MMXVIII
BIMUN

2018 北京国际模拟联合国大会
Beijing International Model United Nations 2018

Background Guide

United Nations Development Programme

Topic A:
Sustainable Utilization of Water Resources
Topic B:
Investment Programme of Clean Drinking Water

青年责任
共同命运

Youth Responsibility
FOR
A Shared Future

Contents

Welcome Letter

Dear Delegates,

It is of great honor to extent our warmest welcome to all the delegates attending Beijing International Model United Nations 2018 and the committee as the Dais of UNDP!

Thousands have lived without love, but no one without water. Effective utilisation of water resources is of fundamental significance in the sustainable development of human civilization, making it possible for the implementation of the 17 Sustainable Development Goals. For a better and brighter future, it is the responsibility of the younger generation to take various reasonable and effective actions to ensure water security, of both quantity and quality. This conference is an opportunity for you to consider the problem and bring forward new ideas of solutions.

In the conference, delegates from around the world will exchange ideas and try to reach resolutions on the sustainable utilization of water resources, Topic A, as well as the investment programme of clean drinking water, Topic B. In this background guide, the Dais provides you with basic information on UNDP, background knowledge on the topic and some important facts of the current situation. To help you better understand the topic, this document also raises a few problems which may be meaningful to consider and present some potential solutions. We hope the guide is of help for your preparation and we are pleased to see you go beyond the guide and explore more resources.

We are more than glad to communicate with every and each of you before, during and after the official sessions about the topic and more. Please do not hesitate to contact with the Dais should you encounter any problem regarding the conference.

Looking forward to seeing each of you in May and enjoying the conference at Beijing together.

Dais of the United Nations Development Programme

Beijing International Model United Nations 2018

January 26th, 2018

Introduction to the Committee

The United Nations Development Programme (UNDP) is a subordinate network of the Economic and Social Council (ECOSOC) by the United Nations aimed for global development, with the headquarters in New York. The organization was founded in 1965, replacing its predecessors the Expanded Programme of Technical Assistance (EPTA) and the Special Fund. The organization works in approximately 170 countries and territories, to achieve the eradication of poverty and the reduction of inequalities and exclusion. (United Nations,2018)

Of its efforts towards global development, UNDP mainly focuses on three areas: sustainable development, democratic governance and peacebuilding, as well as climate and disaster resilience. The programmes and projects initiated by UNDP demand sustainable development “that leaves no one behind”. In the process of sustainable development and other areas of UNDP’s work, the value of peace, just and diversity is emphasized, “making a variety of voices heard”. UNDP also contributes to identify and prevent big risks in order to protect the gains of the development. (United Nations Development Programme, 2018)

A great achievement of UNDP in recent years which will also guide the operation of the organization and other UN bodies is the Sustainable Development Goals (SDGs). The 17 goals, also known as Agenda 2030, came into effect in January 2015 on the foundation of the success of Millennium Development Goals and will guide the formulation of UNDP policies and allocation of UNDP funding in the next 15 years. (United Nations Development Programme, 2018) On the pathway to achieve SDGs, UNDP is guided by the common approach of United Nations Development Group known as Mainstreaming, Acceleration, and Policy Support, or MAPS. (United Nations Development Group, 2015, p.1)

To function as an organization, especially carrying out programmes and projects to achieve SDGs, adequate and continual funding is of primary and paramount necessity and significance, with its annual budget of approximately five billion dollars. The funding of UNDP comes from 5 channels of funding for UNDP, core funding, thematic funds, UN pooled funds, embarked funds and vertical funds. It is essential and crucial for stakeholders to consider the funding when a new project or programme is initiated at UNDP. (United Nations Development Programme, 2018)

To facilitate the discussion and operations during the conference, Beijing Rules of Procedure (Paper-Oriented) with a programme application amendment is applied.

Introduction to the Topics

There are 2 topics at UNDP of BIMUN 2018. Both topics are closely relevant with the Sustainable Development Goals or Agenda 2030, especially the Goal 6, Clean Water and Sanitation.

Topic A is Sustainable Utilization of Water Resources. The topic is about a proper and reasonable way of utilization of the limited resources which could address the stakeholders' concerns. Water resources is limited while it is also indispensable for human lives and production and irreplaceable. According to the Millennium Development Goals Report (United Nations, 2008, p.44), approximately 1 billion people get inadequate access to the essential resources and more than 2.5 billion get to water with poor sanitary conditions. How to utilize the limited water sensibly and to alleviate the contradiction among countries and between generations is an important issue for human beings to consider. With regard to the sustainable development goals, the topic is closely related to the 3rd, 4th and 5th targets under Goal 6, about decreasing water pollution and increasing utilization efficiency across sectors and countries. (United Nations Development Programme, 2018)

Topic B is Investment Programme of Clean Drinking Water. For this topic, countries are to develop and present country-specific investment programmes on their own. Water security is a topic demanding excessive attention for both developed and developing countries. Developing necessary investment programmes is financially necessary to ensure the sanitary conditions of drinking water, which is essential for the health for residents' health and social sanitation, especially for underdeveloped countries. It is also of significance to improve international and regional cooperation in the field, especially for technology transfer. The topic is relevant to the 1st and 2nd targets under Sustainable Development Goal 6, in pertain to people's access to safe, affordable and clean water as well as equitable sanitation. (United Nations Development Programme, 2018)

Similar to the relation among targets under SDG 6, the two topics are relevant to each other. Part of topic B could be understood as a subtopic of Topic A. Adequate and effective investment programmes of clean drinking water is an integral part of sustainable utilization of water resources considering drinking is a primordial and vital function of water. Sustainable utilization of water is partially achieved when people get access to adequate and affordable clean water. In another respect, the condition of sustainable utilization of water resources is a significant factor to consider when developing investment programmes of drinking water. Global, regional and country-specific information on the utilization of drinking water and water for other purposes makes an influence on the expenditures, feasibility and the impact of the investment programme. During the design and presentation of development programmes, it is beneficial to study and scrutinize the overall situation of water utilization comprehensively for reference. Also, to improve the effectiveness of sustainable utilization of water resources offers a better background for countries to compose investment programmes.

