

## WATER RESOURCE IN VIETNAM: CAUSES OF REDUCTION AND CONSEQUENCES

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### **I. Regarding water resource in Vietnam**

#### *1. Overview*

Water is one of the most important resources on Earth, because it meets the essential needs of man and animals in terms of biology.

Vietnam has about 835 billion m<sup>3</sup> / year water surface, in which 522 billion m<sup>3</sup> is the flow from abroad, accounting for 62.5%, only 313 billion m<sup>3</sup>/year is generated from the rainfall in the country, accounting for 37.5%. The total potential reserves of underground water (groundwater) is capable of exploitation, regardless of the water in islands accounting for 60 billion m<sup>3</sup>/year. If counting domestic water alone with the current population, the water volume per capita is only 3,840 m<sup>3</sup>/person/year, less than 160 m<sup>3</sup> in comparison to the world (over 4,000 m<sup>3</sup>/ person/year). Accordingly, Vietnam is a country with water volume per capita only at the average of the world.

Rivers is the product of climate, rain is the main water resource for the flow of rivers, lakes and reservoirs. With the river system is quite dense, natural lakes

and artificial large and small reservoirs have made Vietnam water resource quite rich.

Water resource of Vietnam is rather rich, but there is some characteristics causing some challenges in the management, exploitation, and use as follows:

- Average precipitation per year in Vietnam is around 650mm (1,960 mm/year) being 2.6 times of the rainfall average of the continent on Earth (800 mm). However, rainfall is unevenly distributed in space and time. Rain season with 65-90% of the rainfall concentrates in 3-6 months, although it is short but heavy rainfall with many heart of rain like Bạch Mã (Huế) 8,000mm/year average rainfall, Bà Nà (Đà Nẵng) 5,000mm/year, Bắc Quang (Lô River) 4,900 mm/year, Trà My (Thu Bồn) 3500 mm/year, A Lưới (Huế) 3,500 mm/year, Nam Đông (Huế) 3,575 mm/year, Đèo Cả, Bảo Lộc, Phú Quốc from 3,000 to 4,000 mm/year. The dry season lasts 6-9 months, some areas the rainfall is less than 1,200 mm/year, Ninh Thuận, Bình Thuận is only 400 to 700

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mm/year. There is a rather large volume of vaporation water from surface of rivers, lakes, ponds, marshes distributing. Evaporation volume average is approximately 1,000 mm/year.

- Because of raining focusing in the rainy season, flood should occur. In the North, the largest flood in the year usually occur in July and August, the highest rainfall is over 1,500mm/day. The Red River and Thái Bình river Delta accounts for 50 to 80% of all heavy floods occurring in these months and particularly large floods often occurring in middle and last ten days of August. In Central, floods often occur later in September and October, due to steep terrain, floods often occur quickly and flow quickly. In Cửu Long Basin, the largest floods often occur in late September and early October, floods are up and down slowly, the floods can maintain in the range from 30 to 120 days, the total flooding volume can be up to 380 - 550 billion m<sup>3</sup>.

## 2. Status of water resource in Vietnam

### a. The situation of exploitation and use of water

Recognizing the role of water resource in daily life and production, especially agricultural production, people and the State should attach much important to irrigation. Vietnam is Southeast Asian country spending expense for irrigation most. Water demand for agricultural takes high percentage compared with other needs.

Reserve of underground water according to other exploring documents is

plentiful, but focusing largely in the Southern delta, and shortages in Northern and Central regions. Currently, the total amount of groundwater which can be exploited accounts for 20% of the total groundwater reserves which can be exploited. Many provinces in the country are mining underground water with quite large flow for daily use and industrial, agriculture and service production. Typically, these are Hanoi with 750,000 m<sup>3</sup>/day, Hồ Chí Minh with 1,600,000 m<sup>3</sup>/day, Tay Nguyen with 500,000 m<sup>3</sup>/day. Because of unbalancing the use and exploitation, along with harsh and unpredictable climate change, quality of the water tends to worse.

Currently, there are over 240 urban water supply plants with a total design capacity is 3.42 million m<sup>3</sup>/day in which 92 plants use surface water source with a total capacity of 1.95 million m<sup>3</sup>/day and 148 plants use groundwater source with total capacity of 1.47 million m<sup>3</sup>/day. Many localities use both surface water and groundwater. Total capacity of existing plants can ensure water supply with 150 liters of pure water per day for each of the urban population. However, due to infrastructure, water supply systems in many urban areas are outdate, incomplete, and the system of urban water supply can not bring into play its full capacity, the rate of water loss is high (somewhere the ratio of water loss reach to 40%). Therefore, in fact, in many urbans water supply is only about 40-50 liters/person/day and only

supplying for 60-70% of people living in urban areas.

