Organizacija Ujedinjenih Nacija za obrazovanje, nauku u kulturu

WATER FOR LIFE

Handbook for BiH Primary Schools

Handbook was prepared by the Hydro-Engineering Institute of Civil Engineering Faculty in Sarajevo,

supported by UNESCO

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Published by:

Hydro-Engineering Institute of Civil Engineering Faculty in Sarajevo

For the publisher:

Prof. Dr. Tarik Kupusović

Print:

Amos Graf d.o.o.

Copies:

5000

This book was printed within the Goal Wash component of the general MDG-F: Democratic Economic Governance of Water Access Programme, financed by the Kingdom of Spain. GoAL WASH component is supported by the Swedish Government.

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1 MANAGE THE WATER INTEGRALLY!

1.1 Water – Indispensable Living Condition

Life can exist in all types of very inhospitable environments, but never without water. It is therefore that the pursuit for life in the Solar System has become the pursuit for water! *Thus the Diamond Lake located in the remote part of Argentina may help scientist to reach the conclusion how did the life on Earth start, and how could organisms live on other planets. Researches resulted in the millions of «superbacteria» in the Diamond Lake, located amidst an enormous volcano crater at around 4,650 metres above sea level, and able to survive at extremely low oxygen levels.*

Water has always been an indispensable living condition for humans. Water is a part of us and no human being can survive without water. A man can endure without water for *72 hours* only, unlike food, without which he can endure incomparably longer.

Fresh water is necessary for all human activities. Namely, starting from the primitive development of human kind, considerable part of the civilisation history was related to a constant tendency to use waters for economic development purposes. Thus, the development of large civilisations in our past was closely linked to the irrigation demands, therefore, some of eldest civilisations developed in the valleys of big rivers such as Euphrates, Tigris, Nile and Indus. Water from these rivers was used for irrigation of arable land, or the development of agriculture, further leading to the first technological inventions, and the development of art and culture.

On the other hand, excessive use of water for irrigation purposes was one of key reasons of the destruction of largest civilisations. The examples of such civilisations are the civilisations that developed on the territory of Mesopotamia and the Mediterranean, with extremely high temperatures throughout the entire year. Intensive irrigation under such conditions led to the exhaustion of ground waters and sudden evaporation of water from the soil. The resulting land would become useless for future agricultural production due to evaporation of water and the increase of the salt content, which would have extremely adverse consequences for the population and undermine economic development of the country.

Humans paid poor attention to rational use of water resources and their conservation throughout their evolution. It was the sudden increase in the number of Earth population during the twentieth century, resulting in the increase of water demands as well as the quantity of wastewaters, which alerted the importance of water for life and humankind development. Thus, based on the United Nations estimates, the number of the Earth population at the

beginning of the twentieth century was around 1.65 billion, and by the end of the same century it increased to over 6 billion. Furthermore, the United Nations also predict that by 2050, the number of the Earth population will be around 9 billion. Therefore, the number of the population on Earth is in sudden increase, and available annual quantities of fresh water remain unchanged. It is due to the reasons above that people predict future conflicts related to drinking water.

Despite the differences in the relation to water worldwide, everyone recognises its value and its central point in human lives today. Therefore, the General Assembly of the United Nations proclaimed the period 2005-2015 the water decade under the general slogan *„water for life"*.

1.2 What is the Hydrologic Cycle?

Hydrologic Cycle is the solar driven circular movement of water in nature. In the circulation process, water changes its states of matter (liquid water, water vapour and ice) through evaporation and condensation, and again returns and deposits on and beneath the Earth surface (see Figure 3).

Evaporation of water into the water vapour occurs as a consequence of the solar energy. Therefore, the sun, managing the cycle of water in nature, heats the water in seas, oceans, freshwater lakes and rivers, as well as other water surfaces, and a part of water heated thereby evaporates into the air in form of water vapour. Water does not evaporate only from water surfaces, but from the land as well (from plants and soils), and even, in small part, from snow and ice without the prior melting phase. Thereafter, facilitated by airflow, it rises into the atmosphere, cools and condenses.

Condensation, of water into the water vapour occurs in higher atmosphere layers, creating clouds. Afterwards, parts of the clouds collide and enlarge, creating thereby clouds carrying precipitation (rain, snow and hail).

Return of water onto the Earth is accomplished through precipitation. Water reaching Earth in this form has three possible options. Thus, it can evaporate, and return to the atmosphere immediately thereafter, which is a frequent case during summer periods. Then, it can flow on the Earth surface in form of the *surface runoff*, and continue to flow as a river stream towards seas and oceans, or stop in a stagnant stream such as a lake. Finally, water can *infiltrate*, or penetrate and remain in very deep layers, renewing thereby water quantities in the ground layers of rocks, sands and gravel where water reserves, also known as aquifers. *Aquifers* contain large quantities of ground waters retained for a long period of time. Such water is suitable for exploitation to satisfy different human being demands.

Above described permanent process of circulation, renewal and apparent loss of water on Earth is called the hydrologic cycle, also known as a water cycle. The change of the states of matter occurs sometimes in the blink of an eye, and sometimes requires millions of years. Water cycle in nature has existed for billions of years and the overall life on Earth depends right on it.

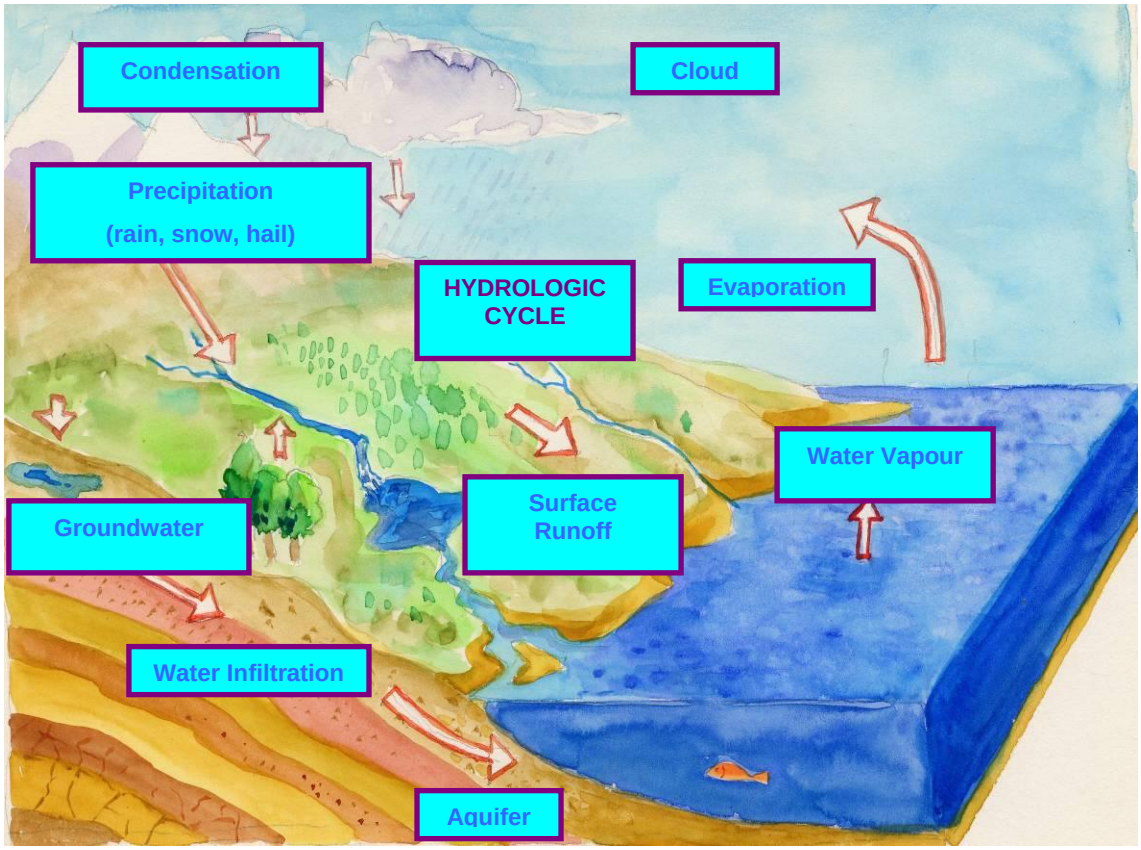

Figure 1 - Water Cycle in Nature

Almost all water on the Earth has undergone this cycle countless times. However, people have interfered in this process for thousands of years already, in a way of constructing dams and embankments to redirect water flow towards dry areas, digging wells to reach groundwater, etc., and thus disturbed the natural balance and imperilled the survival of the living world in water.

1.3 Water Conflicts

Water is called also a "runaway" good, as the water of "others" that started its route somewhere else reaches each one of us, while we send "our" water to the others. Therefore, there are 263 river basins worldwide, creating rivers with their tributaries, and flowing through different countries. Anyway, rivers flowing through different countries, such as Jordan, Tigris, Euphrates, Nile, but also Rhine, Danube, Sava, are also the source of economic and even war conflicts.

