PEMSEA/WP/2011/26

PROCEEDINGS OF THE SIXTH TWINNING WORKSHOP ON INTEGRATED RIVER BASIN AND COASTAL AREA MANAGEMENT (IRBCAM)

Total Allowable Pollutant Load Allocation in River Basins and Coastal Areas of East Asia

Dalian City, People's Republic of China
18–20 May 2011

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A. INTRODUCTION

i. The theme of the Sixth Twinning Workshop on Integrated River Basin and Coastal Area Management (IRBCAM) was "Total Allowable Pollutant Load Allocation in River Basins and Coastal Areas of East Asia." It aimed to share good practices and experiences in planning, implementing and evaluating total allowable pollutant reduction programs in integrated river basin and coastal area management programs of Bohai Sea (PR China), Manila Bay (Philippines), Jakarta Bay (Indonesia), Jiulong River (PR China) and Masan-Chinhae Bay (RO Korea).

ii. The workshop was held at the Xinghai Golf Hotel, Dalian, PR China, from 18–20 May 2011. The workshop was co-organized by the State Oceanic Administration (PR China); Ministry of Land, Transport and Maritime Affairs (RO Korea); Korea Maritime Institute (RO Korea) and PEMSEA.

iii. The Workshop included participants from Democratic People's Republic of Korea, Indonesia, Japan, People's Republic of China, Philippines, and the Republic of Korea.

iv. The full list of participants is attached as Annex 1 while the workshop program is attached as Annex 2.

B. OPENING CEREMONY

i. On behalf of Dr. Zhang Zhanhai, Director-General of the Department of International Cooperation, State Oceanic Administration (SOA), PR China, Mr. Liang Fengkui, Division Director of the International Organization Division, Department of International Cooperation, SOA, welcomed the participants. He noted the progress achieved in IRBCAM by the PEMSEA partnership and emphasized the importance of exchanging experiences in integrated river basin and coastal area management. Finally, he thanked the local host, the National Marine Environmental Monitoring Center, and wished the workshop success.

ii. Mr. Chen Laizhou of Liaoning's Ocean and Fisheries Bureau introduced Liaoning Province and its efforts in managing its marine environment. He introduced the activities and achievements since June 2009, when they began to implement the project on integrated coastal management of Daling River. With the world economy developing so fast, the environment faces more and more pressure, and in this situation, Liaoning province is keen to cooperate with the private sector,

governments and institutions to address the environmental issues. Finally, he welcomed the participants and wished for the success of the workshop.

iii. On behalf of the local host institution, the National Marine Environmental Monitoring Center (NMEMC), Dr. Huo Chuanlin gladly welcomed the participants to the workshop and invited them to visit the NMEMC.

iv. On behalf of the Republic of Korea's Ministry of Land, Transport and Maritime Affairs, Ms. Gusung Lee of the Korea Maritime Institute welcomed the participants and thanked the PEMSEA Resource Facility (PRF) and the Chinese government for the preparation of the workshop. She emphasized that sustainable environmental, social and economic development is closely linked to the integrated management of watersheds, estuaries and adjacent coastal areas (IRBCAM) and exchange of experiences and knowledge among the countries of the East Asian Region through the Twinning Arrangement has successfully facilitated the implementation of IRBCAM. She also elaborated on the Total Pollution Load Management System (TPLMS) of Masan Bay and the importance its gives to water pollution reduction. Finally, she asked the participants to provide their active support and participation to the 2012 EAS Congress and Yeosu Expo which will be held in Korea and wished for a most productive workshop.

v. On behalf of Mr. Raphael Lotilla, Executive Director, PEMSEA Resource Facility, Mr. S. Adrian Ross, Chief Technical Officer, welcomed the participants to the workshop and thanked the local hosts. He especially appreciated the PEMSEA Twinning Secretariat and RO Korea's Ministry of Land, Transport and Maritime Affairs whose years of support have contributed to the forum's transformation from sharing principles and concepts of IRBCAM, to experiences from developed IRBCAM programs, to the current interactions among practicing IRBCAM managers of the region. Finally, he asked the workshop to consider the following three questions: (1) what is the future of Total Allowable Pollutant Load (TAPL) as an instrument for improved water quality management in the river systems and coastal areas of the region?; (2) what are the current shortcomings and gaps that currently constrain its acceptance, further development and application; and (3) how can this twinning network better serve as a driving force in the region for facilitating change?

C. BACKGROUND, OBJECTIVES AND EXPECTATIONS OF THE WORKSHOP

ii. Ms. Gusung Lee recalled that the PEMSEA Twinning Network supports the development of integrated river basin and coastal area management (IRBCAM) programs. IRBCAM is in turn one of the major programs in the current implementation of the SDS-SEA. She identified the three main elements of the Twinning Strategy: (1) capacity development; (2) building political support; and (3) sharing knowledge and experiences. She then outlined the network's interactions from 2005 to the present. Finally, she identified the objectives and the five main parts/sessions of the 6th twinning workshop.

