INDONESIA

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Subject of Common Interest

A. Flood disasters

A.1 Causes of Flood Disasters

In order to mitigate flood disasters comprehensively several factors that cause flood disasters have to be understood. There are three (3) major factors cause of flood disasters in Indonesia, those are:

1) Static natural conditions:
2) Dynamic natural phenomena:
3) Dynamic socio-economic activities of community:

A.2 Counter measures to mitigate flood disasters

1) Structural counter measures
   - Dike: to prevent river overflowing when river flows exceed river discharge capacity
   - River normalization and floodway: to lower elevation of flood discharge water level
   - Reservoir and the use of low lands for flood retentions: to control river discharge, i.e., to reduce the peak of flood discharges
   - Polder and pump: to protect low lying areas from floods and to drain excess water on these areas.

2) Non-structural approaches to flood management:
   a. Flood proofing is the provision of long-term non-structural or minor structural measures to mitigate the effects of floods
   b. Flood response planning is preparing the community for event that floods occur and then, by implementing certain organizational measures (like evacuation), ensuring that disruption and damage caused by the floods is kept to a minimum

   Non-structural counter measures that have been implemented in Indonesia, among other are as follows:
   - Disaster relief: The organization (at national, provincial, district/town levels) and provision of emergency rescue of and short-term relief for those subjected to major flood damage or evacuation as a result of floods.
   - Flood fighting: Actions undertaken during floods to prevent loss of live, damages and failure of flood control structures, as well as to divert floods from sensitive areas. Flood fighting may include evacuating residents of threatened areas, closing roads according to a preplanned schedule, providing medical care, reinforcing police protection, using portable pumos to relieve surcharging in sanitary sewers, sandbagging, building temporary earth dikes, activating floodproofing measures, and continuously inspecting flood control facilities.
   - Flood warning: Issuing the results of a forecast to the public or public authorities. Advance notice that a flood may occur in the near future at a certain station or in certain river basin.

3) Comprehensive programs on flood management:
   Recently Government of Indonesia has launched a comprehensive program for flood management, those are as follows:
   a) Reviewing and revitalization of spatial planning to balance utilization and conservation of natural resources.
   b) Intensification of flood control management by implementing three (3) measures, e.g., flood protection, flood proofing, and flood response planning based on river basin approach, i.e., *one river, one plan, and one management*
   c) Provision of adequate urban infrastructures related flood management, such as drainage facilities, garbage management and solid waste and waste water management.
   d) Provision of low cost housing to accommodate resettlement of squatters on river levee and slump areas.
   e) Improvement of public service by applying *good governance* principles.

A.3 Progress of flood protection measures

- The number of flood prone areas recorded is about 1.4 mill to 1.9 mill hectares. Among those flood prone areas, about 420.000 hectares have been protected from flood with return period ranging from 5 to 25 years.
- According to a rough estimation, flood control measures required on 600 rivers are: (i) dike of about 30,000 km, and (ii) river channel normalization of about 15,000 km. Flood control measures that have been completed up to the year 2001 are: (i) dike of about 2,600 km or 8% of the total dike required, and (ii) river channel normalization of about 1,500 km (10% of the total dike required).
- Most of major cities in Java, i.e., JABODETABEK (Jakarta, Bogor, Depok, Tangerang, and Bekasi), Bandung, Semarang and Surabaya and off Java such as Medan, Padang and Makassar have a Master Plan for flood control development. However, its implementation requires a large amount of investment, and therefore stage wise implementation plan is adopted and the result is partial completion of the total infrastructures required.

B. Sediment Disasters

As a result of growing population pressure and changes in the nature and intensity of economic activity throughout Indonesia, issues of land and water uses have become increasingly important and has caused increase in number of degraded watersheds/river catchments overtime. Number of degraded river catchments was recorded 22 in 1984, increase to 39 in 1992 and become 59 degraded river catchments in the year of 1998.

In Java, river catchments degradation has caused severe problems of unstable river flows. During the wet season river flows bring high rates of sedimentation due to excessive erosion on the upstream watershed. These cause very fast sedimentation rates on reservoirs and lakes, making the lifetimes of reservoirs shorter than planned as well as reductions on storage capacities.

In islands outside Java, soil erosion and high fluctuation of river flows between the rainy and dry seasons due to upper watershed degradation threaten optimal functions and sustainability, which in turn results in a high cost for Operation and Maintenance (O&M) of recently completed water resources infrastructures. High sedimentation on the lower reach of river such as that has occurred in several main rivers in Kalimantan, threatening accessibility of natural harbors on the river mouth as well as inland water transportation especially during the dry season. This condition constrained foods transportation to upper areas and may cause temporary foods scarcity.