Lack of water, increasing disparity in the distribution of water and difficult access to *water resources* (surface and ground water reserves) are the problems that affect numerous communities in the world. The problems above jeopardise their development and stability, and may cause conflicts at the international level. Therefore, based on the UN data, in the past 50 years, even 507 water-caused conflicts occurred worldwide, with 21 of them turning into a war.

Water-caused conflicts occur not only between countries, but between different groups within the same society, such as conflicts between the interests of the industry and organisations pursuing environment protection.

1.4 Can We Prevent Water Pollution?

Water pollution implies any physical, chemical or biological change in the water quality, making it useless for exploitation and adversely affecting the living world. Pollution of

water with hazardous substances is most frequently the consequence of human activities (inflow of water from settlements, industrial plants, agricultural surfaces, roads, and other).

Technological development has an ever growing impact on the environment, and thereby on water. Therefore, the highest impact on water originates from industries (wastewaters from industrial facilities), cities and settlements *(communal wastewaters)*, and waste disposal sites.

Over the past twenty years, it was learned that the pollution should be reduced, or eliminated at its source, i.e. at the place of its occurrence, by means of *actions to prevent pollution*.

The intention of the actions to prevent pollution is to reduce the quantity of the consumed water wherever possible, and thereby reduce the quantity of wastewaters discharged into the environment. Provided the emergence of certain wastewater is impossible to prevent, construction of *wastewater treatment plants* is thus necessary to preserve natural water resources.

Wastewater treatment plants are used for drainage, collection and treatment of wastewaters from a settlement or an industrial facility. Thereafter, wastewater is disposed through sewers, and collected in large volume basins, known also as *reservoirs.* Finally, wastewater is treated by means of different *mechanical* (filtration), *chemical* (chlorination) and *biological processes* (use of microorganisms for decomposition of waste substances in water). The intention of the wastewater treatment is to reduce the quantity of hazardous substances in water to the lowest possible level, thus the discharge of such treated wastewater causes no damage to the *water recipient* (stream, river or sea) receiving treated wastewater.

1.5 How to Use Water Integrally – What Is „Integrated Water Resources Management“?

Integrated water resources management means rational and economic use of water resources, water quality protection, and protection of people and property against adverse water impacts. Integrated water resources management includes also *sustainable water exploitation*, aimed at provision of sufficient quantity of clean water for future generations. Therefore, if we want to use water resources in a sustainable manner, or preserve it for future generations, we have to manage them integrally.

Different ways of water use are interdependent. Thus large water quantities used for irrigation purposes mean less freshwater for drinking purposes or industrial use, and polluted wastewaters from settlements mean less water for *water ecosystems* (for plant and animal communities living in water).

Therefore, water demands, on one side, are in constant increase nowadays due to the accelerated increase in the number of the population on Earth, while, on the other side, waters are subject to constant pollution by human activities reducing thereby the quality of both surface and ground waters.

All this is in contrast to the integrated water resources management, based on the following: – *concern about water is the task and the responsibility of each individual.* Therefore, integrated water resources management will be possible only when people become aware that they are all a part of the hydrologic cycle and that each one of them lives downstream another.

Figure 2 – Buna River Source and 500 m Downstream Pond

Among numerous principles of the integrated water resources management, following shall be accentuated:

- Water is an indispensable living and working condition. Everyone is obliged to preserve its quality carefully, and use it economically and rationally.
- Waters are managed so as to satisfy the demands of the present generation, but without endangering the right or the possibility of future generations to satisfy their demands. This way of water management is called *sustainable water management.*
- Water recognises no boundaries – territorial water management units are *water regions* consisting of one or more river basins. *River basins* include river with all its tributaries; thus, state or municipality borders cannot be a barrier to the integrated management of water resources in the respective regions.
- Upon preparation and adoption of water management plans, primary goal is to protect waters and environment, but also to enhance the economic development of the country at the same time.

The measuring criteria for sustainable water exploitation are the so-called *renewable freshwater resources*, which emerge on the Earth in form of precipitation. If we raise a question how much freshwater is available to a man, it is not the total quantity of freshwater on the Earth that is calculated, but the velocity of the renewal of freshwater reserves within the global water cycle, or the hydrologic cycle. Therefore, if the quantity of water taken from groundwater sources and lakes exceeds the quantity supplemented by rainfall, the sources will dry up throughout a longer period of time.

An example of it is the Aral Lake whose volume has reduced by 80% since 1950, due to the intake of water quantities exceeding precipitation inflow for needs of the agricultural production.

Furthermore, the possibility of converting salt sea water into freshwater initiated hopes that world seas and oceans could be used as inexhaustible sources of freshwater. However, although known since the time of great sailors, the technique of treating salt sea water into freshwater is very expensive and environmentally unfriendly.

Thus, large desalination plants for conversion of seawater to freshwater are installed exclusively in the developed countries located in desert and tropical areas surrounded by the sea, but poor in freshwater surfaces (rivers and lakes), provided, as already indicated above, high costs of the saltwater treatment. Desalinisation plants can thus be found in Dubai in the Saudi Arabia (the largest desalinisation plant in the world), on Florida and in California in the United States of America or, for example, in Spain.

Accordingly, sustainable use of water resources is crucial for the increase of available water quantities. Sustainable use of water resources enables reuse of treated wastewater for industrial, agricultural or recreational purposes.

Additionally, but not less important, especially in Bosnia and Herzegovina, which is extremely rich in water, is the reduction of leakages in water supply systems and water savings to increase the quantity of water available for population needs and avoid additional intake of water from the nature.

Figure 3 – Water Intake from Accumulation

1.6 Why „Integrated Management“?

Successful integrated water resources management brings numerous advantages not only to all water consumers, but contributes also to the preservation of the overall environment.

First of all, integrated water resources management will be beneficial to the poorest, as most exposed to water scarcity, in sense that the application of this method of water resources management will reduce the price of water supply and provide faster and more efficient solution of the water pollution problem.

Therefore, successful integrated water resources management achieved excellent results in developed and industrialised countries. Substantial quantities of water used in daily human activities were saved through rational water consumption, and legal regulations obliged industries to collect and treat wastewater from their own facilities.

Finally, it can be concluded that the integrated water resources management will not only provide safe water supply to the poorest, but through this process, the environment may attain proper position perhaps for the first time. Namely, the demands of the environment,

or of water-dependent ecosystems, in the decision-making process concerning the so-called "water distribution" were mostly neglected before, thus contributing other consumers, especially industry. Therefore, the man will be given an opportunity through the process of integrated water resources management to, at least partly, repay the water and nature as a whole, and preserve it for future generations.

2 PROTECT THE WATER!

2.1 Water Concerns – Condition for Survival of Life on Earth

In America, approximately 800,000 wells for exploitation of water from the ground are drilled every year. *It means drilling the Earth curst 100 times an hour to satisfy the needs of the American agriculture, industry and households.*

At the other end of the world, in China, which accomplished great industrial progress in the past 30 years, the production of polluted wastewater is enormous, and drinking water reserves drastically reduced due to the sudden increase in the number of its population. Therefore, although the experts predict a water crisis in the entire world, China has already proclaimed the ***Chinese water crisis.***

Life developed in water, and plants, animals and people are dependent on the natural water cycle on the Earth. Water is the most abundant substance in the conformation of all living beings, including man, thus it can rightly be claimed that water is the condition for the survival of life on the Earth.

Not only the living world developed in water, but water facilitated the development of the civilisation. Ancient cultures and grandiose structures developed alongside water. Water was and is thereby used as means of transportation, energy production, breeding ground for food, goods, medicines, recreation environment, sport battleground, and often as a boundary between states, cultures and religions.

However, sudden population increase, as well as the increased quantity of polluted water, threatens with future battles related to drinking water, as the water itself has priceless importance for life, and as long as the water resources are subject to constant reduction, such predictions unfortunately make sense. Therefore, men are required to take urgent actions to preserve waters, and thereby preserve the survival of the life on Earth.

2.2 Water Scarcity – Contemporary Crisis

Based on the United Nations data, each third inhabitant might be exposed to the permanent problem of water scarcity in 2025. Therefore nowadays, 1.1 billion people (around 1/6 of the world population) are not provided with the access to drinking water. Furthermore, over 6000 people die a day (4000 of them are children below five!) from infectious diseases, appearing due to polluted water, lack or non-functioning of a sewage system.

Disastrous consequence of the situation above is the population migration. Thus, at the end of the twentieth century, there were over 25 million of the so-called *"eco-refugees"*, or people who had to abandon their residence due to various natural and ecological disasters, one of the most serious ones related to water scarcity. Furthermore, it is considered that this number increases approximately by 5 million a year.