1.0 SESSION 1: ESTIMATING TOTAL POLLUTION LOAD

1.1 The various approaches used in estimating pollution load in Jakarta Bay, Luan River Basin, Manila Bay Watershed, and Masan Bay and some recommendations and/or management interventions were described in the first session. This session was chaired by Mr. Andono Warih of the Jakarta Environmental Management Board, Indonesia.

Estimating Pollution Load in the Downstream of Ciliwung River, Indonesia

1.2 Dr. Budi Kurniawan, Head of Small Scale Industry Monitoring and Control Sub-Division, Ministry of Environment, Jakarta, Indonesia, briefly described the context of Ciliwung River within the Jakarta Bay watershed. He then described the uses, target and actual water quality, and sources of pollution along the various segments of Ciliwung River and the water quality in Jakarta Bay. Quantities of pollutants from point sources were derived from self-reported monitoring data and government inspections. On-site research/studies were used to estimate the emission factors of non-point sources such as households and small industries. These were then modeled with the use of Qual 2K by Chapra, et al. (2008). It was estimated that 74 percent of COD and 94 percent of BOD came from domestic sources while the rest came from enterprises.

Dr. Kurniawan noted that Indonesian regulations provided for total pollution load control but that actual implementation was still slowly being transitioned from effluent standard-based controls. He described programs to reduce pollution such as pollution information disclosure for large firms, technical assistance for small firms, and upgrading of public service facilities for household wastes. Dr. Kurniawan then outlined various management scenarios and water quality model results if, incrementally, large enterprises then small enterprises increased in waste standards compliance, solid wastes were properly managed, informal settlers living on the banks of Ciliwung were either relocated or had their wastes treated, and the rest of the households also had their wastes properly treated. He clarified that allowable pollutant load will not only be based upon the pollution estimates but on technical and financial feasibility of interventions as well. He then shared initiatives to improve management of solid wastes and target facilities for pollution reduction within Muara Angke pilot site.

Total Pollution Load in the Luan River

1.3 Ms. Tian Hailan of the Luan River Basin Work Team, Shijiazhuang, Hebei, PR China, briefly described the population and industrial (primary, secondary and tertiary) structure of the downstream section of Luan River. She depicted the target uses, target and actual water quality of the various segments of the river network and the adjacent sea area. Ms. Tian outlined the government agencies that published information on point and non-point pollution. She shared the estimated COD, total nitrogen and total phosphorus contributed by each district/county in the downstream section and mapped the COD contribution by district/county and by sector. Finally, she outlined the province's planned measures to reduce pollution.

Brief Introduction on Strategic Action Plan for Ecosystem-Based Management in Jiulong River Basin and Xiamen Bay

1.4 Dr. Liu Zhenghua, Research Fellow, Third Institute of Oceanography, Xiamen, PR China, outlined the Strategic Action Plan for Ecosystem-based Management in Jiulong River Basin and Xiamen Bay, drafted for joint implementation by Xiamen, Zhangzhou and Longyan cities through the facilitation of Fujian Province. He noted decreasing COD and increasing nutrients through time. He also outlined the relative contribution of the various sectors (domestic, industrial, crops, livestock) to total nitrogen, and the contribution of COD, total nitrogen and total phosphorus of the various districts/counties, and identified issues of red tides, marine litter, soil erosion, wetland degradation, and pesticide contamination.

Dr. Liu described improvements in government coordination, enterprise compliance and penalties, and COD load but also the need for stronger incentives and stakeholder participation, nutrient reduction particularly from livestock, and improved water (quantity) management. Short-term goals (2011-2015) included both total pollutant reduction in Jiulong River and improved seawater quality in Xiamen Bay, as well as improved ecological protection and management capacity. The plan's Five key areas of action are: (1) capacity building; (2) pollution reduction; (3) ecological restoration; (4) public awareness; and (5) scientific and technological support. He especially advocated the natural ability of wetlands to reduce pollution. Dr. Liu clarified that downstream Xiamen contributes 20 million RMB annually as an incentive to upstream areas to help reduce pollution but that the effectiveness of this mechanism could be improved.

Calculation of Pollution Load Entering Manila Bay in 2010 and 2025

1.5 Dr. Carlos Primo David of the National Institute of Geological Sciences, University of the Philippines, Quezon City, Philippines, described the factors and assumptions used to estimate domestic, commercial and industrial pollution for each sub-basin of the Manila Bay watershed. He emphasized that for purposes of planning interventions, it was important to estimate at the sub-basin level (as opposed to the political divisions). A per capita factor was used for domestic waste while assumed mg BOD/liter of effluent values were used for commercial, industrial compliant and industrial non-compliant sources. The key area for intervention or hotspot is San Juan River and its tributaries. BOD readings from 21 river sampling stations and the Water Quality Analysis Simulation Program (WASP, US EPA) was used to develop a model of the system. He later clarified that the model does not take into account tidal movement. Water quality in three major rivers and the San Juan tributaries in 2025 was predicted for two scenarios: (1) if no intervention is done; and (2) if sewage treatment plants and sewerage systems planned by water concessionaires are built and operated. The planned interventions would lower BOD to around 13-14 mg/liter (except in San Juan River where it would 24.6 mg/liter) by the year 2025 but that this would still not be enough to meet the target standard of 7 mg/liter. (It was later clarified by Mr. Mulingbayan that these planned interventions would cost around 150 billion pesos (approximately US$3.5 billion)). Some future directions were outlined.

