      iii. Average monitored pollutant concentration (Cp)
      iv. Existing Load = Qp x Cp, summed for all sources
   b. Non-permitted industrial sources (estimate loads based on loads from similar permitted businesses) – Pollutant #1
      i. Size of the business, Snp
      ii. Similar to which of the permitted businesses?
      iii. Average estimated daily flow, Qnp = Snp/Sp x Qp
      iv. Average estimated pollutant concentration, Cnp = Cp
      v. Existing Load = Qnp x Cnp, summed for all sources
   c. Diffuse sources (septic tanks, piggeries, aquaculture, etc.) – Pollutant #2
      i. Number of systems or animals
      ii. Literature values of daily pollutant volumes per system or animal (Qd)
      iii. Literature values of typical pollutant concentrations per system or animal (Cd)
      iv. Existing load = Qd x Cd, summed for all sources

9. Perform initial calculations of target TMDL pollutant loads for each priority pollutant as follows:
   a. Industrial sources
      i. Permitted daily flow summed from all sources
      ii. Permitted pollutant discharge concentrations for each pollutant (may differ for different classes of water)
   b. Diffuse sources
      i. Sum the volume from all similar diffuse sources
      ii. Use a typical permitted pollutant concentration based on EPA, UNDP, FAO, or other published source (may differ for different classes of water)
   c. Calculate and sum the target pollutant loads

i. for each priority pollutant
ii. from all sources

d. Overall % reduction = (existing load – target load)/existing load x 100%

10. Allocate target load among sources for each priority pollutant
    a. Where multiple types of sources contribute to the load of an individual pollutant, recommend how to allocate the reduction among the sources
        i. Equal % reductions
        ii. Higher % reduction from larger sources
        iii. Other group-defined rationale

7.2 After the briefing on the 10 steps/tasks for TMDL development, it was emphasized that effective watershed planning should be: 1) iterative and adaptive; 2) holistic; 3) geographically defined; 4) integrated with other planning efforts; and 5) a collaborative and participatory process.

7.3 The participants were divided into two groups, namely Manila Bay and Jakarta Bay to draft respective steps/tasks and schedule for developing TMDL at target tributaries, i.e., MMO and Ciliwung River Basin, respectively.

7.4 The two groups worked on initial plans for the future development of the TMDLs and presented their respective plans at the end of the workshop. The outputs of Initial Group Planning for TMDL development of MMO and Ciliwung River Basin are attached as Annex 5.

8.0 CLOSING

8.1 A certificate of attendance was presented to participants after completion of the Twinning Workshop on TMDL.

8.2 On behalf of PEMSEA, Prof. Lotilla reiterated his appreciation for MLTM, KMI, the Twinning Secretariat and DENR for supporting the workshop. He also thanked Dr. Chul-Hwan Koh from Seoul National University for chairing the workshop as well as his continuous cooperation with the Twinning Workshops for many years. He expressed his gratitude to all the participants and especially to the experts from the Chesapeake Bay Programme, namely, Mr. David Nemazie, Dr. Robert Summers, Dr. Gene Yagow and Dr. Karen Kline for sharing their experiences and knowledge on IRBCAM. He expected long-term cooperation to be further nurtured through various activities in the coming years. Finally, he assured the participants of strong and continuous support and commitment from PEMSEA to work together in the implementation of the SDS-SEA including the Twinning Arrangements on IRBCAM.

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ANNEX 1

List of Participants

Twinning Workshop on Total Maximum Daily Load (TMDL)
18-21 May 2009
Manila, Philippines

List of Participants

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ANNEX 2

Workshop Programme
(Revised to reflect the actual workshop program convened)

Twinning Workshop on Total Maximum Daily Load (TMDL)

Date: 18-21 May 2009
Venue: 4th Floor, Crowne Plaza Galleria Manila, Philippines
(Ortigas Avenue Cor. ADB Avenue, Ortigas Center, Pasig City)