Therefore, the international community, as early as the beginning of the 21st century, drew attention to serious water crisis in the first United Nations report from 2003 related to the status of water on the Earth, and, among other, quoted as follows*: „Out of all crises, in terms of social natural resources, water crisis is the one that will most threaten our survival on this planet."*

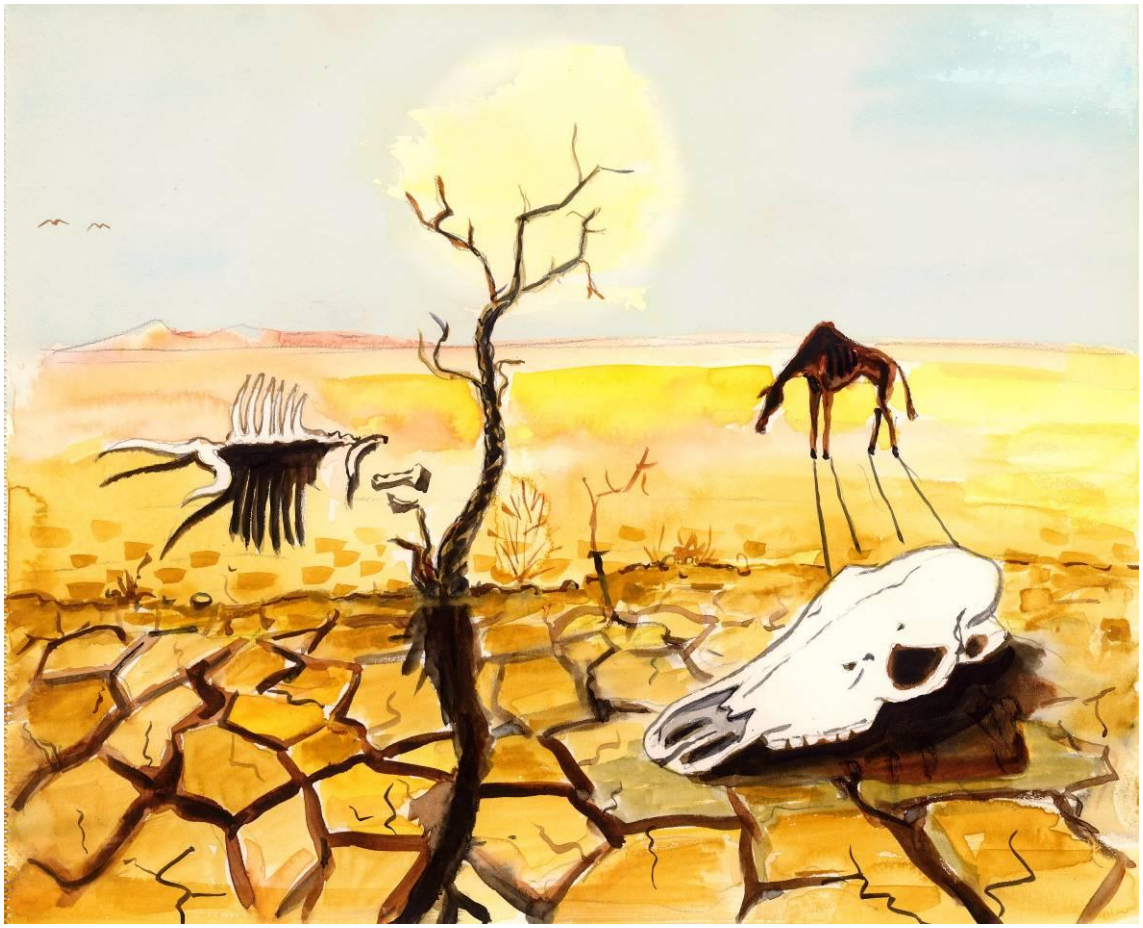

Figure 4 – Droughts Are Increasingly Noticeable Worldwide

2.3 Water Consumption Trend Worldwide in the Past Decade

From decade to decade, water consumption has been enormously increasing due to the sudden increase in the number of the population on Earth (see Table 1). Increased water quantities are demanded not only for water supply of the ever increasing population worldwide, but also for the expansion of industrial and agricultural production, which must follow the indicated population increase.

CONTINENT	1900	1940	1950	1960	1970	1980	1990
Europe	37	71	94	185	264	435	540
Africa	42	49	56	86	116	168	232
Asia	414	628	859	1220	1520	1910	2440
North America	69	211	286	411	556	663	724
South America	15	28	59	63	85	111	150
Australia and Oceania	2	7	10	17	23	29	37
TOTAL	**579**	**1060**	**1300**	**1990**	**2590**	**3320**	**4130**

Table 1 – *Water Consumption Worldwide through the 20th Century (km^3/year)*

As renewable drinking water reserves are fixed, increase in water consumption, following the population increase, results in constant *reduction of available drinking water reserves per capita.* Based on the data of the United Nations agencies, reduction of drinking water reserves during the second half of the 20th century by continents is as below:

CONTINENT	1950	1960	1970	1980	2000
Europe	5.9	5.4	4.9	4.6	4.1
Asia	9.6	7.9	6.1	5.1	3.3
Africa	20.6	16.5	12.7	9.4	5.1
North and Central America	37.2	30.2	25.2	21.3	17.5
South America	105	80.2	61.7	48.8	28.3
Australia and Oceania	112	91.3	74.6	64	50
TOTAL	290.3	231.5	185.2	153.2	108.3

Table 2 – Annual Available Freshwater per Capita by Continents (m^3x103/year/cap)

Fast reduction of clean water resources is mostly affected by the steady increase in the number of the Earth population and the industrial production. Namely, the population increase, especially in large cities, is normally accompanied by the two almost unsolvable problems, such as provision of large quantity of drinking water in a relatively small space and production of large quantities of polluted wastewater further discharged into the environment and thus endangering remaining clean water reserves.

Furthermore, it is needless to particularly emphasise that water polluted by industrial processes does not disappear, but returns to the environment as polluted industrial wastewater. Polluted industrial wastewater is also one of the largest problems nowadays, and requires introduction of measures for protection of waters against pollution.

In addition, it shall be observed that global water consumption doubles every 20 years. Therefore, based on the latest United Nations estimates, over a billion of people in 2008 had no access to drinking water, and by 2010, the number increased to over 2 billion. Thus, if the existing water consumption trends continue, drinking water demand might increase by 56% of the current available quantity by 2025!

2.4 How Much Drinking Water Is Available Today?

2.4.1 Water Quantities

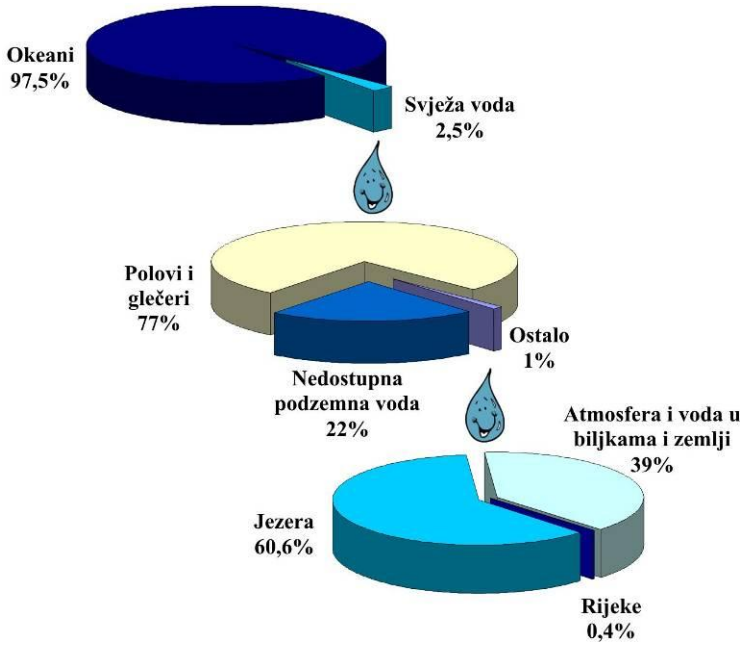

Figure 5 – Water Distribution Worldwide

If we raise a question how much freshwater is available to a man, it is not the total quantity of freshwater on the Earth that is calculated, but the velocity of the renewal of freshwater reserves within the global water cycle. Therefore, the measuring criteria for sustainable water exploitation are the so-called *renewable freshwater resources*, which emerge on the Earth in form of precipitation.

Water covers *72%* of the Earth's surface, and the continents only *28%*. The majority of water (97.5%) is the salt water in seas and oceans, and only 2.5% of it refers to freshwater reserves. Unfortunately, over 2/3 of freshwater is unavailable, or frozen in form of glaciers and ice caps, over ½ of the remaining freshwater is located underground, and less than 1/10 is present in the atmosphere. Finally, *1%* of the remaining water reserves on the Earth are lakes and rivers (see Figure 5).

Therefore, metaphorically speaking, *if water reserves from the entire world could fit one bathtub, the portion of water available for constant use throughout one year would hardly fill one teaspoon.*

Although freshwater reserves make only 1% of the Earth's surface, they accommodate around 12% of all animal species, including also over 40% of known fish species. Despite being remarkably abundant in various species, rivers and lakes are highly subject to the environmental impacts. Over 1/5 of all freshwater fish species were extinct during past years or are at the risk of extinction, and in some regions, certain animal species have already been fully extinct from freshwaters.