Estimating Total Pollution Load in Masan Bay

1.6 Dr. Kim Kyoung Mi of E&WIS Inc., RO Korea, introduced the Total Pollutant Load

Management System (TPLMS) of Masan Bay, including its objectives and its current key water quality variable COD. She then outlined how the technical guidelines established by the Ministry of Land, Transport and Maritime Affairs of RO Korea were applied in the estimation of pollution generated and eventually discharged from domestic, industrial, livestock, land use (non-point source), landfills, inland aquaculture, marine aquaculture, and shipping sources. Domestic sources was the major contributor to generated (74 percent) and discharged (50 percent) COD load. Land use only contributed around 7 percent to the generated load but contributed 47 percent to the discharged load. She also clarified that land use's discharged load is slightly larger than generated load because a factor to take into account unknowns was added. She demonstrated the software used for checking and processing pollution data. After allowing for natural variability and a margin of safety in the estimations, the allowed pollution load contribution from new development, such that water quality targets would still be met, was then estimated. It was clarified that the model is focused on the summer season and that climate change is not currently considered.

Open Forum and Summary [*]

1.7 Questions and discussions revolved around: (1) assumptions, factors/coefficients (e.g., industrial and livestock pollution and reduction due to treatment or passage through terrain) used in TPL models; (2) the selection of TPL target variable (COD, nutrients, pesticides, etc.) with most taking oxygen demand as a starting point but planning to progress to nitrogen and phosphorus; and (3) estimation of the margin of safety. In summary, the session concluded the following:

a. TPL management provides a number of benefits to authorities responsible for water quality management programs in river basins and marine waters across the region. The process takes into consideration the current and/or intended use of the freshwater/marine water ecosystems, and sets pollution reduction targets for individual sectors and sub-basins of watershed areas based on desired water uses. This is seen as a more cost-effective and efficient way of progressing toward desired water quality targets (than management solely based on effluent-concentration standards, for example).

b. TAPL management facilitates implementation of pollution reduction programs in accordance with the principle of "ecosystem-based" management, by providing a rational and transparent means of linking upstream and downstream freshwater uses, as well as marine water use in receiving coastal areas.

c. There are a number of "models" in use for determining "total allowable pollutant load" or TAPL. These models vary in terms of sophistication and level of confidence. Availability of data on pollution sources (i.e., point and non-point) and discharges (i.e., quantity and characteristic of emissions), and monitoring data on receiving waters, are primary considerations in the selection of appropriate models and validation of modeling results. However, the lack of data should not be an impediment to initiating TPL estimation. Empirical emission factors can be

[*] For purposes of this report, discussions and conclusions were grouped and included in the relevant session for the topic even if they were sometimes discussed in other technical sessions.

utilized as a starting point for those areas/authorities lacking monitoring information.

d. There are various considerations to be made when identifying priority pollutants in a river system and marine waters, which cut across environmental, social and economic objectives of national and local governments, and their stakeholders. In some cases, e.g., Masan Bay and river basins around Bohai Sea, the priority pollutant (COD) was identified in the preparation of national policies through consultation, and pollution reduction programs were developed accordingly. In the case of Manila Bay, an environmental risk assessment process was employed to determine priority pollutants in the bay (i.e., BOD; nutrients; bacteriological contamination), which included analysis of environmental, social and economic factors and impacts.

e. For Masan Bay and Manila Bay, the ultimate objectives are achieving a fishable/swimmable water quality. These are challenging targets, and require improved scientific understanding of what "fishable/swimmable" means in layman's language and how the ecosystem responds to pollutant inputs. Adaptive management is an important principle that needs to be applied in these situations. Adaptive management entails, among others, the organization and conduct of a comprehensive monitoring program to determine the effect of applied management interventions on water quality, and continually assess, refine and improve pollutant reduction programs and investment strategies accordingly.

f. Pollutant emission factors from international literature, such as WHO and World Bank Industrial Pollution Survey System, provide a ready reference for the implementation of TPL management. However, studies have been undertaken in some countries (e.g., China; Indonesia; Philippines) which have resulted in sector-specific emission factors. These emission factors may be more appropriate for situations in the region (e.g., pollutant discharges from livestock, agricultural lands, urban areas, aquaculture, industry, and various classes of micro-industries such as tofu production, etc.) and efforts are needed to collate and share such information among the twinning network.