PROGRAMME	
17 May	
1500 – 1800	**Registration**
18 May **Chair: Prof. Chul-Hwan Koh, Seoul National University, RO Korea**	
0800 - 0830	**Registration**
Opening Ceremony	
0830 – 0850	Remarks Ref. Programme of the Opening Ceremony
0850 - 0930	Group Photo and Coffee Break
Session 1: Objectives and Strategies for Twinning Arrangements	
0930– 0945	SDS-SEA implementation and the Strategy for Twinning Arrangements • Dr. Jong-Deog Kim, Head, PEMSEA Twinning Secretariat
Session 2: Overview of Coastal Strategy Implementation in Pollution Hotspots	
0945 – 1000	Overview of Operational Plan for Manila Bay Coastal Strategy • Dr. Vicente Tuddao, Jr., Executive Director, River Basin Control Office, Department of Environment and Natural Resources, Philippines
1000 – 1015	Overview of Coastal Strategy Implementation Plan of Jakarta Bay • Ms. Heni Agustina, Head of Ecosystem Rehabilitation Division, Ministry of Environment, Indonesia
1015 – 1030	Overview of Sustainable Development Strategy and Implementation Plan of Bohai Sea • Dr. Zhang Zhifeng, Associate Researcher/Vice Director, National Marine Environmental Monitoring Center, PR China
Session 3: Integrated Approaches to River Basin and Coastal Area Management among Mature Programs	
1030 – 1050	Implementation of the Chesapeake Bay Program • Dr. Robert Summers, Deputy Secretary, Maryland Department of the Environment, U.S.
1050 – 1110	Implementation of the Masan-Chinhae Bay Program • Dr. Jae-Young Lee, Deputy Director, Marine Policy Bureau, Ministry of Land, Transport and Maritime Affairs, RO Korea
Open Discussion on Lessons and Experiences Learned and Needs on Promoting IRBCAM	
1110 – 1200	Open Discussion on Lessons and Experiences Learned and Needs on Promoting IRBCAM
1200 – 1330	Lunch

Workshop on TMDL	
Workshop 1: Environmental Profile of Selected River Basins for the development of pollution reduction strategies and investment plans	
1330 – 1400 1400 – 1430	Environmental Profile of Marilao-Meycauayan-Obando (MMO) River Basin • Mr. Exuperio Lipayon, Chief, Pollution Control Division, Environmental Management Bureau - Region 3, Philippines Environmental Profile of Ciliwung River Basin • Mr. Hermono Sigit, Head of River Division, Assistant Deputy for River and Lake, Ministry of Environment, Indonesia
Workshop 2: Chesapeake Bay approach to pollution reduction	
1430 – 1530	Chesapeake Bay Experience in the Development and Implementation of a Pollution Reduction Strategy • Mr. David Nemazie, University of Maryland Center for Environmental Science, U.S.
1530 – 1600	Coffee Break
1600 – 1700	Chesapeake Bay Experience in the Development and Implementation of an Investment Strategy and Plan for Pollution Reduction • Dr. Robert Summers, Deputy Secretary, Maryland Department of the Environment, U.S.
19 May **Facilitator: Mr. David Nemazie, University of Maryland Center for Environmental Science, U.S.A.**	
Workshop 3: Basics of TMDL	
0830 – 1200	Understanding the basics of TMDL • Dr. Gene Yagow, Virginia Polytechnic Institute and State University, U.S. ✓ General Overview ✓ TMDL Formula ✓ Load vs. concentration endpoints ✓ Standards and allowable exceedance Application of TMDL in the US and in Chesapeake Bay • Dr. Robert Summers, Deputy Secretary, Maryland Department of the Environment, U.S. Questions and Discussion
1200 – 1330	Lunch
Workshop 4: Developing Watershed TMDLs (Part 1)	
1330 – 1700	1) Data Needs and Sources • Dr. Karen Kline, Virginia Polytechnic Institute and State University, U.S. ✓ Watershed ✓ Climate ✓ Pollutant Sources ✓ Monitoring Data ✓ Data Issues Questions and Discussion 2) Data Analysis for Problem Identification • Dr. Gene Yagow, Virginia Polytechnic Institute and State University, U.S.