Vietnam's rural area has about 36.7 million people being supplied clean water (over the total of 60.44 million people). There are 7.257 water supply works delivering water for 6.13 million people and over other 2.6 million small water supply ones. There are over 50% of households are using water wells, 25% is using river water, over 10% is using rain water.

#### *b. Declining water resource*

Declining water resource is a common phenomenon in Vietnam.

+ *Declining surface water:* As recommended by international organizations on water resource, mined water limitation allowed in countries should be limited within 30% of the flow. Meanwhile, according to the Ministry of Natural Resources and Environment, almost provinces in Centre and Tây Nguyên have been exploited over 50% of the flow in dry season which makes that rivers exhausted. Regarding Ninh Thuận province alone, the flow has been exploited 70-80%. The figure of Irrigation Department (Ministry of Agriculture and Rural Development) shows that water resources in river basins are severely reduced in number. Red River water level is increasingly lower (dry seasons of the year 2006 - 2007 water level is down to 1.12 m, the lowest level since having monitoring station on Red River). The dry season in 2010, drought reached a record during the past 100 years in Red

River Delta and 50 years in the Mekong Delta. Even there are days the water of Red River only left 0.1 m in Hanoi and 0.4 m in Mekong River in Laos.

Situation of surface water quality have tended to deteriorate. As observed for many years that water in major rivers in northern, central and southern regions: Red River (Hanoi), Cẩm River (Hải Phòng), Hương River (Huế), Hàn River (Đà Nẵng), Sài Gòn River (Hochiminh City) are approximate and exceed the permitted norms. In particular, according to environmental report in 2006, three river basins: Cầu River, Nhuệ – Đáy River, Đồng Nai river system are seriously locally polluted which exceed the allowed standard from 2 to 100 times. Lower sections of many rivers in these basins have been seriously polluted, in which there are some parts becoming "dead river."

+ *Declining ground water:* According to a recent research results of Center of monitoring and forecasting water resource, Ministry of Natural Resources and Environment, in ten years, the groundwater in some places in Hanoi down to 6m and some places in Hochiminh City down to 10m. This situation will worsen in the next century when the water needed strongly increase.

Changes in quality of ground water are generally good except for areas where there are high levels of iron and manganese. However, phenomenon of groundwater salinization are common in coastal areas of Vietnam, especially the exploitation works of water in coastal

areas such as Quảng Ninh, Hải Phòng, Thái Bình, Thanh Hóa, Vinh, Huế, Đà Nẵng, Nha Trang, Phan Rang, Hồ Chí Minh City, Tiền Giang, Bến Tre, Kiên Giang, etc. Some areas being far away sea but existing floors or lens of buried ancient salty water, therefore, when exploiting fresh water, some contiguous areas or floors draw salt water into the works supplying water (Hải Dương, Hưng Yên, Hà Tây, Bắc Giang, Long An, etc). Overall, BOD<sub>5</sub> (oxygen required for microbe to consume in the process of oxidizing organic substance in water into) and COD (oxygen required for oxidation of organic substance in water into carbon dioxide and water) of ground water being lower than allowed standard many times.

But contamination of the nitrogen in the floor of groundwater has increased, especially in the floors containing main water resource in the North area, but the level is different, in some other areas such as Hochiminh City, Mekong Delta and some central cities, nitrogen contamination situation are also found, although it is still in local situation and changes follow seasons which becomes clear rules. Phosphate contamination in groundwater (the northern delta) in some areas also increase over time. On the other hand, because of the process of industrialization, a number of groundwater exploitation point have phenomenon of heavy metal pollution, especially in the vicinity of industrial areas. In recent years, finding arsenic presenting in water in some areas in Hanoi, but most models have a lower arsenic standard allowed.

Coastal and marine resources have much potential but due to many different causes, these resources are being polluted by waste, waste water from urban, industrial, agricultural, tourism, oil and gas exploitation and waterway transportation, etc. The concentration of heavy metals in seawater, coastal areas from 1.4 to 3.8 times more than the permitted standard, arsenic concentration is 1.7 times higher than the permitted standard, the concentrations of other toxic substances in water Sea are many times higher than the standard allowed. Pollution by oil and gas exploration and marine oil spilling occur in many places, every year there are tens cases with the total amount of oil spilled being thousands of tons, are directly affecting the marine ecological environment. Many estuaries, harbors, beaches have contaminated water.