Sedimentation problems on rivers that caused by mountain eruption, i.e., Mountain Merapi, Kelud, Semeru, and Galunggung (all in Java) and Mountain Agung in Bali are relatively well controlled by construction of sabo dam systems which were built since about 20 years ago under technical assistance of JICA and construction loan of JBIC (OECF previously).

C. Water Shortages

C.1 Water Resources Potential

Indonesia has over 5590 rivers. Excepts for rivers in Kalimantan and a few river in Java, most rivers are short with limited flood carrying capacity. Although Indonesia has an abundance of rainfall, with a national average of over 2500 mm/year of which 80% falls during the rainy season; however large regional variations in the rainfall exist over the country. It ranging from the very arid areas of Nusa Tenggara, Maluku and parts of Sulawesi Islands (less than 1,000 mm), to very wet areas in parts of Irian Jaya, Java and Sumatra (more than 5,000 mm)

The average annual renewable water resources, or surface water potential per island, can be expressed in terms of per capita population (1990), by dividing the islands into their relative catchments and estimating run-off using a rainfall/run-off relationship (UNDP/FAO, 1992). These vary between a maximum of 543.230 m3 in Irian Jaya, to minimum of 1,767 m3 in Java and Madura, and 2,003 m3 in Bali.

Using this approach, the average annual surface water potential for the whole of Indonesia is 18,178 m3/capita (1990). With estimated total annual per capita demands of approximately 40 m3, the water resources availability would not yet appear to be significant constraint on further socio-economic development in Indonesia.

However, when water resources availability is considered regionally by taking each islands as an independent unit of water, a very different picture emerges. The annual surface water potential per capita in Java (including Madura) is estimated at 1,767 m3. in Java, where there is an estimated population of 120,4 million, the annual per capita water demand amount to 482 m3, or 27% of the available water resources, when high water demand can become a limiting factor on national development.

C.2 Water Resources Demands

The demand on water resources has rapidly increased as the nation implements its development program to meet the sharply increasing needs for irrigation, safe drinking water, industrial water, energy, etc.

By making estimating of the population growth rates and the corresponding requirements for domestic, municipal and industri (DMI) uses, it is possible to project the total DMI demand in the year 2020. Similarly, predictions can be made for irrigation demands, based on population projections and food (rice) requirements to maintain self-sufficiency. River maintenance water demand is estimated by multiplying projected urban population by per capita flushing water requirement. Total annual water demand on each island in year 2020 is shown in Table 1 below.

Table1. Annual Water Demand and Estimated Natural Basic Discharge in 2020

Unit: MCM

Region	DMI	River Maintenance	Irrigation	Fishpond	Livestock	Total Demand	Estimated Natural Basin Discharge
Sumatera	2.630	2.733	15.992	1.275	155	22.766	482.173
Jawa & Bali	9.850	9.799	54.918	809	258	74.569	122.699
Kalimantan	768	820	3.643	753	29	6.014	556.700
Sulawesi	686	769	14.243	354	110	16.612	143.343
Maluku & Nusa Tenggara	406	444	5.526	40	69	6.485	45.909
Irian Jaya	107	124	48	0	2	281	496.422
Indonesia	14.401	14.670	94.370	3.213	623	127.277	1.847.246

Out of 1,847 billion m3 of available water (natural basin discharge per year), about 127 billion m3 will be used for DMI, Irrigation, River Maintenance, etc. Balanced of about 1,720 billion m3 is available for another new development of DMI, Mining, Agricultural uses, etc. However, water surplus can not be used all, since wet season surplus water can not be used for dry season without any large scale water reservoir.

Obviously when taken on an individual catchment basis, there may be some water shortages in meeting all demands at certain periods during dry season. This confirms the need for "real-time management" of all water resources in each river basin, with full regard to water allocation and the operation of each scheme under normal and emergency condition. Consideration will also have to be given to the releases required from reservoir for hydropower generation, for aquaculture, maintaining minimum flows in rivers and for flushing. This can only be achieved by adopting the integrated approach to river basin planning, with the necessary regulations and procedures in place, to provide the means of "managing" the water resources in the fullest sense of the word.

Policies for achieving these targets include; water resources policy, institutional, legislative and regulatory reform program, improving and productivity in water utilization; increasing the supply of human settlement, agriculture, industry, tourism and electricity generation; extending irrigation networks; improving water utilization through development of fair and efficient allocation systems; controlling damage to the environment; strengthening water resources institution; and supporting regional water resources development.

D. Water Contamination and Damage to Ecosystems

Because of its multiple roles—economic, ecological, and socio-cultural—most issues of sustainable development in Indonesia are related in one way or another to the management of land. As a result of growing population pressure and changes in the nature and intensity of economic activity throughout Indonesia, land-related issues of efficiency, sustainability and equity have become increasingly important. On Java, the conversion of upland forests and coastal wetlands to agricultural use has led to soil erosion, watershed degradation and the loss of valuable marine resources. The rapid—but often uncoordinated—expansion of urban areas results in less-than-optimal land use densities and efficiency in the provision of infrastructure. The spread of industrial firms in and around urban areas have little regard, until recently, to their impact on the environmental or the health and welfare of surrounding communities.