2.0 SESSION 2: ALLOCATING POLLUTION LOAD

2.1 This session showed the various stages of development of Manila Bay, Daling River Basin, and Masan Bay in terms of allocating total pollution load. This session was chaired by Mr. Mao Bin of the State Oceanic Administration, PR China.

Challenges in implementing pollution reduction allocations in the Laguna Lake–Pasig River–Manila Bay Watershed

2.2 Mr. Mark Tom Mulingbayan, Manila Water Company Inc., Quezon City, Philippines, shared the Supreme Court (SC) Decision on environmental management of Manila Bay Case with the participants. According to the court decision, all concerned governmental agencies (Executive Branch) of the Philippines have to report quarterly to the SC on their plans and accomplishments for rehabilitating Manila Bay, which should be made suitable for recreational activities (Class SB). He showed that in 12 out of 13 river sections, BOD levels generally greatly exceed the water quality target

of <7mg BOD/liter. He then emphasized that the paradigm shift should be made from concentration-based regulation to load-based regulation for the improvement of water quality even if we have little knowledge of many sources of pollution such as agriculture and erosion. He compared actual BOD load in various parts of the river system with the maximum BOD load to meet the water quality target.

To improve the water quality of Manila Bay, he suggested future directions: (a) addressing fragmented, uncoordinated and overlapping water governance; (b) creating and integrating functional Water Quality Management Areas (WQMA) according to their Clean Water Act mandate; (c) establishing a comprehensive hydrology and water quality database; (d) completing regulatory coverage including small and medium enterprises and agricultural pollution sources; (d) resolving technical issues on water quality modeling; (e) aligning the water utility's Sewerage Expansion Master Plan to targets; and (f) managing stakeholder misconceptions.

TAPL allocation in the Daling River Basin

2.3 Ms. Li Ai, Ocean and Fisheries Research Institute of Liaoning Province, Dalian, PR China, briefly provided general information on Daling River watershed including location, total length, population and GDP of Liaoning Province. She described the estimated COD inputs, water pollution status of Daling River, and the water quality target of each monitoring section and all big reservoirs in Daling River basin. She shared the needed minimum reduction amount for each river section and the total reduction amount (180,254 ton/yr). She shared the methods for COD reduction (reduction of industrial pollution, sewage treatment, use of cleaner production technology, reduction of pollution from livestock, poultry and slaughterhouses) and the reduction to be contributed by each. Finally, she compared the total reduction amount planned (183,084 ton/yr) to be achieved by 2015 (at a total estimated cost of 4.1 billion RMB or US$0.63 billion) with the total reduction required to meet water quality goals. Finally, she recommended other measures to support pollution reduction in the river. In addition to water quality, adequate water quantity is also an issue in Daling River due to water shortage in northeast China.

Allocation of TAPL of Masan Bay TPLMS

2.4 Dr. Chang Won-Keun, Marine Policy Research Division, Korea Maritime Institute, Seoul, RO Korea, described the importance of Masan Bay to Koreans, its shrinkage due to reclamation, major environmental issues and the management history of coastal areas of RO Korea. He noted that risk and scientific uncertainty is managed by 'avoidance' (avoiding some problems), 'reduction' (through adequate study and review), 'sharing' (increasing participation and responsibility), and 'retention' in TPLMS planning. He outlined the estimation of the total allowable pollutant load of Masan Bay, priority setting, implementation scheme of TPLMS including development of the TPLMS Master Plan, and monitoring and reporting system of Masan TPLMS. Dr. Chang introduced the Marine Ecosystem Model as a tool for forecasting the changes in the water quality of Masan Bay and the maximum allowable load. Finally, Dr. Chang shared some principles (equity, cost-effectiveness, allowing future development, etc.) and methods used for the load allocation of Masan Bay emphasizing the roles of scientific experts, public participation and the management council (political leaders) in TPLMS. In conclusion, he described future implementation directions of Masan Bay TPLMS (e.g.. nutrients, air deposition, etc.).

In response to questions, he clarified that management decided it was important to still allow all cities room for development and that all allowable pollution load was thus allocated, leaving no room for succeeding generations of managers.