The two topics are also directly related to other sustainable development goals. On individual level, with adequate and affordable drinking water, it is beneficial to reduce poverty (SDG 1), hunger (SDG2), inequality (SDG10) resulting from lack of water as well as achieve well-being (SDG3). On aggregate level, sustainable utilization of water resources is helpful for economic growth (SDG8), infrastructure development (SDG9) and life below water (SDG14). Also, the sustainable utilization of water is a part of the sustainable cities and communities (SDG11) as well as a process of responsible consumption and production (SDG12). In the end, the necessity of international cooperation relates the topics with international partnership (SDG17). The topics are also relevant to some other sustainable development goals not mentioned.

Topic A: Sustainable Utilization of Water Resources

Background of the Topic

Introduction to Key Terms

Water Resources

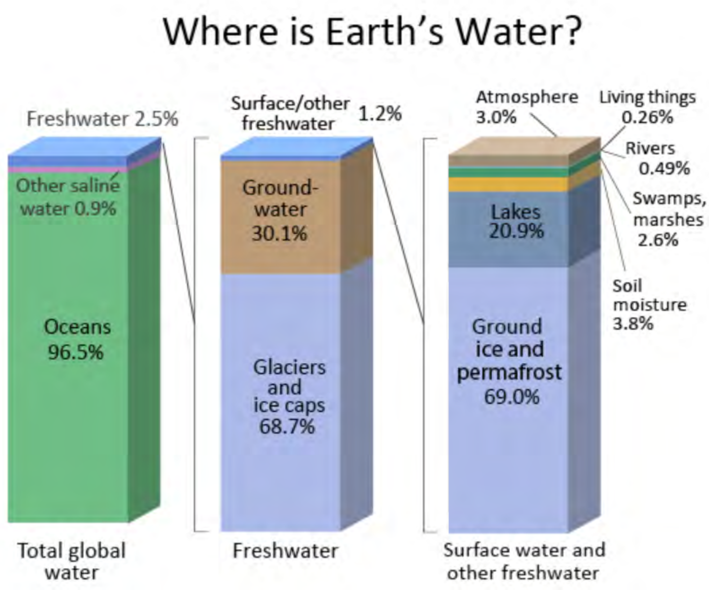

Figure 1: Distribution of Water on Earth (Shiklomanov, 1993)

Water resources is water regarded as resources potentially useful for agriculture, industry, recreation, household and other purposes. There is about 2 billion km3 water on the earth but only 3% of water on earth is freshwater while the remaining part is saline water. (Lane et al., 2017, p.7) About 70% of freshwater is stored in the form of ice in Antarctic and Arctic and about 30% is under the ground, with only a little bit over 1% of freshwater is uncomplicated to get access to and utilize. (USGS Water Science School, 2018) It is freshwater that is utilized at most places. Saline water could be transformed into freshwater used for agriculture, industry and other purposes after the process of desalination.

Water resources is of fundamental and indispensable significance for sustainable development agriculture, industry, recreation, household. Due to the growth of population, the expansion of production, the acceleration of urbanization as well as climate change and other reasons, the situation of lack of water is becoming increasingly severe.

Water Cycle

Reservoir	Average Residence Time
Glaciers	20 to 100 years
Seasonal Snow Cover	2 to 6 months
Soil Moisture	1 to 2 months
Groundwater: Shallow	100 to 200 years
Groundwater: Deep	10,000 years
Lakes	50 to 100 years
Rivers	2 to 6 months[1]

Chart 1: Average Residence Time of Different Reservoir (Physical Geography, 2018)

Water cycle, also known as hydrological cycle or hydrologic cycle, "describes the existence and movement of water on, in, and above the earth". (USGS Water Science School, 2018) It is a cycle in which water circulates within the water and in the cycle, and transforms between fresh water and salt water. The cycle mainly includes precipitation, evaporation, streamflow and some other processes, which you could refer to the graph. Water changes its state and position in the water cycle, due to gravity, solar radiation and other reasons. Human activities also have an innegligible impact on the water cycle.

A technical term residence time is introduced in order to study the process of water cycle. The residence time is the average time a water molecule spends in a type of reservoir and here is a table of average residence time for water in various reservoirs:

Water Governance

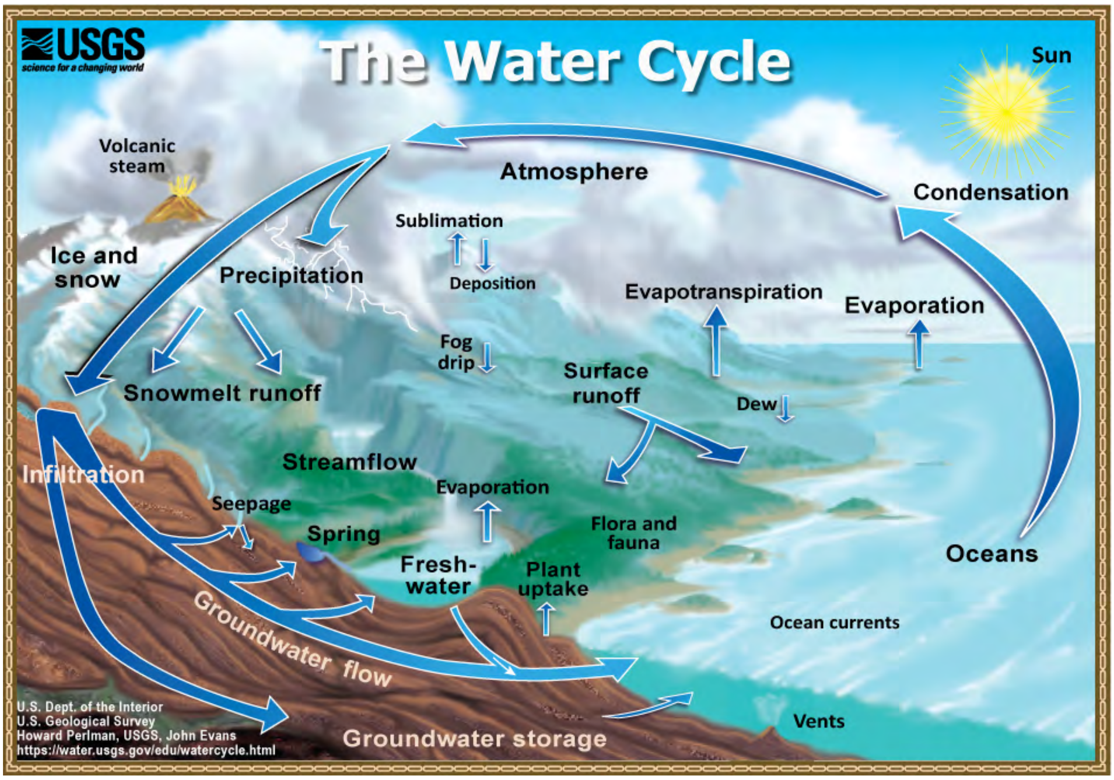

Figure 2: The Water Cycle (USGS Water Science School,2018)

Water governance is a set of administrative systems and institutions with regard to economy, politics, society set by the authorities. Concretely, policies, regulations and laws are established in place to construct and furnish water governance. Water resources management is part of water governance which determines who gets the water and when, how to get the water, as well as other relevant benefits for water users. Equality and quality of allocation and distribution of water are two main concerns for authorities in the field of water governance, which has an influential effect on the detailed and concrete plans of water management. (Water Governance Facility, 2018) Water governance governs not only water resources but also other types of water, including part of meteorology studying precipitation as well as environmental monitoring studying the water cycle and ecosystems etc.