	✓ Chemical pollutants ✓ Biological impairments Questions and Discussion
20 May **Facilitator: Mr. David Nemazie, University of Maryland Center for Environmental Science, U.S.A.**	
Workshop 5: Developing Watershed TMDLs (Part 2)	
0830 – 1200	3) TMDL Development Approaches: Factors Affecting Selection of Technical Approach for Watershed TMDL Development • Dr. Karen Kline, Virginia Polytechnic Institute and State University, U.S. Questions and Discussion 4) Simulating Important Hydrologic and Pollutant Processes • Dr. Gene Yagow, Virginia Polytechnic Institute and State University, U.S. Questions and Discussion 5) Model Selection Considerations for TMDL Development • Dr. Karen Kline, Virginia Polytechnic Institute and State University, U.S. Questions and Discussion
1200 – 1330	Lunch
1330 – 1700	6) Stakeholder and Public Involvement • Dr. Gene Yagow, Virginia Polytechnic Institute and State University, U.S. Questions and Discussion 7) Allocation and Implementation Planning • Dr. Karen Kline, Virginia Polytechnic Institute and State University, U.S. ✓ Pollutant Source Allocations: Scale and Resolution ✓ Stakeholder Involvement ✓ Assessment of pollutant control measures: practicality and feasibility ✓ Site-specific source reductions and sub-watershed targeting ✓ Prioritization of Implementation ✓ Measurable Goals and Milestones Questions and Discussion
21 May **Facilitator: Mr. David Nemazie, University of Maryland Center for Environmental Science, U.S.A.**	
Workshop on Initial Group Planning for TMDL Development	
0830 – 1200	Practicum on Meycauyan-Marilao-Obando and Ciliwung River Basins • Dr. Gene Yagow, Virginia Polytechnic Institute and State University, U.S. • Dr. Karen Kline, Virginia Polytechnic Institute and State University, U.S.
1200 – 1330	Lunch
1330 – 1600	Practicum on Meycauyan-Marilao-Obando and Ciliwung River Basins (continued)

1600 – 1700	Next Steps in Manila and Jakarta Bays for establishing TMDLs ✓ Time-line and work-flow ✓ Next steps for developing TMDLs for sub-watersheds in Manila and Jakarta Bays
1700 – 1730	Closing of the workshop
22 May	
Departure of participants and resource speakers	

ANNEX 3

Opening Ceremony Programme

TWINNING WORKSHOP ON TOTAL MAXIMUM DAILY LOAD

18-21 May 2009
Sapphire B, 4th Floor, Crowne Plaza Galleria Manila
Ortigas Avenue Cor. ADB Avenue, Ortigas Center, Pasig City, Philippines

OPENING CEREMONY

0830 Welcome Remarks

Prof. Raphael P. M. Lotilla
Executive Director
PEMSEA Resource Facility

0835 Opening Remarks

Mr. Seon-Tae KIM
Director
Marine Environment Policy Division
Marine Policy Bureau
Ministry of Land, Transport and Maritime Affairs, RO Korea

0842 Opening Address

Usec. Demetrio Ignacio
Undersecretary
Policy and Planning Department
Department of Environment and Natural Resources, Philippines

0850 Group Photo

ANNEX 4

Major Pollutants and Pollutant Sources at Respective Sites

Major Pollutants and Pollutant Sources at Respective Sites

1) Major Pollutants and Pollutant Sources at MMO River Basin

Major Pollutants	Major Pollutant Sources
BOD	domestic waste, livestock, food and beverage processing
Chromium	tanning, textile, metal platting
Lead	2ndary smelting, gold and silver smelting

2) Major Pollutants and Pollutant Sources at Ciliwung River Basin

Major Pollutants	Major Pollutant Sources
TSS	agriculture, bare soils, urban runoff
BOD	livestock, residential (waste), milk processing
COD	textile, domestic waste, pharmacy production