Open Forum and Summary*

2.5 Questions and discussions revolved around: (1) to what extent and how TAPL estimates were actually adopted/used for planning pollution reduction within a regulatory management and incentive/disincentive system and developing a master plan from the allocation plan; (2) water quantity (in addition to water quality) management which was determined to be especially important in DPR Korea and China; (3) the rationale used for allocation (e.g., past development growth vs. equitability); and (4) the importance of proper stakeholder understanding. In summary, the session concluded that:

a. TAPL modeling provides an estimate — not exact figures — that may be used as a basis for developing pollution reduction programs, including allocation. Providing estimates with a Margin of Safety (MOS) is recommended. MOS may account for errors in calculations, natural variability, variability in effluents, buffers for economic and population growth, the unknown response of the environment to pollution, climate change, droughts, floods, and other hazards, etc.

b. There are some challenges to be considered in setting the MOS. In some cases, MOS factors of 5 to 10 percent of the total pollution load are used; in others, the lowest water flow rate is applied in the calculation of allowable pollutant load. In general, the scientific basis for MOS has not been well established and requires further work to reduce the uncertainties.

c. Pollutant reduction allocation is a political/consultative process normally involving different levels of government (national and local), government agencies and sectors. Different principles and strategies may be employed in these consultations (e.g., equity, efficiency, polluter pays, ecosystem service, upstream/downstream alliance, etc.). Documentation of experience (successes and failures) is required to provide further confidence in the appropriateness of these strategies in the region.

d. The allocation of pollutant loads by sub-basin is an appropriate approach from an ecosystem-based management approach. However, agreement in allocation of loads requires agreement by political jurisdiction and by sector. This implies that the TPL process needs to be flexible and forward looking so that it can respond to issues raised in the negotiation of allowable loads, including matters such as growth and development.

e. Climate change/variation and other natural hazards are likely to have a major impact on integrated river basin and coastal area management. In particular, forecasting water flow/quantities in river systems and discharges to coastal areas is becoming an important consideration in the determination of TAPL. Further work is required in TAPL efforts to make these linkages.

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f. Fishable/swimmable waters are outcomes of pollution reduction programs that the general public and policymakers understand. The challenges for scientists and program managers is to translate TPL targets into a language people can understand easily (e.g., recovery a certain species of fish/shellfish, improvement in transparency, reduction in red tides, food security, public health protection, etc.).

3.0 SESSION 3: GOOD PRACTICES IN ENVIRONMENTAL MANAGEMENT IN DALIAN CITY, PR CHINA

3.1 Dr. Wen Quan of PR China's National Marine Environmental Monitoring Center (NMEMC) guided the participants through a tour of NMEMC's facilities and described the changes in Dalian City's environment. He pointed out: (a) a beautiful city park which used to be a garbage dump; (b) the increased inflow of seawater due to reduced river flow; and (c) the scenic protected forest and coast which used to be occupied by mariculture and a fishing village.

4.0 SESSION 4: IMPLEMENTING POLLUTION REDUCTION PROGRAMS IN SELECTED WATERSHED AREAS

4.1 The fourth session described on-going efforts in pollution reduction in selected watershed areas in China, Philippines and RO Korea. This session was chaired by Mr. Mark Mulingbayan of the Manila Water Company, Philippines.

The Pollution Reduction Program in Guangli River Watershed

4.2 Mr. Wang Shouqiang, First Institute of Oceanography, Qingdao, PR China, presented the pollution reduction program in Guangli River watershed. Guangli River starts from Kenli District, Dongying City, passes through the central town of Dongying and flows into Laizhou Bay. The length of Guangli River is 48.8 km and drainage area is 792 km^2. The population of the watershed is 838,000. Industrial and non-point sources contribute but COD pollution is mainly from domestic sewage.

In order to achieve the water quality target of Guangli River (COD ≤ 5 mg/L, Ammonia nitrogen ≤ 0.5 mg/L), a pollution reduction plan containing three parts has been implemented.

A. Infrastructure of pollutant treatments: (1) Sewage interception and collection projects; (2) Sewage treatment plant expansion and related supporting construction, (3) Channel clean up; (4) Construction of the source water diversion project.
B. Pollutant emission reduction: (1) Industrial pollution source control; and (2) Non-point pollution source control.
C. Ecological management and landscape shaping: (1) Construction of artificial wetlands; (2) Ecological landscape shape.

Through the pollution reduction plan, city views were improved, people can enjoy a cleaner river (COD and ammonia improved from 2008 to 2009), and the integrated management measures connected and enhanced the cooperation between different departments in the government. Finally, Mr. Wang noted areas for improvement: (1) storage capacity of sewage treatment plants; (2) The capacity for wastewater

interception and collection management need to be enhanced; (3) Guangli River's self-clean capacity need to be rebuilt; (4) Groundwater salinization is a limitation for the sewage treatment.

Pollution Reduction Program in Metro Manila

4.3 Ms. Leonor Cleofas, Metropolitan Waterworks and Sewerage System (MWSS), Quezon City, Philippines, presented the pollution reduction program in Metro Manila. The MWSS provides water supply and wastewater requirements of approximately 15 million people in the National Capital Region including the Provinces of Cavite and Rizal. Private companies — Maynilad and Manila Water — have been awarded concessions to develop and manage water supply and sanitation for the west zone and east zone respectively. By the end of 2010, in the west zone, the water supply coverage is 88 percent, sewage coverage is 8 percent; in the east zone, the water supply coverage is 87 percent (99 percent in the central distribution area), sewage coverage is 23 percent. According to the Supreme Court decision of 18 December 2008, the target was to clean up and rehabilitate Manila Bay to attain Class SB (50 percent reduction in BOD loading in Manila Bay area by 2015). In order to achieve the target, the MWSS granted an extension of concession agreements with the condition that concessionaries had to accelerate and double the investment for sewerage and sanitation and to support the development of new water sources. Besides that, MWSS/Concessionaires still need to comply with the Clean Water Act. Combined sewer and septage system should be implemented in areas where a separate system is not doable and septage management program should be continuous. Due to land constraints, different technology options are being considered that will result in smaller footprints. Coordinated advocacies and policies towards behavioral changes on dumping of solid wastes are needed.