History of Water Resources Management

Water resources management, as a subset of water cycle management, refers to the activity and process of planning, distributing and managing water resources. Water resources management includes optimizing the use of water of resources and minimizing the impact on the natural environment.

There are mainly two categories of water resources management, agriculture water resources management and urban water resources management. The primary consumer of water resources is agriculture, using nearly 70% of fresh water. (Grafton et al., 2011, p.11) Other than the aforementioned agricultural water resources management in rural areas, water is consumer in cities, mainly going to industrial and domestic usage, known as urban water resources management.

Strictly speaking, the management of water resources started since the very beginning of human history. People learnt to plan, distribute and manage their use of water resources, though it is admittedly ample. With the development of farming, water resources started to become significant and agriculture water resources management arose, through which people managed the distribution of agricultural water consumption. Time goes by with further development, bringing about urbanization, with merge of villages and settlement of large population. Distribution to individual household for the domestic usage of water as well as collection and treatment of domestic sewage produced daily are new problems regarding water resources, presaging the primitive version of urban water resources management. After the Industrial Revolution, industry using machines powered by water emerged. New usage of water leads to evolution of urban water resources management.

After hundreds of years, nowadays, water resources are mainly utilized for agriculture, industry, household, recreation and other purposes. Water resources management is becoming more comprehensive, synthesizing agriculture water resources management, urban water resources management and management of water resources for other purposes. With the development of agricultural and industrial development, the acceleration of urbanization, as well as the growth of population, water scarcity has become the theme of water resources management since the last century. How to distribute water across sectors is a tricky issue? Stepping into the 21st century, with the idea of substantial development, the impact on the natural environment is another major task for people to consider, which also has a huge influence on contemporary water resources management plan.

Current Situation

I. Sustainable Water Resources Management in Multiple Nations

Water resources management varies dramatically across countries and continents due to the distinction of climate and geography. In this section, a few water resources management programmes would be introduced.

Riyadh, Saudi Arabia

As the capital of the desert nation Saudi Arabia, Riyadh faces a stressful situation of water scarcity. The tropical desert climate brings the city with only less than 100 millimetres of prescription every year, proposing a problem for Riyadh authority to feed the 4.2 million residents in the urban areas of 1600 square kilometres.

Decades ago, the major source of water used at Riyadh came from underground, primarily a huge sandstone water layer 1200 meters from ground. In the 1970s, there were almost 60 wells in Riyadh to draw water from the single layer. As the result of excessive exploitation, the water level decreased from the original 175 meters to 45 meters, which drew the attention of Riyadh authority. In response to the water shortage and salt-water encroachment, Riyadh took actions to restrict the amount of water drew from underground and cut down on the usage. Riyadh authority renovated various water resource facilities to take full advantage of prescription. Also, water supply to urban residents was charged, instead of being free, which helped in cutting down on the urban water waste. Also, in accordance with the water amount available at Riyadh, the city agriculture authority changed the agricultural plan to restrict the expansion of farmland and the development of water-consuming agriculture. Fortunately, by 1980, the water level rose to 85 meters.

In the meantime, Riyadh authority utilizes effective alternative resources in the water management, famous two of which are reclaimed water and sea water desalination. A large number of sewage plants are constructed across Riyadh, which allows reclaimed water to be extensively used for irritation of crops and city gardens, relieving the tense situation of fresh water. Also, numerous desalination plants are built on the coast of Saudi Arabia to provide Riyadh with a steady flow of desalted sea water as a new resource of fresh water supply.

Another measure of Riyadh is to build transmission tubes for water. The tubes help save water from the dry weather at the city during the process of transportation. (Gao et al., 2017, p.84-88)

Hong Kong SAR, China

Hong Kong is one of the largest cities in the world, with more than 7 million residents. Though enjoy the subtropical climate with abundant prescription, due to the large amount of water consumption, Hong Kong also faces serious water scarcity and more than 70% of water consumed is from Guangdong Province of the mainland of China.

In addition to the normal ways which are also seen at the water resources management system of other cities including reclaimed water and protection of water resources, there are also several unique methods applied at Hong Kong in the water management. First of all, Hong Kong authority develops investment programmes to promote the use of water-efficient apparatus. Hundreds of thousands of water-efficient apparatus are installed at government apartments for free. The popularization of water-efficient appliances helps Hong Kong reduce about 100 thousand cubic meters of water waste. Secondly, Hong Kong authority invests in the regular examination, repair and replacement of water pipes across Hong Kong. The programme costs more than 2 billion HKD but will reduce water waste dramatically. Also, though no desalination plant is constructed in Hong Kong, sea water is directly utilized where it is possible. For instance, 80% of the toilets at Hong Kong are washed by sea water. Hong Kong authority also carries out activities against illegal use of water. In the end, Hong Kong authority performs well in publicity, organizing hundreds of activities to propagate water-saving relevant campaigns, which are believed to exert a positive effect on the sustainable water resources management of Hong Kong. (Ying, 2017, p.172-174)

From the example of Hong Kong, it is learnt that as a city entity, authority responsible for water resources management could take very limited measures in traditional ways of water management. However, it is possible to carry out popularization of water-efficient apparatus, propagation of water saving and other convenient ways in urban areas to achieve the goal of sustainable utilization of water.

Finland

The water resources management in this section describes a system utilized at a sparsely populated region at Finland. The country harbours only 5.4 million inhabitants on her vast 300 million square kilometres of land, among which about 1 million live in rural areas without connection to the municipal water systems. In reputation of numerous lakes, water scarcity is not a problem for Finland. However, eutrophication is a serious issue to deal with due to the large number of inhabitants by lake or sea, which is also the key point of the water resources management system in this section.

