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ENVIRONMENTAL BRIEFING NOTE

Integrated Watershed Management for Laguna de Bay

Laguna de Bay, one of the largest lakes in Southeast Asia, is a source of livelihoods for the fishery sector, provides irrigation water for the agricultural sector, and is an important potential water source for Metro Manila. However, the lake region has been experiencing rapid urbanization and subsequent environmental deterioration. Based on Korea's recently implemented nationwide integrated river basin management system, this note suggests integrated watershed management strategies for the Laguna de Bay in the Philippines.

Laguna de Bay is the largest freshwater lake in the Philippines. Approximately 11.3 million people (15 percent of the total population in the Philippines) live in the Laguna de Bay region. Out of the total 2,943 km2 watershed area, residential and industrial areas already account for 1,108 km2, and are expanding very rapidly. The lake is a source of industrial cooling water, irrigation water, and hydroelectric power; a transport route for oil products and lakeshore dwellers; and most notably a source of fish supply. Because of its proximity to Metropolitan Manila, the resources and their use contain unique potential for economic development. In the long term, the lake is expected to be a main source of domestic water supply for the Laguna de Bay region, especially Metropolitan Manila.

However, the quality of water has been getting worse in the course of rapid urbanization, and the water quality status of some stations in the lake is below Class C level. Most tributary river stations have worse water quality than the lake stations. The potential use of Laguna de Bay as a water supply source for the people in the Laguna de Bay region requires the upgrading of water quality from Class C to Class A. This can be achieved with systematic measures and integrated methods.

This note aims to provide integrated watershed management strategies for the Laguna de Bay based on the recently implemented nationwide integrated river basin management system in Korea. In particular, we note the possible application of the Total Pollution Load Management System (TPLMS), the extension of the Environmental User Fee System (EUFS) to the household sector, and Suspended Waste Management (SMS) strategies. These systems are integral parts of the Korean watershed management system to (a) promote the balance between local development activities and traditional water control activities; and (b) maximize

the effectiveness of traditional water control regulations.

Total Pollution Load Management System

TPLMS seeks to harmonize preservation and development by allowing regional developments to be carried out in an environmentally friendly manner and within the scope of achieving and maintaining the desired water quality. Under the system, pollution sources are managed so as to keep allowable pollution loads in accordance with water quality standards. The system includes procedures to (a) establish target water quality; (b) set allowable pollution loads to meet target standards; and (c) regulate pollution loads within suggested criteria. TPLMS can be summarized as a sustainable watershed management system that relies on scientific data, increases efficiency for management, and intensifies the responsibility of economic sectors. TPLMS was introduced to compensate for the shortcomings of conventional concentration-based effluent regulation.

The fundamental purpose of TPLMS application in the Laguna de Bay region is to improve water quality to the designated level by controlling pollution loads within the allowable level. Intensive studies on the selected demonstration sites in Laguna de Lake watersheds indicate that more efforts should be directed to improve the basic water quality management systems and to strengthen technical support systems before introducing TPLMS in Laguna de Bay.

Improving Water Quality Management Systems

This study shows that:

- It is important to clearly establish water quality management targets for specific reaches of streams and lakes in terms of water quality standards (designated water uses) to estimate total allowable pollution loads for the specific pollutants. However, no reach-by-reach water quality management targets for the specific pollutants are yet established.
- Before introduction of TPLMS, we suggest implementation of preventive pollution source control measures, such as designations of Water Protection Areas, Riparian Buffer Zones, and Special Measure Zones. These are very direct and powerful source control tools. Implementation of such prevention measures is recommended when development pressure is relatively low.
- Introduction of TPLMS is required when designated water quality cannot be attained by the traditional approaches. Therefore, management priority should be given to install or expand basic environmental facilities, including swage treatment facilities.
- Extensive stream water quality and flow monitoring systems and powerful national inspection systems for individual pollution sources are necessary to evaluate water quality, to support water quality monitoring, and to monitor effluent compliance. These systems were implemented in Laguna de Bay, but require extensive upgrading to support TPLMS.
- It is a critical component to identify pollution sources (population, industry, livestock, land use, etc) in detail in terms of administrative units as well as watershed units. In addition, reliable statistics on pollution sources need to be compiled for pollution load estimation. An administrative system for periodic pollution source surveys and reliable statistics on pollution source changes should be established.

Strengthening Technical Support Systems

- Collecting reliable pollution source data is the first step to TPLMS development. Very extensive, detailed, and reliable pollution source data are required for load estimations. Development of a GIS-based database system and compilation of associated pollution sources are necessary for effective data management and pollution control.
- Extensive research is needed to get reliable "unit loads" and to identify detailed transport pathways and fates of discharged pollutants in the Laguna watershed. There are many ways to estimate loads. We suggest developing rather simple and affordable methods based on local natural processes and management conditions.