Community's Wisdom and Concerted Efforts for Pollution Reduction in Masan Bay Watershed

4.4 Dr. Nam Jung-Ho, Marine Policy Research Division, Korea Maritime Institute, Seoul, RO Korea, outlined the history of environmental degradation and management of Masan Bay including the social forces that led to the development of its Total Pollution Load Management System (TPLMS). After using TPLMS in Masan Bay, the total pollution load decreased from 25,203 kg/day in 2005 to 24,347.5 kg/day in 2010. In order to achieve the target of 21,788 kg/day, the following measures are planned: (1) improving water treatment effectiveness so emission concentration is reduced from 15 ppm to 10 ppm; (2) reducing uncertainty by rewarding good monitoring of water treatment; (3) expanding sewerage coverage, reusing treated wastewater so there is no discharge of treated wastewater into the sea; (4) adjusting the scale, cancelling or withholding development projects from which 3,392 kg/day reduction is expected; (5) enhancing ecological functions of river ecosystem by making artificial riparian areas more natural. In addition, supportive measures include closer periodic evaluation, water quality and pollution load monitoring, review of development activities and projects, consulting process for adaptive approach, and building capacity and raising awareness. Future plans include more public awareness raising and local capacity building; controlling total phosphorus; advancing the modeling system, and ecosystem-based spatial management.

Japan-China Cooperation for Total Emission Control

4.5 Dr. Tetsuo Kuyama, Institute for Global Environmental Strategies, Kanagawa, Japan, presented on the Japan-China cooperation on total emission control in China which aimed to build demonstration models on decentralized domestic wastewater treatment in rural China (small towns). It began in 2008 after a Japan-China assessment of wastewater in China showed that the volume of domestic wastewater has exceeded industrial wastewater since 1999 in China; the urban sewage treatment rate increased from 52.0 percent in 2005 to 76.9 percent in 2010 while the villages' domestic wastewater treatment rate was 4 percent in 2007; there is larger population in rural areas than urban areas; and the increase of wastewater discharge from rural areas is expected along with the improvement of living standards.

The project implementation used the following guidelines: (1) simple treatment process and technology for easy management; (2) adaptation of treatment process and technology to socioecological and natural conditions; (3) waste sludge treatment for reuse as compost; (4) use of artificial wetland or soil treatment for low cost treatment; (5) on-site construction by using materials and labor available at site. Three indicators were used to evaluate the project: effluent water quality, initial cost, and operational cost. The project learned the following: (1) Applied technology can contribute to total emission control in China; (2) Contact aeration method is feasible for small-scale domestic wastewater treatment facilities in rural China; (3) Construction of pipelines for wastewater collection costs more than the actual treatment facility; (4) Electricity billing system and operational system should be reviewed in order to lower operational cost; (5) Costs for maintenance and repair of equipments, management of waste sludge, and maintenance of artificial wetland are needed in addition to costs for manpower and electricity; (6) Waste sludge requires treatment costs if it is not re-used.

Open Forum and Summary[*]

4.6 Questions and discussions revolved around: (1) the relative roles, power, responsibilities and costs of national government, local government, industries, households, and water companies/treatment plants with respect to constructing and operating sewerage and treatment plants; and (2) sustainability (including social acceptability and long-term accountability) of management interventions. In summary, the session noted the importance of:

a. Both hard engineering (e.g., sewage treatment plants) and soft engineering (e.g., natural and manmade wetlands; buffer zones) solutions need to be considered in the development and implementation of pollution reduction programs, as appropriate.

b. Management systems for TPL need to include: (1) institutional arrangements/roles and responsibilities of different agencies/levels of government; (2) genuine public understanding, participation, acceptance, behavior change and ultimately benefits even at the preparatory stage; (3) adequate financial, technical and management capacities; (4) sustainability and source(s) of revenue to support the operation and maintenance of required facilities and services; and (5) policies and legislation for controls and/or

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economic instruments to encourage upstream/downstream cooperation. A driving force to reduce pollution must be identified and recognized by upstream and downstream users and beneficiaries.

5.0 SESSION 5: THE FUTURE OF THE IRBCAM NETWORK PARTNERSHIP

5.1 After the participants had reviewed, refined and agreed upon the Conclusions for each of sessions 1, 2 and 4, Ms. Gusung Lee of the PEMSEA Twinning Secretariat facilitated a discussion of the recommendations of the workshop.