2.4.2 Water Resources in BiH

Bosnia and Herzegovina occupies in total 51,129 km^2 of the southeast part of the European continent. Its surface retains the form of a triangle with the base located north and gradually narrows towards south, where it accesses the Adriatic Sea shore. Dinaric Mountains spread through the central part of the Bosnia and Herzegovina, creating a watershed, or directing water courses on the BiH territory in two directions. Thus, the

water courses in BiH flow either north towards the Sava River, or south towards the Adriatic Sea. Therefore, there are two main basin districts in BiH, as follows:

Black Sea Basin District, comprising:

- *Sava River basin*,
- *Una River basin with Korana and Glina in BiH*,
- *Vrbas River basin*,
- *Bosna River basin*, and
- *Drina River basin*, and

Adriatic Sea Basin District, comprising:

- *Neretva River basin in BiH*,
- *Trebišnjica River basin in BiH*, and
- *Cetina River basin in BiH*.

To know the actual quantity of available water resources of a territory, it is necessary to know two very important data, such as *average annual precipitation* (the quantity of water that falls to a certain area space throughout one year in form of different precipitation), as well as *average annual runoff* (the quantity of water that runs off a certain area throughout one year). Thus in BiH, average annual precipitation is 1,250 l/m^2, and average annual runoff is 1,155 m^3/s.

Average annual runoff is very often expressed, or divided by the number of population of an area to calculate the *total annual runoff per capita*. It is a very important data as it enables calculation of the quantity of water that runs off a certain area (most frequently a region or a state). Therefore, there are territories that belong to low, medium or high runoff category. Total annual runoff for the territory of BiH is 8,045 m^3/cap/year, which, when compared to the equivalent data for other EU countries, groups BiH into the medium category of European countries by water resources availability.

Total annual runoff per capita does not have to be observed exclusively within a territorial but also a water area, such as a basin. Thus the runoff within the Black Sea basin district belongs to medium runoff category and is 5,675 m^3/cap/year, and in the Adriatic Sea basin district it is 26,500 m^3/cap/year and belongs to high runoff category. One of the reasons for such high difference in the runoff of two neighbouring basins is the fact that the values of average annual precipitation on southeast of the country, or in the Adriatic Sea basin, is 1,500 – 2,000 mm, while in northern parts, gravitating towards Sava River, the value of average precipitation is only 700 mm per year.

For the supply of BiH population with water, mostly ground waters are used, or around 90% in relation to the total quantity of water resources. Anyhow, the supply of BiH population with drinking water, compared to other forms of water usage, has always had certain priority.

Therefore, the population water supply via public water mains on the BiH territories derives from the period of Roman Empire. Furthermore, large portion of water mains within BiH originates from Turkish-Ottoman Age, with construction of the first public water main in Sarajevo in the middle of the 15th century, or much earlier than in many other European cities. First modern water supply systems with water treatment facilities were constructed during the period of the Austro-Hungarian Monarchy on our territories, with many of them functioning even today.

2.5 Access to Drinking Water

Access to drinking water for needs of the population water supply, as well as for exploitation of water for agricultural, industrial and catering needs, is the main precondition of social and economic development of a certain area. Therefore, disabled access, insufficient quantities, as well as inappropriate water quality, considerably affect individual and social development possibilities of a certain area, as they adversely affect not only the health of the population, but disable the development and progress of any kind.

Access to water in the world and in the society is unequally distributed. While the majority of countries on the North Hemisphere has access to more than sufficient water quantities, the majority of countries on the South Hemisphere suffers from water scarcity. Therefore, higher competition concerning this valuable resource, tensions, and even political conflicts and population migrations occur among countries poor in water resources.

2.6 How People Relate to Water Resources?

The relation of people towards water resources nowadays is, unfortunately, such that it is extremely difficult for people living in the countries rich in water resources to understand how the lack of clean and healthy water affects the quality of life. Therefore, there is an average USA citizen at one end of the world, consuming over hundred times as much water as a citizen of Uganda! In the majority of the developed countries, clean water is used not only for drinking, cooking and bathing, but also for car or street washing purposes. Accordingly in Europe, 80% of water, discharged from a town or a house water main, ends in the sewage system.

Further increase in the number of population, industry and agriculture, predicted in the future, will only deteriorate the already very poor situation, and wherever mankind applies force against nature, the nature returns mercilessly. Thus, hurricanes, tsunamis, believed to be the consequence of the global warming, and affecting many parts of the world, may be considered a warning or an announcement of even worse disasters, threatening the population if they continue to behave unreasonably against water resources and against environment in general.

2.7 How Much Water is Spent in Our Activities?

The quantity of water consumed on a daily basis includes not only water used for drinking, hygiene and cooking (household water consumption), but also water used for other human activities, such as agricultural, industrial and catering activities. In addition, there is considerable amount of the so-called „hidden“ water, known also as „virtual“ water worldwide, in the daily used products needed for food production.

„Hidden“, or *„virtual“* water includes the total quantity of water spent to produce final products from raw materials. Therefore, the quantity of water consumed in the production of certain daily products is presented below:

- *1200 l for production of 1 l of juice*,
- *1900 l for production of 1 kg of rice*,
- *500 l for production of 1 kg of potato* and
- *8000 l for production of one pair of jeans*!!!

2.7.1 Water Consumption in Agriculture

The largest portion of available water resources worldwide (even *70%*) is spent in agriculture. Such, surprisingly high water consumption in agricultural sector is the consequence of a sudden increase in the number of population on the Earth, therefore, more and more land must be cultivated and irrigated to feed the increasing population.

Consumption of water for agricultural needs is particularly high in dry areas, such as the Middle East, North Africa, Southwest USA, where irrigation is required throughout the entire year. Furthermore, agriculture of certain most populated countries in the world, such as China and India, as well as Pakistan and Indonesia, is almost entirely dependent on irrigation, facilitating over half of the food production in the referred countries.

2.7.2 Water Consumption in Industry and Energy Sector

Consumption of water in industry and energy sector is *22%* of the total available water resources in the world. It varies depending on the level of the development and industrialisation of certain area. Thus, only 10% is consumed in the developing countries, while highly developed countries consume over 50% of the total available water resources for industry and energy sector needs.

For example in Europe, water in industry is consumed practically in every step of almost each technological process. Therefore, water is used for cooling, industrial treatment, cleaning, and even waste removal. Water is also largely used for energy production, primarily hydro power plant production, as well as for the process of cooling in atomic and thermal power plants.

It shall be indicated herein that atomic and thermal power plants are actually the highest industrial water consumers, as they produce large quantity of thermal energy and water, used as a cooling instrument, is largely consumed. Major part of water used in the industry again returns into the natural water course; however, such water is often contaminated with chemicals and heavy metals or very heated, thus seriously threatening the survival of eco-systems.

2.7.3 Water Consumption in Households

Consumption of water in households, as well as in facilities such as restaurants and hospitals, makes the smallest share in the consumption of water worldwide. In average, it is *8%*. Consumption of water in households, as in industry above, is also unequally distributed.

Thus, in South California, recognisable by houses with large gardens, pools and golf courses, daily water consumption is 3000 litres per capita. It shall be indicated herein that, pursuant to the World Health Organisation (WHO), minimum water need per capita per day is 50 litres.

Unfortunately, minimum water quantity above is not available to the overall population. Namely, there are 1.1 billion people worldwide with available water resources of below 20 litres per day. For example, in many part of India, women are responsible for daily water supply and must walk up to 12 kilometres to return to their villages with a couple of well water buckets on their heads.

2.7.4 Specific Water Consumption of Certain Household Appliances

Household appliances such as boiler, used to heat water in kitchens and bathrooms, as well as dishwashers and washing machines are high water consumers in a household.

Therefore, upon purchase of a household appliance, two types of prices shall be considered. Firstly, the purchase prices, that should be reduced to the minimum, and secondly, the price of the appliance operation throughout its lifetime. The latter is paid each month during next 10-20 years, through electricity and water bills, depending on the product life.

Accordingly, purchase of a more expensive appliance with higher water consumption efficiency is more cost effective as, consequently, less water will be consumed, water costs reduced, and thereby the quantity of wastewater, further discharged into the environment, will be reduced as well.

Boiler – Water Heater

Approximately, 300 to 800 litres of warm water is used per capita per week. It is estimated that 80 to 120 litres of warm water is used for one bathing in a bathtub, while not more than 50 litres is spent for showering. Less water for showering purposes requires less warm water, provided by means of a boiler. Therefore, if *showering (50 litres)* is used instead of *bathing (80-120 litres)*, one family can save around 400 KM a year. It is also important to repair dripping taps, as substantial quantity of warm water will be saved thereby, reducing also the time required to heat new water quantities.

Dishwasher

Manual dish washing, including the running water wash off is by far the most expensive with the highest water consumption. Dishwasher is a useful household appliance, which can often replace an unwanted hand washing of numerous dishes. Less energy and water will be spent during machine than manual dish washing, depending of course on the manual washing habits. Based on expert studies, *daily savings* during washing in an average European dishwasher are as listed below:

- *25 litres of water* or 1.3 million m^3 for Europe, as well as
- *1 kWh of electricity*, or energy from 2 nuclear power plants for the overall Europe,
- *Approximately 1 working hour*.

Approximate energy and water consumption for dishwashers nowadays is 1.1 – 1.8 kWh, or *15 - 28 l of water per washing*. For comparison purposes, hand dish washing of similar size requires in average *100l-120l of water*, 2,5 kWh of energy and around 80 working minutes, including dish drying.