- The quantitative relationship between pollution source and stream water quality is generally derived from water quality models. There are many good models available in the public domain as well as commercial products, but operation of any model requires experienced model experts and reliable data. Basic stream geometry parameters and stream flow/water quality data used for model calibration and validation are particularly critical to guarantee reliable model prediction.
- Diverse water quality measurement and monitoring systems (including automatic systems) are used to support TPLMS implementation. However, those systems are rather expensive and may not be affordable for the Laguna watershed at this time. It would be better to improve current water quality monitoring systems with more cost-effective and affordable ways-first to support current management demands, and then to establish long-term water quality monitoring strategies for future development.

Environmental User Fee System

The Environmental User Fee System (EUFS) in the Philippines is a market-based instrument to reduce the water pollution of industry discharged to the Laguna de Bay. With the polluter-pays principle, each industry is trying to save fees, and this effort can help decrease pollution loads.

EUFS in the Philippines has a supplementary role as a pollution discharge regulation. The unit rate of the variable fee is differentiated by the BOD concentration (50mg/L) and the criterion is from the effluent standard (Class C). Therefore, it can be an implementation method to control pollution discharges. Regarding the fee structure, EUFS is composed of a fixed fee and a variable fee. The variable fee is based on the total pollution load. The charging structure, based on the total pollution load, helps motivate polluters to reduce the pollution load. Issues surrounding EUFS are as follows.

Refining Fee Structure

Since the formula of EUFS is based on the concentration of pollution, it provides an incentive for dilution to the target discharger. Removal of this incentive for dilution is an issue. The incentive for dilution under LLDA schemes can be eliminated through amending the differentiation structure of variable fees. However, this differentiation structure has a supplementary role of supporting the pollution regulation. Therefore, until the regulatory scheme is switched to total pollution load regulation, whether to maintain this supplementary role of EUFS is a policy decision. And for fair and uniform implementation of EUFS, harmonization of LLDA and DENR EUFS is needed.

For efficient pollution control, the carrying capacity of the controlled region should be considered. EUFS also should have a consistent structure to induce pollution abatement behavior in regions with different ambient conditions. The Korean system can provide a reference for these regional factors. We recommend setting the regional differentiation structure within EUFS. First, designate the specific regions for different ambient water conditions, and restructure the charging structure differentiated by regional characteristics; that is, set different rates or coefficients for each category of regional condition. The designation of the specific regions can be converted to different load allocation under the TPLMS.

To further refine this structure based on the Korean experience, we recommend (a) reflecting a change of cost; (b) a supplementary role for pollution regulation; and (c) expansion of EUFS to the other pollutants. Also, adjustment of the EUFS under TPLMS in the future is discussed.

Expansion to Other Sectors

Regarding the expansion of EUFS to the other sectors, different characteristics of each sector should be considered. For the industry sector, emission charges to induce socially preferable pollution abatement activities-including treatment facility investment-can be implemented for each polluter.

For the household sector, individual emission reduction activities-including operation of individual treatment facilities-are less efficient than common treatment and impossible in some cases. Common treatment is generally planned and provided by the

government. In this case, the EUF for the household should be in the form of a sewage treatment tariff levied by the service supplier (government or private).

For commercial sectors and smaller firms, measuring and monitoring costs would be too high to implement EUFS. Therefore, a fee or charging system unrelated to actual discharges and implemented with identified nature of effluent is efficient, considering the implementation cost.

This study shows that there has often not been much concern about the cost of water source protection or competitive usage of water resources. For efficient use of water resources and effective water quality maintenance, the introduction of abstraction charges should be considered.

Suspended Solid Waste Management

Suspended solid waste is generated from watersheds mainly by illegal dumping or inflow of natural or left waste through rainfall and runoff. It raises hygiene and water quality issues, and affects activities in the watershed such as fisheries and irrigation, as well as the quality of drinking water sources. It also can restrict water use for power generation, transport, and recreation. Generation and management between upstream and downstream sites create additional issues in solid waste management.

At present, suspended solid waste management is not addressed systematically in the Philippines. Suspended solid waste management (SWM) is a part of general solid waste management. Regarding the generation status and composition of suspended solid waste in the Philippines, the first issue in suspended SWM is to control illegal dumping into rivers. Establishing rules and regulations for waste discharge and its implementation is an important first step, and establishing an adequate collection and treatment system is also needed. For the financial accountability of waste management systems, waste collection and treatment service fees should also be implemented.

In addition, because of the externality between upstream and downstream, reaching a consensus regarding basic principles and establishing schemes for cost-sharing between related regions could be another policy issue. The case of the Han River in Korea could be a reference to resolve this issue and related disputes between regions by establishing a cost-sharing scheme. It is discussed in detail below.

To solve the externality issue between regions in suspended SWM, reaching a consensus among interested parties for the principle and scheme for waste management and cost-sharing is important. That includes the system of national, municipal, and individual responsibilities for waste management, and the balance of principles for cost-sharing between polluter and beneficiary as well as upstream and downstream.

As regional development proceeds, and the usage of water resources becomes more complex, many kinds of cost-sharing issues related to water use and protection will be encountered, including cost-sharing for drinking water source protection.

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