3) Major Pollutants and Pollutant Sources at Pasig River Basin

Major Pollutants	Major Pollutant Sources
Organic waste (measured by: BOD; DO; TSS; Oil and Grease)	domestic, industrial, solid waste, storm drain, surface TSS (surface runoff), toxic
Toxic (measured by: mercury, lead, cadmium, chromium)	hospital, industry, domestic
Bacteriological (total fecal coliform)	domestic, individual septic, sewage treatment plant discharges

4) Major Pollutants and Pollutant Sources at Manila Bay

Major Pollutants	Major Pollutant Sources
Nutrient	fertilizer, household, agriculture (organophosphate pesticide). sulfates (air pollution, industrial, high sulphur fuel, acid rain
Heavy Metals (cyanide mercury, lead, chromium)	electric platting, manufacturing, smelter
Coliform	domestic sewage waste, industrial sources

5) Major Pollutants and Pollutant Sources at Jakarta Bay

Major Pollutants	Major Pollutant Sources
DOM	waste: solid, detergent, sewage
Nutrient (Nitrate, NH4, PO4)	domestic waste, agriculture waste, fertilizer, pesticides
TSS	industrial, domestic waste, agriculture, urban runoff

6) Major Pollutants and Pollutant Sources at Bohai Sea

Major Pollutants	Major Pollutant Sources
Nitrogen	agriculture, sewage, atmospheric
Phosphorus	industry, sewage, agriculture
Oil	industry, transportation, exploration

7) Major Pollutants and Pollutant Sources at Chesapeake Bay

Major Pollutants	Major Pollutant Sources
Nitrogen	agriculture, urban runoff, sewage, atmospheric
Phosphorous	agriculture, urban runoff, sewage
Sediment	shore line erosion, stream channel erosion (hydrologic from development, and agriculture), re-suspension

ANNEX 5

Initial Group Planning for TMDL Development

Initial Group Planning for TMDL Development

1) Initial Plan for TMDL Development of MMO River Basin

Step 1. Who will serve on the Project Team?

a. Resource team
- Chair: Environment Management Bureau (EMB), Region III
- Co-Chair: Site Management Office- DENR Region III

b. Technical Team: Technical representatives from:
- EMB
- FMB
- RBCO
- NWRB
- LLDA
- PAWB
- RED
- LGUs
- NGO
- Bulacan Chamber of Commerce
- Bulacan State University
- RDC
- NDCC

c. Steering Committee:
- RBCO- Asec for RBCO
- Bulacan Chamber of Commerce
- LGU – Governors / Mayors
- Bulacan State University
- DENR –RED, NWRB, EMB, LLDA, PAWB
- NDCC
- RDC
- NGO – Blacksmith Institute
- Donor Agencies

Step 2. Engage Stakeholders

a. Other Ministries
- PAG-ASA
- DA
- HLURB
- PHILVOCS
- DPWH-BRS
- NDCC
- DOH
- NWRB
- NAMRIA
- MGB
- DTI

b. LGU
- all LGUs within the Meycauayan watershed area

c. NGO/ Institute
   - Blacksmith
   - Malolos Dioceses
   - Academe

d. Peoples Organizations
   - Fisherfolks

e. Include MWSS & Local Water Districts

Step 3. Collect Watershed Characterization

a. There is an available budget allocation for the waste characterization and profile of the watershed.

b. A technical team will be created in Region III headed by EMB Reg. III.

c. Activities to be undertaken for watershed characterization:
   - data gathering (zoning, identification of point sources and non-point sources, forestry, biodiversity, run-off, erosion, meteorological data, stream flow measurement)
   - mapping
   - workshop
   - timeline to be completed by December

Step 4. Watershed Map

a. General Land use
   - satellite map
   - GIS
   - map of Bulacan
   - Geohazard Map
   - Development Framework Plan of Bulacan

b. Location of facilities & discharge locations – based on inventory and data from EMB Regional Office

c. Monitoring Locations – data from EMB Regional Office
   - Angat 4, Bocaue 3, Upstream 1, Obando 3, Meycauayan 5, Marilao 5, and Prenza 1
   - will not focus only on the quality but also on the volume
   - rain/flow gauge monitoring station to be determined by DPWH & NWRB

Step 5. Delineate sub-watershed based on RBCO

a. Major Tributaries

b. Monitoring Points:
   - To be expanded.
   - Budget for laboratory analysis to be determined after assessment of laboratory facilities and staff requirements which will cater to laboratory samples.

c. Inventory of point sources, man power requirements should also be re-assessed.