Washing machines, spend from *70-120 l of water*, depending on the volume and type of the machine, and in latest machines, water consumption is reduced to 45 litres.

2.8 How to Care for Waters

2.8.1 Water Saving

Drinking Water Should Be Strictly Saved!

In developed industrial countries, daily consumption of drinking water per capita varies from *120 to 300 litres.* The USA is ahead of the countries with the highest drinking water consumption. Therefore, the USA resident consumes around 295 litres of water per day, and, for example, a German resident consumes around 128 litres of water.

Nowadays, numerous projects for improvement of water resources exploitation methods are implemented worldwide, to preserve it for new generations *(sustainable development!)*. For example, better procedures are being discovered and the use of biological treatment of wastewater is more and more frequent. Furthermore, water saving is propagated in numerous ways, thus there are entire cities, mostly in the developed countries, whose residents are attempting to reduce water consumption in different ways, and thereby contribute to the preservation of water and environment.

For example, the target set in Bremen, a German city, is to reduce daily water consumption per capita from 140 litres, as their current consumption, to 70 to 80 litres. Water saving in wealthier countries is achievable by higher drinking water prices. In addition, substantial water can be saved by the improvement of irrigation systems within which, due to their deficiencies (use of ground canals), up to 80% of used water is lost.

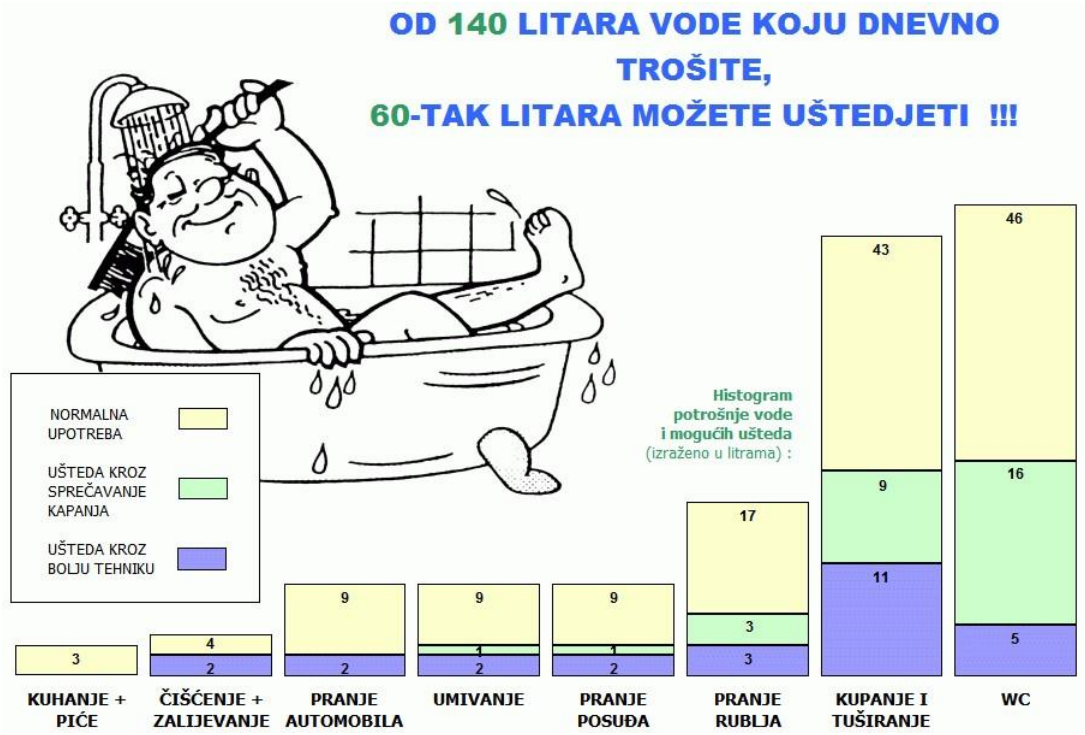

Figure 6 – Household Water Saving

Water and Body Hygiene

Considerable water quantities can be saved upon maintenance of the body hygiene. A histogram of consumption and possible water savings is presented in Figure 6 above. Therefore, water used upon showering is twice as less than upon bathing. Furthermore, considerable savings can be achieved by use of better quality technical devices, and by undertaking measures to prevent water dripping. Thus, a defective dripping taps should be repaired immediately, as up to 2,000 litre of water a year can be saved thereby! Nowadays, there are simple devices available on the market for control or saving of substantial water quantities.

Sink – droplet or rotary extension is installed into the bathroom and kitchen sink fitting

Droplet extension is used to reduce the quantity of water that flows through the tap in a way of being broken into small drops by water flush. Thereby, we gain the impression that more water is used, with softer and more pleasant water flush. The product life of droplet extensions is very long, as scale hardly settles in them. Water savings thereby are around 3,000 litres of warm water per capita per year.

Shower

Large amount of warm water is often lost while showering. Installing and showering plate, water flow can, for example, be simply stopped during the soaping. Water temperature set thereby remains unchanged.

If, additionally, common shower head is replaced with the saving head, up to 50% of water can be saved, meaning 2,000 to 6,000 litres of water per capita per year.

Toilet Flush

Approximately one third of the overall household water is spent for toilet flushing. Thus, it is particularly important to reduce such consumption. If a water plate is installed within the

toilet flush, the flush will not use the total water quantity; and water will run only during the button press.

The water plate above is nothing but an iron pan, simply hung into the flush pipe. Therefore, each toilet flush can accommodate the water plate. Up to 8,000 litres of water can thereby be saved per capita per year!

Water and Laundry

Every detergent, even the one marked eco or bio (the contents of the detergent is carefully selected to least possible harm the environment) more or less burden the environment. Therefore, use the detergents economically, i.e. never use more than given in the instructions for use. Excessive detergent will not make the laundry cleaner, but will endanger the environment and our wallet. Prior to purchase, read the detergent ingredients and avoid those with phosphates. Slightly and medium dirty laundry should be washed without the pre-wash. 30% of water, 40% of energy and 30% of the detergent are saved thereby. Washing machine should be started only when full, as the half-full machine implies the waste of water, energy and detergents.

Water and Clothes Washing / Cleaning

Clothes made of different materials (combination of wool, leather, metals, decorative beads) shall not be dishwasher treated, but only dry cleaned. Thus, not only the clothes quality will be preserved, but unnecessary water consumption and thereby the discharge of wastewater into the environment will be reduced as well.

Water and Dishwashing

Half empty dishwashing machine wastes water and electricity. Therefore, start it only if full. Pre-wash in most cases is unnecessary, provided food remains are cleaned off the dishes beforehand (and thrown into the container for food remains and not into the toilet!). Thereby, both water and energy are saved. It is useful to investigate the minimum quantity of a detergent sufficient for proper dishwashing. It is often much less than previously thought. Shine dishwashing agent unnecessarily increases the amount of *tensides* (substances facilitating dissolution of oil in water), difficult to be eliminated from waters. Washed dishes are clean without the shine agent as well!

Water and Car Washing

Car washing is best to be done in a car wash. Do not exaggerate with frequent car washing. In certain cities within the developed countries, there are car washes that treat wastewater for multiple uses. If, for any reason, we wash the car in the yard, a bucket of water, a sponge and economically dosed detergent shall be sufficient.

Interesting Findings about Water Saving:

A man, in his daily activities, can be a very serious water consumer, often being unaware of it himself. Thus, for example:

- 10-17 l of water flows out of the running tap into the sink each minute of being open,
- During teeth brushing, 40-60 l of water is consumed if the tap is kept running,
- In average, 120 l of water is consumed during dishwashing with a running tap,
- Shaving with the running tap consumes 40-80 l of water, and
- Car washing using a water hose can consume up to 600 l of water!!!

Therefore, better self-control, higher attention and rational water consumption may provide saving of substantial amounts of water in a household. Therefore, the savings that can be achieved through daily household activities include the following:

- One household can save up to 75,600 litres of water per year by paying attention to the taps;
- Teeth brushing, including only wetting and tooth brush washing spends 2 l of water. Thereby, if compared to teeth brushing with the running tap at all times, up to 35 l of water is saved at each teeth brushing;
- Substantial amounts of household water can be saved by better self-control, higher attention and rational consumption;
- If, upon shaving, a water filled pot is used, only 4 l of water will be spent, and, if compared to the shaving with constantly running tap, the savings are up to 55 l per shaving;
- If the sink is filled with water during manual dishwashing, approximately 20 l of water is consumed per one dishwashing. It means the saving of 100 l of water at each dishwashing, provided the running tap is replaced by this method of manual dishwashing.

3 HOW MUCH IS THE WATER?

3.1 Why Pay for Water?

American experts estimated that one water utility, responsible for the supply of certain area with drinking water, may need up to 45 minutes to produce one glass of water. *Water pipes of the United States of America and Canada together are approximately 1,600,000 km long, which is sufficient to embrace the planet Earth 40 times.*

Water is basic human need! Modern way of life means clean water daily and easily accessible to a man. However, providing such services requires time and money, as water supply needs to be organised. Organisation and provision of water supply services are mostly performed by *water supply companies (water utilities)*, as it is their main business activity. Water thereby becomes also an *economic good*, as water supply is a payable service.