Originally, rural residents of Finland get their drinking water from their own well and dispose the sewage through their own preferred way into the environment. However, the sewage from household is filled with nutrition and lead to eutrophication taking place in local lakes or adjacent sea. According to the current water waste legislation of Finland, every property in sparsely populated area is required to be equipped with a purification system. For those living next to their neighbours or to cities, a shared system or connection to municipal sewage treatment system is recommended by the government. The system reduces the nutrition of the sewage disposed into natural water. (Leskinen et al., 2015, p.8-9, 12)

II. Existing Programmes for Sanitation and Water Resources

Zimbabwe

In this section, a pilot city project to guide achievement of universal water supply and sanitation access in Zimbabwe is introduced. The pilot city is Marondera and the programme is included as one of the "cities of the Future" Programme initiated by the African Water Facility upon the request of the government of Zimbabwe. Marondera has a population of 65 thousand and is the elite education centre of Zimbabwe. The successive droughts at the city has led to the economic decline and de-industrialization. Currently, it is the pumping but not the plant that limits the amount of water treated in Marondera. Generally, most properties at Marondera gets access to toilets but in these years, the city sewer network suffers from overloading and lack of maintenance.

The programme is to "provide the Municipality of Marondera with an innovative and integrated approach that will ensure the sustainable management of water and sanitation for Marondera's population". And according to the urgency, the sub-project is classified into 4 categories, immediate needs, sustaining the future, capacity development as well as the project management.

The detailed plan of the project is listed below:

A) Component 1: Immediate Needs:
   a) Undertake critical assessment of the status of water supply and sanitation infrastructures;
   b) Undertake immediate repairs to the Water and Sewer reticulation system;
   c) Rejuvenating the Waste Stabilization Ponds;
   d) Repairs to the Elevated Steel Tanks at Braithwaitte;
   e) Undertake construction supervision;
B) Component 2: Sustaining the Future:
   a) Develop a Master Plan for the management of water, wastewater and solid wastes;
   b) Prioritizing investment projects;
   c) Undertaking an economic appraisal of Marondera;
   d) Develop a sub-catchment Water Resources Development Strategic Plan for the sub-catchments;
   e) Assess causes of high non-revenue water;
   f) Undertake feasibility studies including opportunities for resource recovery and re-use;
   g) Undertake feasibility studies for the scientific management/disposal of solid waste and identify options;
   h) Undertake an institutional analysis, which would include reviewing the roles and responsibilities of the various stakeholders at local and national level;
C) Component 3: Capacity Development:
   a) Conducting 3 training workshops for capacity reinforcement of stake-

holders at various levels, local and national;
   b) Providing on the job training activity to provide governance support to Marondera Municipality;
   c) Work together to promote good IUWN practices and organize learning visits to councils with successful management stories;
   d) Offer regular support to the Consultant's team on IUWN

D) Component 4: Project Management:
   a) Establishing a Project Management Team;
   b) Establish a Technical Advisory Committee;
   c) Organizing a donor's round table at the end of the project.

The project is funded by the African Water Facility and the Government of Zimbabwe collaboratively, covering the about 2.3 million Euros. (African Water Facility et al., 2017, p.10-13)

Europe

In this section, the Water Information System for Europe (WISE) will be introduced. WISE is a partnership between the European Commission and the European Environment Agency.

WISE is a platform to provide information on all European water issues. According to its website, WISE provides information to EU institutions and advise them to make administration decisions. WISE also provides professionals from public and private sectors as well as researchers with necessary data and information for their work. Most importantly, the data provided by WISE is also accessible to the general public, on which people are able to learn more about the water surrounding their life. (Water Information System for Europe, 2018)

The project is not about people's access to "at least basic water resource" and "at least basic sanitation" but about people's access to necessary and important information on water. It is about the right to know of the professionals, researchers as well as the general public. This will benefit the overall situation of water resources management as well as sanitation because of more suggestions from professionals, researchers and the general public based on the necessary information.

Problems to be Solved

I. Ways Demanded to Sustainable Management of Water Resources

Figure 3: Soil erosion ("Soil Erosion – Causes and Effects",2018)

Soil and Water Conservation

Soil and water conservation projects aim to preserve water and soil resources. One of the primary cause of water pollution is soil erosion, which means the wearing away of a field's topsoil by the natural physical forces of water and wind or through forces associated with farming activities such as tillage.

Soil erosion is a natural process that humankind cannot prevent from happening. However, many experts and agents have tried their best to reduce the severity of it. Due to various problems many states are facing, governments and organizations would adopt different approaches. Usually, local government would start by adjusting farming policies, for over-tillage is the most direct and significant human activities that trigger soil erosion. When these methods are not enough to ease erosion on a field, a mixture of various measures might solve the problem. For example, contour ploughing, strip-cropping or terracing may be considered. In the place where concentrated runoff occurs, it may be necessary to introduce engineering projects as part of the overall solution – grassed waterways, drop pipe and grade control structures, rock chutes, and water and sediment control basins.

Ecohydrological Approaches

The word Ecohydrology consists of three parts, which comes from three Greek words--Eco from οἶκος, Oikos, "house(hold)", hydro from ὕδωρ, hydōr, "water"; and logy from λογία, logia, "story". Its components indicate that this subject an interdisciplinary field studying the interactions between water and ecosystems.