## **II. The cause of declining and implications**

Declining water resource in our country is due to many reasons, including some major causes that led to several consequences:

### *1. Due to the impact of global climate change*

- *Air temperature* has been increasing. The acceptable script is that in 2070, coastal areas are likely to increase +1.5 °C, interior areas increase +2.0 °C. Consequently, the amount of water evaporation increases about 7.7 to 8.4%, demand for irrigation increases as well, surface water flow will be correspondingly less when rainfall is constant.

- *Hurricane*: ElNino and LaNina make the weather more extreme. Consequently, they make flows in rivers more extreme.

- *Drought*: ElNino goes along with serious drought in our country. In the year which ElNino took place, rainfall and river flows particularly in the dry season were significantly reduced, even without river flow as Lòng Sông River (Bình Thuận), Krong Buk River (Dak Lak), etc. The drought is so severe that even animals can not survive. Ten thousands hectares of crops died due to lack of water.

- *Sea level rise*: Sea level rise leads to the saltwater intrude into continent from 50-70km leading to the fact that water shortages has been happening in many places, especially in mountainous areas north and coastal plains.

## 2. Due to unsustainable exploitation and use of water resource

a. Block the gate of river branch to exploit river banks inside the dike, serving for agricultural purposes. For example, in 1910, blocking Cà Lò river gate which is a natural division of Red River, Cà Lò River became a tributary of Cầu River who contain rainwater, polluted waste water, organic matter, and grease; in 1937, blocking Đáy river by Đáy dam, the river became death part (from Đáy dam to Ba Thá). In 1967, blocking Đáy river by Vân Cốc culvert and Cửa Hát dike to exploit the bottom of Vân Cốc – Đáy dam.

b. Small rivers in the urban areas of cities are polluted by waste water, industrial waste water. Typically, Tô

Lịch river, Sét river, Kim Ngưu river, etc. flowing in the inner city of Hanoi are seriously polluted which directly pour into Nhuệ River; Nhiều Lộc-Thị Nghè, Tàu Hũ channels, Tân Hòa-Lò Gốm channels, Tham Lương channel, Đôi – Tẻ channel, and other channels flowing in urban area of Hồ Chí Minh city pouring water directly into Sài Gòn river causing serious pollution.

c. River can generally divide the polluted part as it flows through urban areas, industrial regions, villages or agricultural activities, etc.

d. Building spillways taking advance of the basic amount of water create “dry” parts of rivers under the dams. The spillways like Thạch Nham on Trà Khúc River, Lại Giang on Đại Giang River, 30 years ago in the dry season there is water overtopping the dam. Recent decades due to the increase of irrigated areas, and water volume for living, industry, and the destruction of forest in riverhead in addition, water in lower section of rivers exhaust in dry season which can last some months if there is no rain. Therefore, people living in the the bank of the spillway lower section have to suffer from bad consequences. In hydroelectric spillways, the section between downstream of the dam and plant creates “dead” part of river; regulating day and night generates half days in the lower section without discharging water.

e. The planning and design of the reservoir, in a long time do not be cared or insufficiently paid attention to the environmental flow in the downstream of the dam.

f. Excessive water extraction, lack of planning, synchronized plan. For example, the exploitation of groundwater causing serious pollution in Dak Lak, Ninh Thuận and Bình Thuận provinces, requires additional measures to counter. According to the planning of water resource, in 2010, to meet the requirements for irrigating water for five Tây Nguyên provinces, we need 80,000 hectares of coffee. Until 2000, Dak Lak province (old) planted 260,000 hectares of coffee that leads to the consequence of lacking of water irrigating for thousands hectares of coffee and it died (see more: 4).

g. Management of water resource are distracted, binding is loose and inconsistent leading to conditions like: the lack of "artificial" water because there is no application processes running in the dry season (Red River does not meet need for water in February and March every years); lacking of concentration, lacking of strict complying, many agencies issue ban command, but no agency decides. For example, at the part of Krong Ana River on the bridge Giang Son, there are 3 announcement of 3 Ministries: Ministry of Transport, Ministry of Natural Resources and Environment, Ministry of Agriculture and Rural Development with *three signboards* with a prohibited item: Prohibiting taking of sand. In fact, the prohibiting boards are not complied: axis of the bridge is eroding, boats still exploit sand causing erosion of river, falsifying of hydrographic data.

*3. Besides, there are many causes of declining water resource, such as:*

\* Population growth leads to decrease of the amount of water per capita. While many people still regard water as "*a windfall*" and using indiscriminately, lacking of awareness of saving and protecting water resource.