5.2 Discussions during the open forum are summarized in the Conclusions and Recommendations below.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The Workshop noted, on the value of TAPL as an instrument for improved water quality management in river systems and coastal areas of the region, that:

6.1 In contrast to regulation purely based upon effluent standards, Total Allowable Pollutant Load (TAPL) management provides a more effective way of progressing toward desired water quality targets in river basins and marine waters. TAPL management, supporting databases, partnerships/coordinating mechanisms and regulations are to be promoted with key stakeholders. However, it is just an element of coastal management and not a panacea. Good governance is needed in addition to the technical elements of TAPL.

The Workshop noted that the current shortcomings and gaps that currently constrain TAPL's acceptance, further development and application, include:

6.2 Inadequate information and technical capacity, advocacy and social acceptance, multisectoral coordination, an agreed upon method for TAPL allocation, managing uncertainty, and leadership.

The Workshop recommended that, the twinning network can better serve as a driving force in the region for facilitating change, through:

6.3 PEMSEA partnership to prepare a synthesis of lessons learned/good practices in TPL management, based upon experience in twinning sites in the region, for dissemination during the next Regional Twinning workshop/EAS Congress 2012.

6.4 Twinning sites to collaborate in the preparation of lessons learned/case studies by submitting individual case studies and/or providing access to project information/syntheses for incorporation into the informative document. Contributions do not have to be from full-blown successful efforts; various elements can be contributed such as provision of non-revenue generating water supply, customer feedback mechanisms, pollution inventory of micro-scale industries, etc. The Twinning Secretariat will discuss with RO Korea's MLTM regarding support for facilitating this.

6.5 Organize two or three expert workshops and policymakers workshops to prepare some guidance/overall framework both technical and social for those who want to introduce TAPL and IRBCAM to their river basins.

6.6 Future twinning programs/workshops to include expansion of issues with respect to integrated river basin and coastal area management (IRBCAM) including, for example, water use/water management, the impact of natural hazards (e.g., climate change/climate variation), and most especially, institutional and governance arrangements and social consensus for IRBCAM involving high-level policymakers.

6.7 Promote and expand the network to other sites beyond the current sites especially at the upcoming EAS Congress 2012. Explore the need for formalizing membership of the twinning network and better define membership (technical network or government network) as needed.

7.0 CLOSING

7.1 The Twinning Secretariat facilitated the distribution of certificates of appreciation and participation and a few words from each of the participants.

7.2 Prof. Mao Bin remarked that much was learned from the workshop. He thanked PEMSEA, KMI, NMEMC, and the participants on behalf of the State Oceanic Administration and wished participants a safe travel home.

7.3 Ms. Gusung Lee remarked on the friendship, cooperation and exchange of information and knowledge between the twinning sites. She thanked her co-organizers, the representatives from each twinning site, and the Chinese government. She looked forward to seeing the participants again at the EAS Congress 2012 and at the Yeosu Exposition.

7.4 Mr. S. Adrian Ross noted that progress and transformation from the first Twinning Workshop to the present is being seen. This workshop also featured the key exchange of valuable information. He agreed with the participants that it might be time to shift to new topics, especially on political support for IRBCAM, but reminded the participants not to shift too quickly into flavors of the month and forget that pollution is still a major problem. The Twinning Network can get political support by providing a strong technical role. He thanked SOA, KMI and MLTM and friends from the various project sites and wished for further development of relationships with NMEMC and Japan.

ANNEX 1

List of Participants

6th Regional Twinning Workshop on Integrated River Basin and Coastal Area Management (IRBCAM)

Theme: Total Allowable Pollutant Load Allocation in River Basins and Coastal Areas of East Asia

18-20 May 2011
Dalian City, Liaoning, PR China

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ANNEX 2

Workshop Programme

6th Regional Twinning Workshop on
Integrated River Basin and Coastal Area Management (IRBCAM)

Theme: Total Allowable Pollutant Load Allocation in River Basins and Coastal Areas of East Asia

18-20 May 2011
Dalian City, Liaoning, PR China

1. Workshop Objective:

To share good practices and experiences in planning, implementing and evaluating total allowable pollutant reduction programs in integrated river basin and coastal area management programs of Bohai Sea (PR China), Manila Bay (Philippines), Jakarta Bay (Indonesia), Jiulong River (PR China) and Masan-Chinhae Bay (RO Korea).