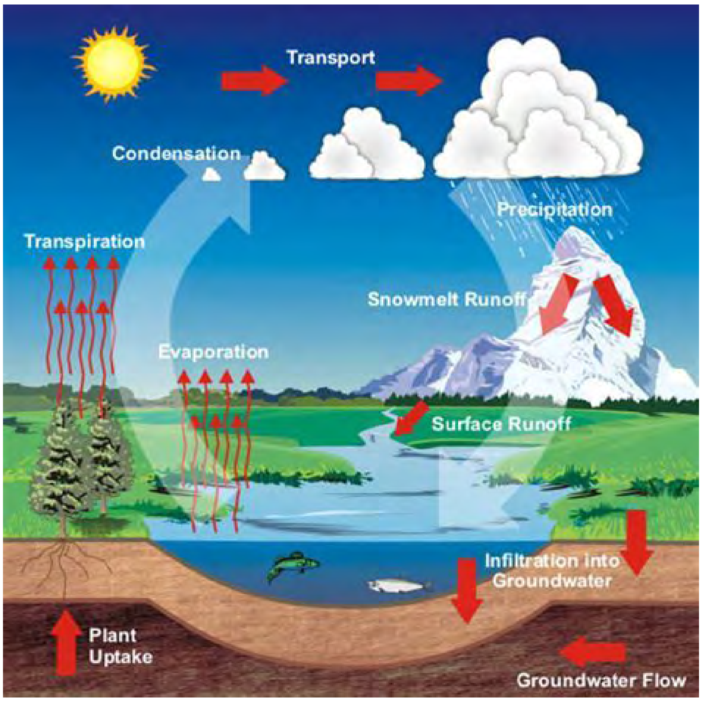

Figure 4: Water Cycle (“Water Cycle”, 2018)

To understand ecohydrological approaches for sustainable water management, firstly we need to introduce a term- the hydrologic cycle. The hydrologic cycle is the continuous movement of water on, above, and below the surface of the earth.(U.S. Geological Survey, 2018) The ecosystems alter the flow at numerous points. Transpiration from plants provides the majority of the flow of water to the atmosphere. Water is influenced by the vegetative cover as it flows over the land surface, while the vegetation within the river channels could shape them. (Ecohydrology – Wikipedia, 2018)

Basically, ecohydrological approaches for sustainable water management are interfering water cycle and turned it into a way that both humankind and the mother earth could fit themselves in with the force of the ecosystem itself. For centuries, humankind has tried to harness nature by modern technologies and as it turned out to tragedies like Japan Minamata disease events and Chernobyl. However, ecohydrologists found out that with proper management of vegetation, water stress and community of aquatic organism, we could use and circulate water much more efficiently with minimum human interference.

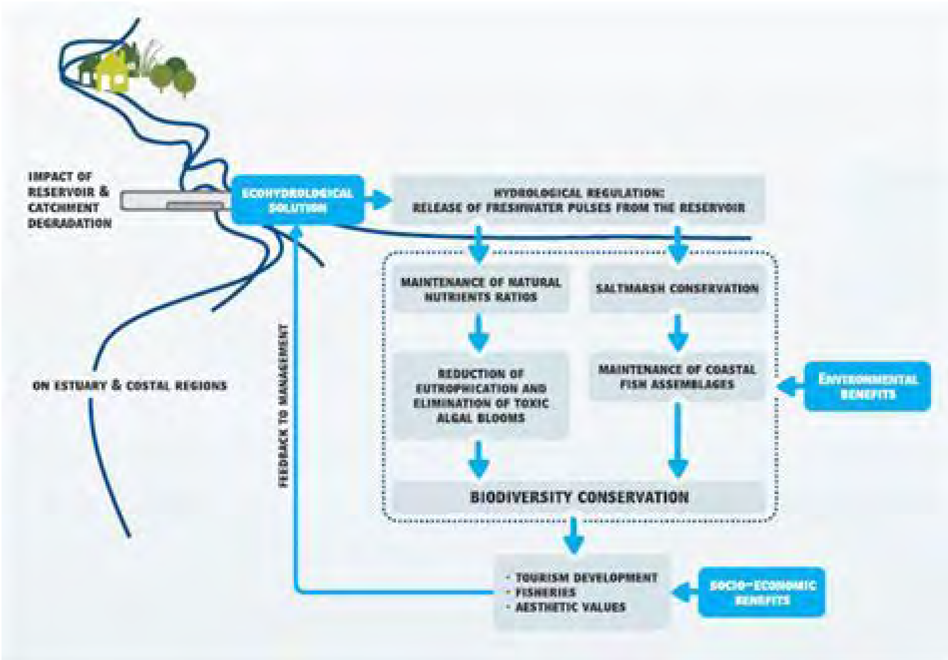

Figure 5: Ecohydrology (Ecohydrology-UNESCO Office in Venice, 2018)

II. Data Collection

The Shift in Demanded Data (from mainly monitoring hydrological data to data related to water use and policy processes and implementation)

Talking about data related to water quality, what first comes to people's mind is a series of biological and chemical terms which are hardly understandable. Moreover, this is true for most water quality standards like the Guidelines for Drinking-Water Quality (GDWQ) edited by the World Health Organization (WHO). In 1993, with the unanimous collaboration more than 200 experts from more than 40 countries, the GDWQ came to its second version, and within it, there were two microbiological indices, 131 chemical indices, and two radioactive indices. (WHO Guidelines for Drinking-Water Quality 4th Edition, 2011)

However, it is noticeable that there is a gradual shift in demanded data we use for the evaluation. In the United States, the implementation policy and the assigned use of water were first introduced to water standard in the late 20th century. (Copeland, C. 2016) It could be concluded that there is a trend of adding more and more data related to water use and policy processes and implementation into modern water standard which mainly contained monitoring hydrological data in the past.

Assessment and Monitoring Systems Reform

Without assessment system, it is foreseeable that there will be much more difficulties in the process of effective further development of establishing and running a sustainable water management mechanism. In the past, accurate assessment system helped to form the monitoring system, and it has played a vital role in the process. Besides, with the information gathered from it, states or organizations can make better plans about water protection.

U.S. Environmental Protection Agency (EPA) uses the term Total Maximum Daily Loading to analyse water quality and pollution problem quantificationally. This term means how much a pollution source must reduce its emission to make lakes, rivers, streams or estuary meet the minimum water standard for assigned uses. EPA encourages states to use present information in Total Maximum Daily Loading to help the assessment. Moreover, according to Article 1453, Safe Drinking Water Act, local government could only increase the Total Maximum Daily Loading with the reserved funds, which is 10% of the total funds.

III. Absence of Effective Supervision and Unanimous Collaboration

Lack of International Information Sharing Effectiveness

As a matter of fact, most rivers are not domestic and owned by only one state. According to the International Commission on Large Dams (ICOLD), these Shared Rivers has some 265, and their drainage basins cover an area of almost half of the total land area of the earth. (International Commission on Large Dams, 2018) Moreover, 74 among 88-member states has this kind of international rivers. Countries which locate in the downriver basin are most likely to be affected since the headstreams of the rivers, which are lifelines to them, are not on its territory. Additionally, overusing the surface water could bring tremendous impact to the whole basin and its underground water storage and vice versa.