Water utilities, providing water supply and wastewater discharge services, are encumbered by many costs. Thus, water supply and sewage systems shall firstly be constructed, then constantly maintained and their operation supervised. Supervision and monitoring of water supply and sewage systems are performed by experts and employees of different professions with high electricity consumption. Finally, water needs to be delivered to final consumers and their wastewaters discharged through an adequate sewage system. All activities above require substantial funds, collected through payments of the quantities of consumed water and fees for the disposal of wastewater from households to a water supply and wastewater utility.

Figure 7 – Use of Water in Agriculture

The idea of water as an economic good was for the first time officially accepted and announced on the International Conference on Water and Environment, held in Dublin, the capital of Ireland, in 1992. Accordingly, one of four water resources management principles, adopted by the majority of water experts attending the conference above, was as follows: *"Water has an economic value in all its usages and thus should be accepted as an economic good, given the criteria of affordability and equity".*

Nevertheless, introducing water as an economic good faced numerous disagreements among many water experts, present even today. There is a concern that by acceptance of the Dublin principle, or by introducing water as an economic good, the rights of the poor will be highly threatened. Therefore, to avoid misuse of water for exclusively market purposes, the Dublin principle was subject to a correction indicating that water is also a *"social good"*, and as such shall be available to everyone.

3.2 What is the Principle „Polluter Pays“ and „User Pays“?

Principle “polluter pays” and associated principle “user pays” are used in the pursuit of sustainable water resources management. Principle *"polluter pays"* is based on the idea that those who cause the pollution should pay for the damage to the environment, while principle *"user pays"* is based on the idea that those who use water should pay the compensation for the referred service.

There are many ways of water use: use of water in households, for irrigation of agricultural surfaces, use of water in industry, in electricity production, for recreational purposes, etc. Water supply companies provide consumers with required water quantities, i.e. provide water supply services, and consumers pay a monetary compensation for such services pursuant to the "user pays" principle. In cases when consumers provide their own water, they still must pay certain compensation as they use a natural resource that belongs to the overall society.

Principle “polluter pays” obliges polluters to pay for the damage caused to the environment by their activities. This principle stimulates also protection of environment against pollution and encourages households, industry and other polluters to behave in an environmentally friendly way. The money collected by means of “polluter pays” and “user pays” principles is most frequently directed to the *Environmental Protection Funds*, whereby the money is spent for rehabilitation of the degraded state of environment.

However, use of the "polluter pays" should not mean that the environment pollution is the right of everyone able and willing to pay for the damage caused. Namely, in a long-term sense, this principle should only be an incentive to orientate the society towards the use of new environmentally friendly technologies. It means that the investment of funds into the treatment of wastewater should be more cost-efficient on a long-term basis than constant payment for the damages caused to the environment pursuant to the "polluter pays" principle.

Figure 8 – Flood Illustration

4 WATER AND ENVIRONMENT

4.1 Water As Living Environment

A man needs half a litre of water per day only for breathing. *The share of water in a newly born is 80%, and in an adult 60-70%. Furthermore, water makes 70% of a rain worm, 70% of a chicken, 70% of an elephant, 90% of tomato, 80% of pineapple and 70% of a tree.*

Living environment or human environment is everything that surrounds us, or everything any human activity is linked to. Living environment may be observed as a system comprised of the following five parts:

- *Atmosphere (atmospheric layer of the planet Earth),*
- *Hydrosphere (aquatic layer of the planet Earth),*
- *Lithosphere (Earth crusts),*
- *Pedosphere (soils), and*
- *Biosphere (living world).*

Water habitats are all habitats, natural or human affected, with water as crucial ecological factor, regardless of whether it refers to water habitats in ten narrow sense – whereby water represents main living environment, or to habitats where water (at least periodically) participates in the formation of the character of an ecosystem, its structure and function.

4.2 What Is an Ecosystem? Which Ecosystems Depend on Water?

Living beings (plants and animals) that live in certain area are considered an *ecosystem*. Such living beings depend on each other to survive. Balanced relation of all plants and animals, comprising an ecosystem, is extremely important for its survival. Therefore, any disruption of an ecosystem may have fatal consequences for all organisms therein.

For example, observe what will happen if a new plant or a new animal arrives to an ecosystem where it has never existed before. New organism will compete with the host organisms for food. Such foreign organisms may „push out“ some organisms causing their extinction, and will further affect remaining organisms which used the extinct organisms as a source of food.

Each water body, together with the organisms living therein, also makes an ecosystem. Thus, there are *ecosystems of freshwaters* (rivers, lakes, wetlands, ground waters), and *ecosystems of seas and oceans*.

Freshwaters are relatively „young“ waters, as they occurred during or right after the ice age. *Sea waters* are the so-called „old” waters, as they occurred much earlier, and are considered the place where the life on Earth has started.

Freshwaters can be divided to three main groups:

- *Running waters* (sources, streams, rivers),
- *Standing waters* (lakes, wetlands, pools, marshlands), and
- *Groundwater* (deep in the Earth interior, most of ground waters have accumulated throughout millions of years by rain and snow fall).

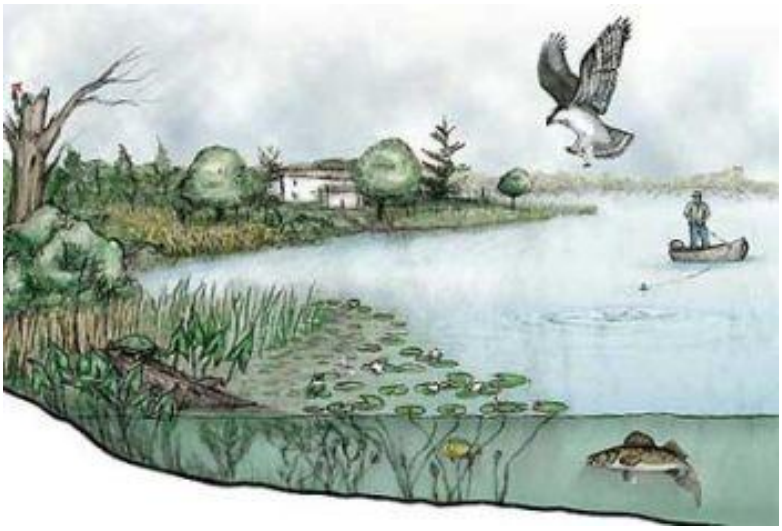

Figure 9 – Lake Ecosystem

In case of streams and rivers, there is *upper, middle and lower course*, settled by different living world due to the differences in temperature, air quantity and water velocity. Thus the trout is a typical organism in the upper course of running waters, and among aquatic plants there are algae diatom and moss.

Figure 10 – Trout

Middle course is characterised by medium water flowing velocity and convenient living conditions, thus, in apart from algae diatom and mosses, there are also green algae, fungi, etc. The soil in the lower course is sandy and sludgy. Organisms present therein include oligochaeta, shellfish, many insect larvae, and then catfish, carp and pike (see figures 11, 12 and 13).

Figure 11 - Carp

Figure 12 - Catfish

Figure 13 - Pike

Living beings in running waters, especially those living in rapids, undergo special body adaptations to withstand strong water flows. Thus, for example, *aquatic caddis fly larva* (or insects bound to water habitats on the land due to their development cycle and their lifestyle) builds a house of small stones and sand grains to increase the weight of its body and thus survive in certain parts of a running water course (see Figure 14).

Figure 14 – Aquatic Caddis Fly Larva

Ground waters are also relatively poor in living beings due to the small quantity of available food and fixed living conditions. Therefore, groundwater inhabitants undergo a series of adaptations to specific conditions prevailing in these environments – absence of pigment and particularly eyes. Typical representative of groundwater inhabitants is *Olm* (see Figure 15).

Figure 15 - Olm

All seas and oceans are interlinked and build an eternal water space, allowing sea organisms a high freedom of movement. Main feature of the sea environment is its salinity. Scientists believe that life originated in water, or precisely in sea water, and moved to the land only several millions of years thereafter.

4.3 How to Preserve Flora and Fauna Habitats?

Is it really important if several unknown butterfly species extinct? What do we lose thereby?

There is more and more scientific evidence that, together with butterflies, birds and flowers, much more is lost. Impaired ecosystems lose their ability to provide numerous services to people, such as polluted water treatment, provision of fertile land, easement of climate changes and similar.

The European Union (EU) has perceived this threat and started with the prevention of biodiversity losses by means of corresponding legal documents and regulations. Thus perhaps the most important step in this direction is the establishment of the *network Natura 2000*. It is the European ecological network of protected sites established by the European Union member countries, and defined through the so-called *Habitats Directive* and *Birds Directive*. The goal of the Habitats Directive adopted in 1992 is to contribute to the preservation of biodiversity in the European Union member countries through the protection of flora and fauna habitats, while the attempt of the Birds Directive is to protect and secure survival primarily of the endangered bird species.

4.4 What are Ramsar Convention and Ramsar Sites?

Convention is a treaty between countries to respect the same law. When Government of a country accepts the convention, it means that it accepts to respect the Law written in the referred convention. *Ramsar Convention* is a document, adopted in 1971 in the Iranian city Ramsar, extremely important for wetland areas. The document is also known as the Convention on Wetlands of International Importance, especially as waterfowl habitats.