2. Workshop Programme

17 May 2011	
1700-1800	**Registration** at the hotel lobby
1900	**Welcome Dinner** hosted by State Oceanic Administration
18 May 2011 (5th floor meeting room)	
Opening	
0800-0830	**Registration** at the 5th floor meeting room
0830-0845	**Welcoming Remarks** Liang Fengkui, Division Director, Department of International Cooperation, State Oceanic Administration, PR China Chen Laizhao, Deputy Director-General Liaoning Department of Ocean and Fisheries, PR China Huo Chuanlin, Division Director National Marine Environmental Monitoring Center, PR China Gusung Lee, PEMSEA Twinning Secretariat, Korea Maritime Institute, RO Korea Stephen Adrian Ross, Chief Technical Officer, PEMSEA Resource Facility
Twinning Workshop Background, Objectives and Expectations	
0845-0900	**Twinning Workshop Background, Objectives and Expectations** Gusung Lee, PEMSEA Twinning Secretariat
0900-0930	Group Photo and Coffee Break
Session 1: Estimating Total Pollution Load Chair: Mr. Andono Warih, Environment Management Board, Jakarta Province, Indonesia	

0930-1000	**Estimating Pollution Load in the Downstream of Ciliwung River, Indonesia** Budi Kurniawan, Head of Small Scale Industry Monitoring and Control Sub-Division, Ministry of Environment, Jakarta, Indonesia
1000-1030	**Total Pollution Load in the Luan River** Tian Hailan, Luan River Basin Work Team, Shijiazhuang, Hebei, PR China
1030-1100	**Brief Introduction on Strategic Action Plan for Ecosystem-Based Management in Jiulong River Basin and Xiamen Bay** Liu Zhenghua, Research Fellow, Third Institute of Oceanography, Xiamen, PR China
1100-1130	**Open Forum**
1130-1300	Lunch
1300-1345	**Calculation of Pollution Load Entering Manila Bay in 2010 and 2025** Carlos Primo David and Mark Vincent Clutario, National Institute of Geological Sciences, University of the Philippines, Quezon City, Philippines
1400-1430	**Estimating Total Pollution Load in Masan Bay** Kim Kyoung Mi, Environmental & Whole Information System, Seoul, RO Korea
1430–1500	Tea Break
1500–1600	**Open Forum**
1600–1630	**Summary and Wrap-up of Session 1**
1630–1700	Administrative Briefing
1900	**Welcome Dinner** hosted by Korea Maritime Institute
19 May 2011 (3rd floor meeting room)	
Session 2: Allocating Pollution Reduction Chair: Prof. Mao Bin, Department of International Cooperation, State Oceanic Administration, PR China	
0830–0900	**Challenges in implementing pollution reduction allocations in the Laguna Lake-Pasig River-Manila Bay Watershed** Mark Tom Mulingbayan, Manila Water Company Inc., Quezon City, Philippines
0900-0930	**Total allowable pollutant load allocation in the Daling River Basin** Li Ai, Ocean and Fisheries Research Institute of Liaoning Province, Dalian, PR China
0930-1000	**Allocation of Total Allowable Pollutant Loading of Masan Bay TPLMS** Chang Won-Keun, Marine Policy Research Division, Korea Maritime Institute, Seoul, RO Korea
1000–1030	Tea Break
1030–1130	**Open Forum**
1130–1200	**Summary and Wrap-up of Session 2**
Session 3: Field Trip	
1200–1330	Lunch
1330-1700	**Field Trip**

1700-1730	Discussion of the good practices observed
1900	**Dinner** hosted by National Marine Environmental Monitoring Center
20 May 2011 (3rd floor meeting room)	
Session 4: Implementing Pollution Reduction Programs in Selected Watershed Areas Chair: Mr. Mark Tom Mulingbayan, Manila Water Company Inc., Quezon City, Philippines	
0830–0900	**The Pollution Reduction Program in Guangli River Watershed** Wang Shouqiang, First Institute of Oceanography, Qingdao, PR China
0900-0930	**Pollution Reduction Program in Metro Manila** Leonor Cleofas, Metropolitan Waterworks and Sewerage System, Quezon City, Philippines
0930-1000	**Community's Wisdom and Concerted Efforts for Pollution Reduction in Masan Bay Watershed** Nam Jung-Ho, Marine Policy Research Division, Korea Maritime Institute, Seoul, RO Korea
1000–1030	Tea Break
1030–1100	**Japan-China Cooperation for Total Emission Control** Tetsuo Kuyama, Institute for Global Environmental Strategies, Kanagawa, Japan
1100–1200	**Open Forum**
1200–1330	Lunch
1330–1430	**Open Forum**
1430–1500	**Summary and Wrap-up of Sessions 4**
1500–1530	Tea Break
Session 5: The Future of the IRBCAM Network Partnership	
1530–1630	**Discussion and Summary: Way Forward - Twinning Arrangement** Lee Gusung, PEMSEA Twinning Secretariat
Closing	
1630-1700	Mao Bin, Department of International Cooperation, State Oceanic Administration, PR China Gusung Lee, PEMSEA Twinning Secretariat, Korea Maritime Institute, Seoul, RO Korea Stephen Adrian Ross, Chief Technical Officer, PEMSEA Resource Facility