It is indispensable for joint management of shared rivers to exchange hydrological, meteorological and ecological data regularly. Besides, modern technology has made shared data system much more feasible and with the help of computer networks, data-gathering and exchanging is becoming much closer to real-time than ever. After all, information-sharing systems are often the basis of an official collaboration project. By building mutual trust and better relationships, these systems could lay the foundation for further agreements and treaties.

Lack of Regulation on Mandatory Aids from States

Significantly, hydraulic engineering works are usually massive projects, and it costs a great deal of money. In China's South-to-north water diversion project, Construction costs of the eastern and central routes are estimated to be 254.6bn yuan ($37.44bn). China has reserved 53.87bn yuan ($7.9bn) for the south-to-north water diversion project. Of the 53.87bn yuan, the central government has budgeted 15.42bn, special funds in treasury bonds from central government accounts for 10.65bn yuan, and local governments are funding 7.99bn yuan. Loans will contribute 19.81bn yuan for the project. (Water-technology.net, 2018)

Figure 6: South-North Water Transfer Project (Internationalrivers.org, 2018)

Lacking effective monitoring systems about such huge amount of money from the state could lead to corruption and procrastination of the projects and eventually damages both the ecosystem and the society, and this is also true for any other country.

Topic B: Investment Programme of Clean Drinking Water

Background of the Topic

Introduction to Key Terms

This part will briefly introduce some terms in the field of drinking water sanitation. You may refer to the Guidelines for drinking-water quality published by the World Health Organization for more information.

Microbial Hazards & Waterborne Infections

Microbial hazards of drinking water are hazards arising from microbes, particularly waterborne infections. Waterborne infections are pathogens that may be transmitted through contaminated drinking water. (World Health Organization, 2017, p.118-122) Waterborne infections could be classified into four categories: a. bacterial pathogens, b. viral pathogens, c. protozoan pathogens, and d. helminth pathogens. Properties and treatment may differ among four different categories of waterborne infections.

Waterborne infections persist, grow and even reproduce in water. When water with toxic waterborne infections is drunk, pathogens enter the circulatory system via gastrointestinal and reproduce rapidly in human bodies, which results in diseases. (World Health Organization, 2017)

Reference Pathogens

There are numerous species of microbes which may live in the water, which is impossible to detect and monitor the conditions of each one. For simplicity and convenience, with the summary of biological nature of various species, some are picked to be monitored as reference pathogens, representing a particular group of pathogens. In addition to the fact that a reference pathogen is a typical waterborne infection with all the properties mentioned in part i, there should be adequate data about it to establish a mathematical model in order to study the pathogens. (World Health Organization, 2017, p.125-127)

Common reference pathogens include total coliform bacteria, heterotrophic plate counts, intestinal enterococci, clostridium perfringens, coliphages and so on. (World Health Organization, 2017, p.128)

Chemical Hazards and Threshold

Chemical hazards of drinking water are hazards arising from the chemicals in the drinking water. (World Health Organization, 2017, p.156) There are mainly three types of chemicals existing in the water classified as per their sources: i. chemicals naturally existing in water, ii. chemicals from household and agricultural or industry production and

iii. chemicals used in treatment and transportation. For chemicals naturally existing in water, it is necessary to monitor and control them at proper dose. For other two types of chemicals, proper plans should be set in place to reduce pollution into drinking water. pH value is an important value to consider for drinking water.

It should also be paid attention to that separate studies on every particular chemical may be inadequate because mixing with each other in the mixture may result in chemical reactions with unexpected aftereffects.

Some chemicals have a threshold for human health while others not. A threshold chemical has a level of dose below which it will exert no adverse effect on human bodies. (World Health Organization, 2017, p.160-165)

Corrosion

Corrosion is the partial dissolution of the materials constituting the treatment and supply systems, tanks, pipes, valves and pumps. (World Health Organization, 2017, p.174) It is of essence to treat and control corrosion because it may result in new pollution after normal treatment of raw drinking water resources.

Radiological Relevant Terms

Drinking water may contain some radiological matters with adverse effect on human health. Key terms introduced in this section is significant when dealing with the radiological hazard of drinking water:

a. Becquerel (Bq): the unit of radioactivity representing the number of radioactive disintegration per second.
b. Effective dose: Considering that the effect on human being of different radiation differs, a value effective dose is constructed to measure the actual biological effect. The unit is Sieverts (Sv).
c. Effective half-life: The length of time radionuclides take to reduce half in human bodies. (World Health Organization, 2017, p.205)

Acceptability

Acceptability of drinking water refers to the taste, odor and appearance of the drinking water. The acceptability is determined by the physical and chemical property of drinking water, which is partially resulted from other types of drinking water pollution. Acceptability may lead people to choose better-looking but Insafe water due to esthetic reasons so it is of importance to improve the acceptability of drinking water in addition to ensure water is healthy scientifically.

Drinking Water Security Management

Water security management is a system to ensure drinking water provided to individual consumers are safe to drink. There are mainly three parts involved in the management, consumers, suppliers and surveillance authorities. Suppliers includes the water resource management authority, drinking water treatment agencies and water vendors, each of which participates in the drinking water supply process chronologically. Surveillance authorities include various institutions set by the government and third-party companies, also known as certification agencies that verify the devices and materials used in the drinking water supply process. (World Health Organization, 2017, p.15)

Issue Statement and Resolution Introduction

Water Pollution and its Form

Pathogenic microorganism in drinking water

Water-borne pathogen contamination in water resources and related diseases are a major water quality concern throughout the world. It is a serious issue involving almost all types of ambient water bodies. In the United States alone, pathogenic contamination in water recourses have been impairing more than 480,000 kilometers of rivers and shorelines and 2 million hectares of lakes. Such contamination gives rise to a variety of public security risks, as water borne diseases are a significant source of various outbreaks.

Water borne diseases are prevalent in almost every continent of the planet. In developing countries, such as those in the African continent, water-borne diseases infect millions (Fenwick [2006]). According to World Health Organization (WHO), each year 3.4 million people die from water-related diseases (WHO [2014]). According to United Nations Children's Fund (UNICEF) assessment, 4000 children die each day as a result of contaminated water (UNICEF [2014]). WHO ([2010]) reports that over 2.6 billion people lack access to clean water, which is responsible for about 2.2 million deaths annually, of which 1.4 million are in children. Improving water quality can reduce the global disease burden by approximately 4% (WHO [2010]).