Namely, people have long considered the wetlands useless or even adverse, and thus destroyed them by converting them into agricultural surfaces. Thereby, a threat of the permanent disappearance of many plant and animal species occurred. Therefore, scientists have decided to initiate the process for protection of wetlands for the first time, further accompanied by the wider public as well. The result of the fight for the protection of wetlands is also the afore-mentioned Ramsar Convention, signed in 1971 in the city of Ramsar in Iran , the Convention was named after. Presently, there are 116 signatories of the Ramsar Convention, including Bosnia and Herzegovina.

Although wetlands cover only around 3% of the earth surface, they are of vital importance for our environment, as each wetland has a unique ecosystem providing food, water and required living and propagation environment to various plant and animal species. Furthermore, wetlands accumulate excessive water as sponges, and plants living therein

absorb water polluting substances (primarily nitrates and phosphates), and use them for their own growth. Thus water flowing through a wetland area is filtered, or treated through its flow. In addition, wetlands serve for the acceptance of water after heavy rainfall or for slow water drainage in cases when water levels in the surrounding area become extremely low.

Finally, wetlands are useful for migration or reproduction of many animals that normally do not live in wetlands. For example, herons nest in large trees, but also need shallow water sites to seek fish, or feed themselves.

Therefore, although truly unique, wetlands shall not be considered isolated and independent habitats, as all the so-called *wet habitats*, whether wetlands, marshlands or flooded fields, serve as a home of many animals, extremely interesting from the scientific standpoint.

4.5 What Are Ramsar Sites in BiH?

There are two Ramsar sites in Bosnia and Herzegovina, Hutovo Blato and Bardača.

Figure 16 - Hutovo Blato

Hutovo Blato (www.hutovo-blato.ba) is located in the southeast Herzegovina, on the left side of Neretva River, within the territory of Čapljina and Stolac Municipalities. Hutovo Blato is a Nature Park and a bird reserve in BiH. It is known as the oasis accommodating many waterfowl species, as well as many other plant and animal species. Hutovo Blato i important for hibernation of ducks and wader, as well as for nesting of European endangered species, such as different herons or, for example, Pygmy Cormorant.

Owing to wide wet areas and diverse wetland habitats, as well as favourable Mediterranean climate impacts, Hutovo Blato is a pleasant resort during winter time for ducks, water hens and numerous other birds arriving from northern parts of Europe. Apart from diverse flora and fauna, the park waters were very rich in fish species, especially eels and carps (22 species). Unfortunately, during past years, fish stocks impoverished and thus could adversely affect the overall flora and fauna diversity in this area.

Figure 17 – Pygmy Cormorant

Wetland Area of Bardača is located between the right Sava River bank and left Vrbas River bank in the northern part of Lijevče Polje, and was proclaimed a Ramsar Site on February 2, 2007.

Figure 18 Wetland Bardača

84 out of the 202 bird species observed in this wetland nest and reside herein throughout the entire year. *This is the only habitat in Europe where glossy ibis, spoonbill, black-headed gull, whiskered and common tern*. On Bardača, great cormorant, ferruginous duck, little bittern, night heron, purple heron, corn crake, white stork, tit and other interesting and rare bird species can be observed during flybacks and bird migrations.

Figure 19 – White Stork

Figure 20 – Little Bittern

Figure 21 – Ferruginous Duck

4.6 Violation and Conservation of Water Ecosystems

Contamination of natural waters may lead to major ecosystem disorders, which can consequently result in poisoning or even death of individuals, and the loss of biodiversity. Water organisms must fight against water contamination in a special way. Therefore, it is not surprising that there is much less plant and animal species nearby the pollution, as only more resistant living organism species survive in such areas.

Different pollutants in natural waters usually appear as the result of precipitation (rain or snow), wherein air pollution is first dissolved upon passing through the atmosphere, then descended to the soil, where, flowing on the soil surface, it is mixed with the remains of different types of agricultural fertilisers, oils, fuel and similar.

Adding the increasingly irresponsible relation of people towards water, often uncontrollably used, we waste and pollute, and thereby forget that water is necessary for our survival. Such relation to water leads to major pollution problems.

Water can also be polluted by poisonous substances from industries, mines and abandoned hazardous waste (containing detergents, oils, petroleum, heavy metals, salts, and similar).

Communal wastewaters are wastewaters from households, restaurants, medical institutions and they mostly contain faeces, food remains, detergents, and disinfection agents. Communal wastewaters include also *storm waters*, occurring as the result of precipitation (rain, snow).

Agricultural activity can also cause major problems for the environment. Farms often use large quantities of chemical fertilisers, which can reach rivers, lakes, ground waters, and thus endanger the quality of water normally used for population water supply or as a living environment for plants and animals living therein. Furthermore, use of fertilisers in agricultural production can increase the quantity of nutrients in water, and thus results in excessive growth of water plants, or cause the so-called *„flourishing“* of a lake, river or any other water surface.

Resistant pollutants such as *pesticides* (chemicals used against pests in fields) are the most hazardous elements for an ecosystem as well as for human health. Such chemicals may accumulate in fish organisms, and cause serious damages to people or animals eventually eating such fish.

It can be concluded that wherever chemicals are largely used, ground waters become polluted as well, further leading to the pollution of drinking water. In addition, the majority of hazardous substances are more or less dissolvable in water, and, during certain period of time, rain will transport them to their final destination, such as surface waters (seas, rivers, lakes), or through the soil to ground waters.

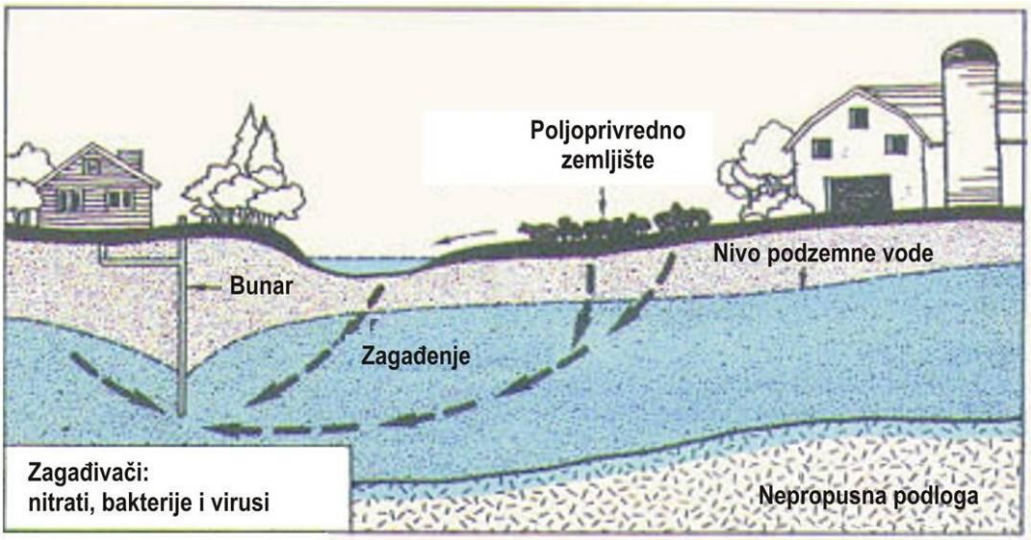

Figure 22 – The Course of Pollutants

It is necessary to indicate also the waste that has been covering our rivers and lakes during past years, or numerous plastic bags and other plastic containers (see Figure 23). Due to their low weight, wind can easily blow them away, thus scenes of plastic bags hung on trees, as well as river beds covered in disposed plastic, can be found every day. The best examples are Neretva River exiting Konjic, as well as Bosna River from Vogošća to Sava Rive estuary.

Figure 23 – Bosna River

Although the majority of plastic bags is used very shortly, for several minutes only, and thereafter disposed, long-term impact on the environment is substantial. Decomposition of one plastic bag needs 20 to 1000 years. In some countries, various measures are undertaken to encourage consumers to use reusable bags, and some countries have fully prohibited use of plastic bags – thus, next time you go shopping, do what other Europeans do, i.e. take your on canvas bag!

5 HOW TO MANAGE WATER – THE ROLE OF LAW

Famous American actress Julia Roberts won an Oscar in 2001 for the best actress in the movie called „Erin Brockovich", based on a true story. Erin Brockovich, working as an officer in a law firm in a small Californian town, found evidence on the discharge of enormous quantities of hazardous chemicals from an international electricity and gas production company into the water used for water supply of the surrounding population. Namely, inhabitants of the surrounding area started to fall ill massively from various diseases, and Erin managed to prove that hazardous chemicals, released into the water, were the cause to it. The PG&E Company had to pay the compensation of $333,000,000 as, by then, the highest compensation ever paid in America. This is only one example of how law, even through individuals, can accomplish major changes and revolutions.

The law has a major role in the water resources management system. The law imposes goals to be achieved through a number of rules that must be respected. The goal to be achieved thereby must be real, and the rules easily applied.