Step 6. Identify reasonable control measures

a. Possible reasonable control measures within the facilities/treated prior to discharge, expected benefits, expected costs and the time when these measures can be implemented were drafted as the following table shows:

Control Measures	Expected benefits	Expected costs	When can they be implemented
a. Waste Minimization + Best Environmental Practices + Best Available Technology	Savings, reduce treatment costs	varying cost, minimal	ASAP
b. STP for treatment of BOD	Reduction of BOD and increase in DO, improved water quality and aquatic life	Php 2 Billion	ASAP
c. Chemical Treatment for Lead	Reduction of Lead in the receiving body, reduction of health risks, improve water quality, centralized treatment	Php 20M per industry	
d. Chemical Treatment for Chromium	Reduction of Lead in the receiving body, reduction of health risks, improve water quality, centralized treatment	included	ASAP
e. Waste exchange program			
f. strict enforcement of national & local laws			

b. Possible reasonable control measures out of the facilities/treated after discharge, expected benefits, expected costs and the time when these measures can be implemented were drafted as the following table shows:

Control Measures	Expected benefits	Expected costs	When can they be implemented
a. recycling and re-use	savings		
b. wetland treatment technology	Reduce pollution Protection of habitat (flora & fauna), flood mitigation, tidal buffer, prevents salt water intrusion		
c. recover of easement areas	Improve aesthetics, tourism, deterrent to informal settlers, improves water quality		
d. tree planting	Improved air & water		ASAP

	quality		
e. bioremediation	Improved water quality		ASAP
f. Boom traps	Reduce solid wastes in rivers		ASAP
g. strict enforcement of national & local laws	Deterrent to illegal waste disposal		ASAP

Step 7. Establishing Water Quality Goals

a. Set a pollution standard to a concentration limit:
To restore water quality of Meycauayan and Marilao to "Class C"

b. Set a pollution standard to meet a habitat goal:
To restore water quality of Meycauayan and Marilao to "Class C"

Step 8. Perform initial calculations

a. Pollutant loads from permitted sources to be calculated.
b. Pollutant loads from non-permitted facilities to be calculated.

Step 9. Develop initial TMDL

a. For example, the allowable load for BOD based on the permission is calculated as 16kg/day (80 mg/L x 200 m3/day).

b. Based on the existing data, the overall percentage reduction of BOD is expected as 70 %.

Step 10. Allocation targeting of loads among sources

Allocation of loads among sources to be developed.

Step 11. Timeline for Interim Milestone

- August 28, 2009 – Presentation of Draft TMDL
- November 9, 2009 – Signing of TMDL program/plans

2) Initial Plan for TMDL Development of Ciliwung River Basin

Step 1. Who will serve on the Project Team?

a. Resource team
   - Project Manager : Assistant Deputy for River and Lake Degradation Control
   - Local environmental management agency (Jakarta and West Java Prov)
   - Ministry of Environment
   - Ministry of Public Work
   - Ministry of Forestry
   - Ministry of Agriculture
   - Bureau of Meteorological and Climate
   - Mapping and Survey Coordinating Agency

b. Technical Team
   - Chair person : Assistant Deputy for River and Lake Degradation Control
   - Bogor Agriculture University
   - Directorate for Water Resources Management, MoPW
   - Directorate for Watershed Management, MoF

- Directorate for Water Allocation, MoA
- Assistant Deputy for Marine and Coastal Degradation Control

c. Steering Committee
   - Mrs. Masnellyarti Hilman, Deputy for Enhancement Conservation for Natural Resources and Environmental Degradation Control, MoE
   - Mr. Gempur Adnan, Deputy for Pollution Control, MoE
   - Mrs. Peni, Head of EMA – Jakarta Prov
   - Mr. Setiawan W, Head of EMA West Java Prov
   - Head of EMA Bogor Regency, West Java Prov
   - Head of EMA Bogor City, West Java Prov
   - Head of EMA Depok City, West Java Prov