Although water-associated diseases in developing countries are prevalent, they are also a serious challenge in developed countries. A study by Arnone and Walling ([2007]), who compiled data of outbreaks in the U.S. (1986 – 2000), reported 5,905 cases and 95 outbreaks associated with recreational water. Gastrointestinal Illness (GI) caused by variety of different microbes and germs, which causes symptoms, such as diarrhea, nausea, vomiting, fever, abdominal pain, was responsible for about 29.53% cases.

Pathogenic contaminations are also facing challenges of footprint traces when it comes to disease predictions. The most commonly used approach in scientific research right now is using indicator organisms to assess the levels of pathogens in water resources by quantifying the indicators in various ambient water bodies. However, such technique has been undergoing numerous debates regarding the organisms' ability to present potential presence of diseases. Moreover, identifying the source (e.g., human waste, animal waste, wildlife excreta, and waterfowl droppings) of pathogens is another technique problem. Scientists are expecting new approaches including host-origin libraries establishments, which requires fairly devotion of money and technique support worldwide.

Chemicals in drinking water

Chemicals detected in water bodies is another reason contributing to drinking water contamination. Chemicals in water supplies can cause serious health problems – whether the chemicals are naturally occurring or derive from sources of pollution. At a global scale, fluoride and arsenic are the most significant chemicals, each affecting perhaps millions of people. However, many other chemicals can be important contaminants of drinking-water under specific local conditions. Often, identification and assessment of risks to health from drinking-water relies excessively on analysis of water samples. The limitations of this approach are well recognized, and contributed to the delay in recognizing arsenic in drinking-water as a significant health concern in Bangladesh and elsewhere. To overcome such limitations, the latest edition of the World Health Organization (WHO) Guidelines for Drinking-water Quality (WHO, 2004; WHO, 2006) emphasizes effective preventive management through a "framework for drinking-water safety" that incorporates "water safety plans".

Effective preventive management of chemicals in drinking-water requires simple tools for distinguishing the few chemicals of potential local or national concern from the unmanageably long list of chemicals of possible significance. The aim is to identify and prioritize the chemicals of concern, to overcome the limitations of direct analysis of water quality, and ensure that limited resources are allocated towards the monitoring, assessment and control of the chemicals that pose the greatest health risks.

Identifying and prioritizing chemical risks presents a challenge, especially in developing countries, because information on the presence of chemicals in water supplies is often lacking. The implementation of a successful risk management strategy requires the development of an understanding of those hazards that may impact on the quality of water being provided to a community. It requires efficient approaches on information sharing as well as technology exchanges.

Water Processing Techniques

Conventional Water Processing Techniques

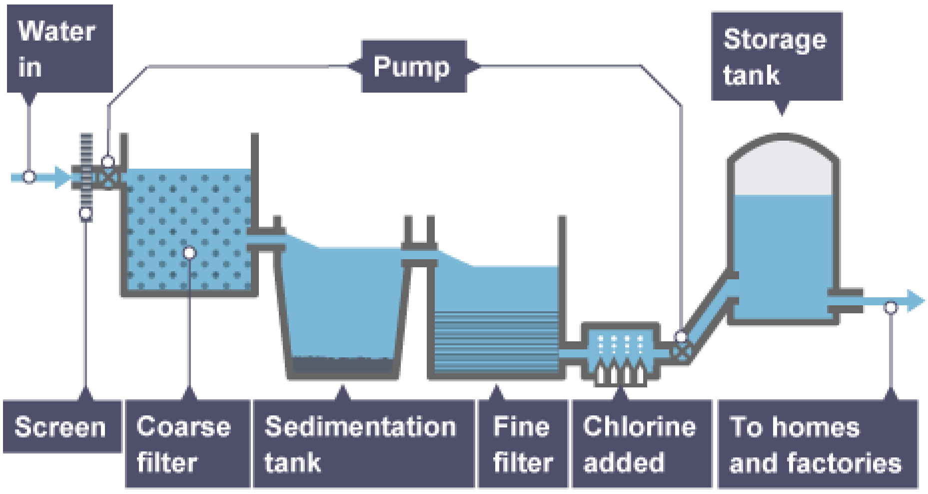

Figure 7: Chlorinating the water (BBC, 2018)

So far, some countries are still using conventional water purifying and disinfecting techniques like chlorination and few of them using carbon dioxide or ozone to do so.

These conventional approaches mainly target to alter the turbidity, Chromaticity and the total number of bacteria in the product water. This set works well with the source water with high quality. However, as the pollution level continues to rise and the pollutant within source water is becoming more and more diverse, conventional measures have been proved to be ineffective against organic pollutant and carcinogen. Even worse, things could go uglier as the remaining chlorine could react with many other organisms and produce more carcinogen like trichloroethene, bromodichloromethane, dibromochloromethane and trichloroethylene. Besides, conventional methods have little effect against pathogens like parasite and virus. Lastly, Chlorine and chloramine are toxic to fish, other aquatic animals, reptiles, and amphibians.

Further Purification Techniques

a) Activated carbon

Activated carbon, also called activated charcoal, is a form of carbon processed to have small, low-volume pores that increase the surface area available for adsorption or chemical reactions.

Due to its high degree of microporosity, just one gram of activated carbon has a surface area more than 3,000 m2 (32,000 sq. ft), (Edward C; Wilton, John H; Barlow, Jared C; Watson, William A, 2014) as determined by gas adsorption. (Jhadhav. S. 2018)

A biological-activated carbon process is a choice for many water uses. Granular activated carbon (GAC) has been used to clean out organisms from drinking water. In the 1970s, it was reported that bacteria which proliferate in GAC filters might be the reason for a fraction of the net removal of organics in the filter. After this report, pre-ozonating was found to enhance the biological activity of GAC significantly. The combination of ozonating and GAC is commonly referred to as the biological activated carbon (BAC) process, or biologically enhanced activated carbon process.

In Europe, the BAC process was implemented in many large water treatment plants in the '80s, for the poorer quality of surface waters and the concern for chlorination by-products The strict aesthetic demands of European consumers. Soon, the European way of thinking about the production of high-quality drinking water is spreading rapidly in other industrialised countries such as Japan, Canada, and Australia.