Java which has 60% of the population, 70% of irrigated agriculture, and 75% of industry, issues of water quantity and quality include emerging conflicts between competing uses (agriculture, industry, and municipal), and between surface and groundwater use in rapidly growing urban areas. In the aggregate, Java is well endowed with rainfall. The problem is one of seasonal and annual variations, with dry season flow in the main rivers only 20% of annual flows—and as little as a 10% in a dry year. This is compounded by the fact that river basins on Java are relatively steep and short (less than 150 km on average) and almost all of their upper catchments are facing serious degradation, resulting in most of the wet season water running unused into the sea and very little flows during the dry season. During the wet season river flows bring high rates of sedimentation due to excessive erosion on the upstream watershed. These cause very fast sedimentation rates on reservoirs and lakes, making the lifetimes of reservoirs shorter than planned as well as reductions on storage capacities. While a number of dams have been built in major river basins such as Citarum, Brantas, Serayu-Bogowonto, Bengawan Solo and others, their reservoirs hold less than 5% of total river flows. Most of the reservoir capacities of those river basins were planned to meet the water demand for various uses up to the planning horizon of

2010. Several additional sites have been identified for possible future dams, but implementation is likely to be constrained by high population densities and the social and economic costs of resettlement.

In volume terms, water use in agriculture currently accounts for 80% total demand, while industrial and municipal requirements together account for only about 20%. The consumption of water by households and businesses will rapidly grow over the next two decades, but their needs will reach an amount to about 25%-30% of total demand by the year 2020. To support continued rapid growth and improvement in human health and welfare, however, these needs will have to be met. This will require a shift of water in the dry season from agriculture to municipal and industrial use. Such diversions are already beginning to occur, but greater attention is needed to the process of water allocation so as to minimize the social and economic costs for farmers and the potential disruption to agricultural output. Government of Indonesia is aware of the need to manage its water resources on an integrated river basin basis, and is currently assessing the regulatory and institutional changes that would require. It will be especially important to ensure the coordination of groundwater –as well as surface water— use. Many of the aquifers in Java's rapidly growing urban centers are already suffering from over-extraction, resulting in salt-water intrusion and ground subsidence in coastal areas.

The challenges of meeting the demand for water in the dry season are complicated by the growing volume of pollution from urban and industrial sources. Most of the major rivers on Java are seriously polluted with a combination of untreated human waste, uncollected municipal refuse, and largely uncontrolled effluents from industry—including increasing amounts of toxic and hazardous waste. During the dry season, when river flows are greatly reduced, the concentration of pollution loads increases dramatically. One solution of this problem is to release water from storage reservoirs to "flush" these wastes away from urban areas. This provide only temporary relief, however, at a high cost in term of alternative uses in agriculture. The groundwater aquifers in many urban centers are also polluted, primarily by human waste, but with increasing evidence of industrial waste as well. Fecal contamination of water supplies represents a constant hazard to human health, and this is compounded during the rainy season by the flooding of low-lying areas—in part due to the clogging of drains and canals by solid waste. Over the longer, toxic and hazardous waste poses an even more serious threat to human health and welfare. Sample of groundwater in Jakarta, and marine life in Jakarta Bay, for example, already show evidence of contamination by toxic metals (e.g., mercury).

E. Other Water Related Problems

Water Availability and Sustainability

Issues of water quantity include increasing competition between alternative uses (agriculture, industry and municipal), and between surface and groundwater in rapidly growing urban areas.

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In volume terms, water use in agriculture currently account for 95% of total demand, while industrial and municipal requirements together account for only 5%. The consumption of water by households and business will grow rapidly over the next two decades. To support continued rapid growth and improvements in human health and welfare, however, these needs will have to be met.

Currently the rate of coverage of pipe water service (from surface water) for almost all of major cities in Java is at the range of 40%-60% of total demands. The remaining is fulfilled by groundwater. The heavy reliance on groundwater to serve industrial and domestic needs in large urban areas cannot continue indefinitely. This is particularly true for the northern coastal cities of Java where groundwater is being abstracted at greater than replenishment rates, leading to saltwater intrusion and land subsidence—with attendant increases in floods and waterlogging which, in turn, aggravates groundwater pollution from septic tanks and leaching pits. In Jakarta the overdraft is causing land subsidence ranging from 4 to 9 cm a year, increasing the risks of flooding and threatening superstructure stability. Moreover, there is clear evidence that the overabstraction is causing salinization of the groundwater along the coast.