Step 2. Engage Stakeholders

a. Other Ministries
   - Ministry of Transportation
   - Ministry of Health
   - Local government / Local Planning Board (Jakarta and West Java Prov)

b. Local Government
   - Local Planning Board (Jakarta and West Java Prov)
   - Local Industrial Agency (Jakarta and West Java Prov)

c. NGOs
   - WALHI
   - Ciliwung Bersih
   - URDI (Urban Research Development)

d. Citizens
   - Mr. Badri (Ciliwung Upstream)
   - Mrs. Bambang (Ciliwung Down Stream)

Step 3. Collect Watershed Characterization

a. Land Use in 2007
b. Water Quality Data in 2006
c. Water Quality Average of Each Parameter
d. Water Flow 2002 - 2006

Step 4. Watershed Map

a. Watershed map
b. Land use distribution

Step 5. Delineate sub-watershed

a. Watershed map

Step 6. Identify reasonable control measures

a. Within the facilities (treated prior to discharge)
   - Cleaner production
     (3R in the process production: replace diesel fuel into gas)
   - Increase the capability of treatment plant:

From Primary to Secondary; and

From Secondary to Tertiary.

- Better house keeping

b. Out of the facilities (treated after discharge)

- Riparian buffer
- Sediment traps
- Better septic tank
- Wetland restoration in the watershed
- Sewage treatment plant

c. Expected benefits

- Brand image increasing of the product and company
- Material use efficiency

d. Expected costs

- Increasing costs for treated waste better: Billions of Rp
- Costs in cleaner production and better housekeeping: Billions of Rp

e. When can they be implemented

- Cleaner production – within 3 years
- Better Treatment Plant – within 5 years
- Sediment Trap – within 3 years
- Better septic tank – within 3 years
- Buffer riparian – within 5 years
- Wetland restoration – within 10 years
- Sewage treatment plant –within 10 years

Step 7. Establishing Water Quality Goals

Water quality goals to be established either by:

a. Setting standard as a numeric criterion (i.e., concentration)
b. Setting standard as a habitat criterion (i.e., reestablish fish species)

Step 8. Perform initial calculations

Available data to be used for the initial calculations:

- Water Quality Standard
- Effluent Standard
- Existing Effluent Quality

Step 9. Develop initial TMDL

Target TMDL pollutant loads for each priority pollutant to be developed.

Step 10. Allocation targeting of loads among sources

Allocation of loads among sources to be developed.
Targeted sources for allocation are as follows:

- Textile
- Milk processing
- Pharmacy industry

Step 11. Timeline for Interim Milestone

a. The following is the interim milestone for developing TMDL:

- June 2009: Promotion/socialization on Field Visit to stakeholders
- July 2009: Field Visit
  1) Picturing the point and non point sources
  2) Communication with local people
  3) Identification of point sources and non point sources
- August 2009: Mapping point sources and non point sources
- August 2009: Delineate sub watershed
- November 2009: update the progress at EAS Congress2009
- September-December 2009: Developing TMDL and implementation plan
- January-April 2010: Setting up scenarios for pollution reduction

b. The following table shows the interim milestone for the year 1 to year 3 of Ciliwung River pollution reduction programme:

Target	Year 1	Year 2	Year 3
85% of Point Sources Pollution Reduction	- Cleaner production and better housekeeping - Recycle and Reuse waste water	Increasing Treatment Plant: Primary Treatment plant into secondary treatment plant	Increasing Treatment Plant: Secondary treatment plant into Tertiary Treatment Plant
25% of Nonpoint Sources Pollution Reduction	Buffer Riparian Better Septic Tank	Buffer Riparian Better Septic Tank Sediment trap	Buffer Riparian Better Septic Tank Sediment trap Community awareness – education & pilot project in 3R