Also, the US water industry has been reluctant to use microorganisms for drinking water treatment. However, biological treatment is expected to become more familiar over the next decade. Driving forces behind this change will be the increased use of ozone in response to the disinfectants-disinfection by-product (D-DBP) rule and the increased concern over natural regrowth in the distribution system.

b) Ozone-oxidation

Ozone, or trioxygen, is an inorganic molecule. It is a pale blue gas with a distinctively pungent smell. It is an allotrope of oxygen that is much less stable than the diatomic allotrope oxygen, breaking down in the lower atmosphere to r dioxygen. Ozone is formed from dioxygen by the action of ultraviolet light and also atmospheric electrical discharges, and is present in deficient concentrations throughout the Earth's atmosphere (stratosphere). Its concentration is highest in the ozone layer region of the atmosphere, which absorbs most of the Sun's ultraviolet (UV) radiation. (Ozone – Wikipedia, 2018)

Ozone is a highly unstable and reactive gas with a short half-life before it reverts to oxygen. Ozone is the most potent and rapid-acting oxidiser man can produce and will oxidise all bacteria, mould and yeast spores, organic material and viruses given sufficient exposure. It is said to be 50 times more powerful than chlorine and 3000 times faster at killing bacteria and other microbes. Besides, it does not leave any by-products such as, with chlorine which create trihalomethanes (THM's) (Quality Drinking Water.com, 2018). Ozone is primarily a disinfectant that effectively kills biological contaminants. It also oxidises and precipitates iron, sulphur, and manganese, which means that it can be filtered out later. Since ozone is made of oxygen, it can be reverted to pure oxygen so that once it has been used, it could vanishes without a trace. The Ozonating process produces no taste or odour in the water and can oxidise and break down many organic chemicals including many that cause odour and taste problems.

However, this fancy technique also has its disadvantages.

Ozone is ineffective at removing dissolved minerals and salts. Moreover, the process can create undesirable by-products, such as formaldehyde and bromate, that can be harmful to health if they are not properly arranged. Last but not least, the process, of creating ozone in the home requires electricity, so the loss of power means no purification.

c) Film processing technology

Membrane filters are widely used for filtering drinking water. For drinking water, membrane filters can remove virtually all particles larger than 0.2 μm—including giardia and cryptosporidium. Membrane filters are most effective when reusing the water for the industry for limited domestic purposes, or before water emission into a river that is used by towns which locate in further downstream. This kind of treatment is widely used in industry, particularly for beverage preparation.

Ultrafiltration films (UF) use polymer membranes with chemically formed microscopic pores that can be used to filter out dissolved substances avoiding the use of coagulants. The type of membrane media determines how much pressure is needed to drive the water through and what sizes of micro-organisms can be filtered out.

Past Actions and Resolution References

Universal Actions

Globally, the UN-Water was established in 2003 serving as the core UN entity dedicated exclusively to water issues. Over 30 UN organizations carry out water and sanitation programmes, reflecting the fact that water issues run through all of the UN's main focus areas. UN-Water's role is to coordinate so that the UN family 'delivers as one' in response to water related challenges. (UN-Water, 2018) The Activity Information System of UN-Water (UNW-AIS) is an online platform where information on water-related projects and learning initiatives is easily available.

The International Small Community Water Supply Network was formed, with WHO as its lead organization, to promote the substantive and sustainable improvements to the safety of small community water supplies around the world, particularly in rural areas, as a contribution to the Millennium Development Goal (MDG) drinking-water target.(World Health Organization, 2018)

UN-HABITAT helps us be aware of meeting Development Goals in small urban centers which tend to be overlooked, however they are the first-tier markets and service providers for rural enterprise and development. (United Nations Human Settlement Programme, 2018)

Africa

In Africa, on Sep 15, 2011, the World Bank (WB) initiated the National Water Resources Development Project for Mozambique whose objective is to strengthen the development and management of national water resources and increase the yield of the Corumana dam to augment water supply for the greater Maputo metropolitan area. (World Bank, 2018)

In Jun 8, 2006, cooperated with the UN-Water member and its partners, through enhancing the capacity of the local government and sharing the managerial knowledge, WB started the Senegal River Basin Multi-Purpose Water Resources Development (APL) Project for Mali, Mauritania, Senegal and Guinea programme aimed to strengthen regional integration among the riparian countries of the Senegal River Basin Organization (OMVS) for multi-purpose water resources development to foster growth and improve community livelihoods. (World Bank, 2018) There are three project components. Component 1 supports regional institutional development for water resources. It modernizes the OMVS and enhances institutional capacities, updates and adapts OMVS institutions and legal frameworks to include Guinea, and rehabilitates the OMVS documentation center. Component 2 supports local level multi-purpose water resources development.

It develops small hydraulic infrastructure and related activities, improves traditional fisheries, protects water resources through planning and management, and reduces waterborne diseases. Component 3 supports regional multi-purpose and multi-sectorial master planning through preparing the Comprehensive Master Plan for the Senegal River Basin, pre-investment support for the OMVS Gouina Hydroelectric Project and the OMVS multi-purpose dams, and ensuring stakeholder participation in multi-purpose and master planning.

Asia

In Asia, after the 2004 Indian Ocean Tsunami, the WHO began observing and documents the drinking water response in the immediate aftermath of the tsunami with a view to learn lessons and guide future deployment of resources. It includes a detailed analysis of the role of household water treatment. (Clasen et al., 2004, p.20)

China

Domestically, in China, since 1985, with the help of the UN-HABITAT, in order to deal with nitrogen and phosphorus elements in eutrophicated water of the Xuanwu Lake, Nanjing, the local government set out the Comprehensive improvement project on Xuanwu Lake. With more than 30 years of hard and constant effort, water quality of the lake has improved due to a reduction in nitrogen and phosphorus pollution from sewage and surface water. In 2002, Shangyuanmen treatment plant was rebuilt, and the new facility can treat 100,000 tons of water per day from Yangtze River to supply to a lake and two rivers in Nanjing. As a result, the water quality is improved. (United Nations Human Settlement Programme, 2018)

Brazil and Latin America

In Latin America and Caribbean, especially in Brazil, with the implementation of the Integrated Health and Water Management Project (SWAP), two benefits are noticeable of which the first one is the increased access to clean water, sanitation and basic health care in at least 10 selected municipalities most affected by infectious intestinal diseases (IDD) and the second one is the improved neonatal health care in 25 selected hospitals using a Barema indicator of quality and efficiency. The project will have two components and a total project cost of US$60 million: component one for contributing to the reduction of the infant mortality rate and component two for the institutional modernization of the health, water, and planning sectors. (World Bank, 2018)

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