\* The process of industrialization resulting in the use of water in many industries is high and waste, particularly the private sector, small and medium enterprises loss of water and water used in the manufacture almost can not be controled. The most obvious problem is in beer industry. In the world, to produce a liter of beer needs to use about 4 gallons of water on average, but in Vietnam the number is more than three times (about 13 liters).

\* According to the researchers, the rate of economic growth is not coupled with good environmental protection causing negative impacts to water resource. Urban and industry development without strict controlling measures and handling of liquid wastes, solid waste under demand make surface water further polluted both in level and scale. Therefore, water resource seriously decline.

\* Along with the massive launch of zones, industrial locations, the traditional handicrafts also recover and develop. According to the Vietnam Trade Village Association in 2010, today our country has 2.700 villages, including 240 traditional craft villages being active. However, because of spontanous production and using obsolete technology, patchwork, cramped production premises, the construction of wastewater system

handling being paid less attention, poor awareness of ecological environmental protection of people, lacking of a mechanism management and supervision of state authorities, environmental pollution in craft villages is increasingly severe, especially water pollution. Activities that cause pollution of the village not only directly affect the lives and activities of public health and people in the villages but also affect people living in the vicinity, causing the reaction drastically in the population, the rise to the intense social conflict.

\* In the big cities, pollution is also alarming. These are pollution in sewage, garbage, medical waste, air, noise, etc. In recent years, population increases rapidly in urban areas leading the fact that water supply system does not respond well and rapidly degrade. Urban waste water almost directly discharge into environment without any handling measures. In terms of rubbish, apart from transporting to the burying place, there is a small amount of people still indiscriminately pouring into rivers, lakes, ponds, canals under their habitual, causing bottlenecks of the flow, and more severe pollution of water. Fish cages in the river was dead many times, mainly due to sewage from large urban areas, causes large damage for fishers.

\* Agriculture increasingly growing leads to the increase of using chemical fertilizers, plant protection drugs. This not only make ecological environment imbalance that residues of it pollute soil and is washed into rivers, streams, canals, ponds and lakes, and makes water more polluted.

\* The exploitation, indiscriminate forest burning causes erosion, land degradation and also makes water exhausted, flooding and drought tends to rise and become more serious. Many coastal forests being tens of years having certain effect on preventing storms, sand is being cleared for mining or for aquaculture, etc. Specifically, in 2010, phenomenon of flood superimposing on other floods in central provinces from Nghe An to Khanh Hoa caused great harm to both people and asset whose main reason is that forest land is used for construction of small and medium hydro-electric which is arising as mushrooms. When hydro projects was implemented, one must cut down trees to make dams and open ways for transportating equipment, machinery, materials and construct power transmission line to the place of consumption, create new housing for people resettlement, etc. As estimated, to generate an MW of electricity it takes 10 hectares of forest, to have 1,000 hectares for hydroelectricity, it takes 1,000-2,000 hectare of flattened upstream. On the other hand, due to lack of coordination in the regulation, discharge of hydropower in the flooded region, causes the phenomenon of "flood overlapping flood" doubly damaging for people living in the lower section.

***In general,*** water resource in Vietnam is large but not rich. In the process of socio - economic development, exploitation, use and management of water resource is not scientific and lack of planning. Water supplying infrastructure degrades and awareness of the important resource is not proper resulting in untreated

wastewater was discharged into environment. Habit of using waste water, indiscriminately dumping wastes into rivers and canals, ponds, etc. still exist. Associated with severe climate change, rising sea level has been decreasing water resource leading to unpredictable consequences which people in all three region of our country are suffering.

Summing up the experience from other countries going ahead, we must move to general management of water resource which priority task is managing water in river basins. Comprehensively and radically implementing the solution as follows: Requiring industrial zones must have a wastewater treatment centralized system. Planning the village, industries with waste water must be handled before being discharged into the environment. Promoting construction of water supply systems in both urban and rural areas. Pay attention to repair and upgrade infrastructure to avoid degradation of water supply to reduce losses and gradually issue water prices follow price in market and require wastewater charges from living activities and services to the production. Studying and applying scientific advances to handle urban waste water, especially in big cities. Applying effectively saving irrigation technologies for plants, changing plant structure which is appropriate to each area to reduce water or to use it efficiently in agriculture. Preventing deforestation of upstream forest, coastal forests, and cultivating effectively forest to reserve and protect water resource. At the same time,

regularly advocate, educate to raise awareness for all people in mining, rationally using, saving water because our country's water resource is declining and shortage of water in the near future.

Recently, research, evaluation, and management of water resource have promoted, but in the context of climate change happening severely we have much work to do.

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