Water resources management is the control of the water usage pursuant to the sustainable development principles. It means use water uniformly and efficiently for different human needs (population, industry and agriculture water supply), thereby protecting as much as possible water resources (surface and ground water reserves), as well as water and water-dependent ecosystems.

In order to make the water resources management really efficient, joint involvement of technical, legal and financial experts is required, to create a key document with even and ecologically acceptable water usage as its primary task. This approach to water resources management is called the *interdisciplinary approach*, and the key document above *Water Resources Management Strategy*.

5.1 Water Protection Background

The first United Nations conference on environment was held in 1972 in Stockholm, the capital of Sweden. It was the first major international conference dedicated to the adverse impact of human activities to the environment, which brought into question the future of the mankind, as the hazards of the global environment pollution threatening the planet Earth were indicated for the first time.

As a response to the first United Nations conference on environment, in 1980, the World Nature Conservation Strategy was created, the International Union for Nature Conservation formed, and the United Nations and the WWF (World Wide Fund for Nature) Environment Programme developed.

The second UN conference on environment was held in 1982 in Nairobi, the capital of Kenya, admonishing the uncontrolled industrial development and excessive use of natural resources, as well as their serious consequences to the environment.

Thereafter, in 1992, the United Nations conference on human environment and development was held in the Brazilian metropolis, Rio de Janeiro. This conference was of special importance as the instructions on continuation of the industrialisation and mankind development, thereby protecting environment as much as possible, were provided for the first time through a number of important documents. Accordingly, several important documents were signed and adopted, including those listed below:

- *Declaration on Environment and Development – better known as Rio de Janeiro Declaration*,
- *Convention on Climate Change*,
- *Convention on Biodiversity*,
- *Principles for Management, Conservation and Sustainable Development of All Types of Forests*, and
- *Sustainable Development Action Plan for the 21st Century named Agenda 21*.

Figure 24 – Water Resources Management Principles

Certainly, one of key afore-mentioned documents, adopted on the conference in Rio de Janeiro, is the *Agenda 21*. It is a comprehensive document of over 500 pages dealing with numerous topics of exceptional importance for mankind and environment (the issues of poverty, atmosphere protection, preservation of forests and water resources, health, agriculture, waste disposal and many other issues).

Conferences that followed the Rio Conference were held in the American metropolis New York in 1997 and in the capital of the South African Republic, Johannesburg, in 2002. The conferences above are also known as Rio + 5 and Rio + 10, as they followed five or ten years after the Rio Conference.

Apart from the documents adopted on the afore-mentioned conferences, exceptionally important is also the document named „A Sustainable Europe for a Better World: the European Sustainable Development Strategy ", issued by the European Council in 2001 in Swedish town Gothenburg, as well as the „Millennium Declaration“ adopted by the General Assembly of the United Nations in New York in 2000.

5.2 How Does the EU Treat Water and Environment?

Aimed at water and environment preservation, the European Union (EU) established a legislative framework for environmental issues during the past 30 years, with the attempt to provide high and equal standard in all member countries, or those yet to become member countries. This framework consists of over 300 legal documents and forms, including *Water Framework Directive* as a document of special importance for water and environment issues.

The Water Framework Directive, adopted in 2000, provides a framework (stating what to achieve, but not how) and the direction (good state of water by 2015). Good sate of waters means access to sufficient quantity of water of adequate quality. Thus, it is attempted, among other things, to provide sufficient quantity of water through a balance between the quantity of water exploited from the ground and the quantity of water inflowing the ground, and adequate quality of water through measures to prevent quality deterioration (reduce the discharge of pollutants into surface and ground waters and similar measures).

5.3 Who Manages Waters in BiH?

Pursuant to the BiH Constitution, water resources management is under the authority of two *entities* (sub-state divisions) comprising the state of BiH, such as the Federation of BiH (FBiH) and the Republic of Srpska (RS). In case of the Federation Entity (FBiH), water issue is a common responsibility of the Federation and its Cantons, thus, in addition to the Federal Water Law, individual Cantons within the Federation have adopted their own Water Laws.

There is one *Ministry* (institution responsible for management and monitoring of the state/region development in a specific field) responsible for waters in each entity. Thus the water issues are under the authority of the Federal Ministry of Agriculture, Water Management and Forestry in the FBiH, or the Ministry of Agriculture, Forestry and Water Management in RS. Within the FBiH, comprised of ten Cantons, there is one Ministry responsible for the water sector in each Canton.

Finally, since August 2006 and under the Brčko District Supervisory order, the RS Law from 1998[1] is considered the Law of the District of Brčko until this District adopts its own Water Law. The development of the water management sector on the territory of the BiH District of Brčko is the task of the Department for Agriculture, Forestry and Water Management within the Government of Brčko District.

[1] Official Gazette of RS, no. 10/98; 51/01

6 DO WE HAVE THE RIGHT TO WATER?

6.1 Water Is a Human Right!

Water is a human right! *It is evidenced by the International Water Law. Very often, especially in the areas poor in water, different conflicts of interest, tensions, and even war may arise. Provided this is a frequent advent worldwide, such conflicts are called* ***water conflicts****.*

Thus, the international organisation ***„Green Cross"*** *attempts, through numerous projects, to prevent conflicts often arising in the developing countries. An example of it is one of the ongoing projects implemented by the organisation above, involving the world-famous Italian fashion designer Giorgio Armani, where purchasing one special edition perfume, 100 litres of drinking water is donated to the children in Ghana.*

6.1.1 Right to Water within International Human Rights Framework

Right to water is the human right of access to sufficient water quantities of adequate quality at affordable price. Sufficient water quantity means sufficient quantity of water to satisfy basic human water needs, while adequate quality means water that is clean and safe to drink.

Several international documents, such as the Geneva Convention, the Universal Declaration of Human Rights, and the Declaration on the Right to Development, contain definitions of some basic human rights, thus the right to water can indirectly be interpreted also as one of basic human rights. The documents above list human rights such as "the right to life, right to optimum living conditions, and everything that makes life sustainable", including also the right to water as one of the most important conditions for sustaining life.

In addition, right to water is clearly cited in two of six core human rights treaties, such as: the Convention on the Elimination of Discrimination against Women (1979) and the Convention on the Rights of the Child (1989).

Therefore, human right to water cannot be jeopardised in any case, as water is the basic and the most important life element. However, in the "International Law" and other international legal documents, the right to water has not yet been clearly defined, but implied as part of the existing human rights, i.e. a part of the right to life.

Anyhow, in the 21st century, when water becomes an increasingly scarce natural resource, separation of the right to water from the shadow of other human rights may contribute to its better protection.

6.1.2 What Is the Right to Water?

Given that the right to water implies the human right to access sufficient water quantities of adequate quality and at affordable price, there are three basic components of the right to water:

1. *Drinking water availability*, implying:
    - *physical availability*,
    - *affordability or payment ability*,
    - *legal availability without discrimination*.
2. *Water quality*, and
3. *Water quantity*.

Availability

Physical availability means that water is close, or within or in close proximity of a human residence, thus nor necessarily in the home of the consumer. *Affordability* means that water and sewerage services must be affordable to all, even to the poorest population classes. Provided water is not costless, the state must ensure that the water supply costs are such to allow each person an access to water services.

Figure 25 – Availability of Water Worldwide Is Unequal

Water Quality

Water must comply with the prescribed quality standards to be usable for drinking purposes. It means that water ingredients that may be dangerous to health must be removed or reduced to the minimum allowed concentrations.

Water Quantity

Water quantity is the quantity of water that should be sufficient to satisfy basic human water needs, as follows: for drinking, bathing, cleaning, cooking and sanitary purposes.

Furthermore, there are also other ways of water usage, such as food production and industrial water consumption, water consumption in agriculture, and similar.

6.2 Water and Health

6.2.1 Availability of Clean Drinking Water Worldwide

Availability of clean water is one of crucial issues of the mankind today. The increase in the population of the world countries and the increase in water consumption are major reasons of the ever reducing availability of drinking water worldwide. Provided the data on the number of population for 2008 indicate the increase of the world population to 6.6. billion people, unequal distribution of water on the planet, as well as the variation of water resources in relation to the seasons, is a major problem. On one side, there is no or insufficient water where needed, and on the other hand, there is surplus water on the wrong place and in wrong time. Two regions already facing serious water scarcity are Africa and the Middle East, both due to accelerated population increase and the fact that the referred regions are poor in water due to, among other things, climate and geographic reasons.

Access to drinking water is measured by the number or percentage of people with acceptable and safe access to sufficient quantity of water for drinking, hygiene and other household needs. Based on the UN data from 2003, *1.2 billion people, i.e. even 20% of the world population does not have safe access to clean drinking water*. Safe access to water means house water connection, public tap, protected well, protected source or protected well collecting rainfall.

Main reasons of the lack of safe access to clean water in some countries are insufficient funds to supply the overall population on the referred area with water. Overpopulation and water reserves scarcity are also considered factors contributing to the situation above.

Therefore, it is not surprising that the majority of the world population without safe access to water is in Asia (65%), then in Africa (27%), Latin America (6%) and Europe (2%)[2] (see Figure 25).

[2] "Water for People, Water for Life", The UN World Water Development Report, 2003

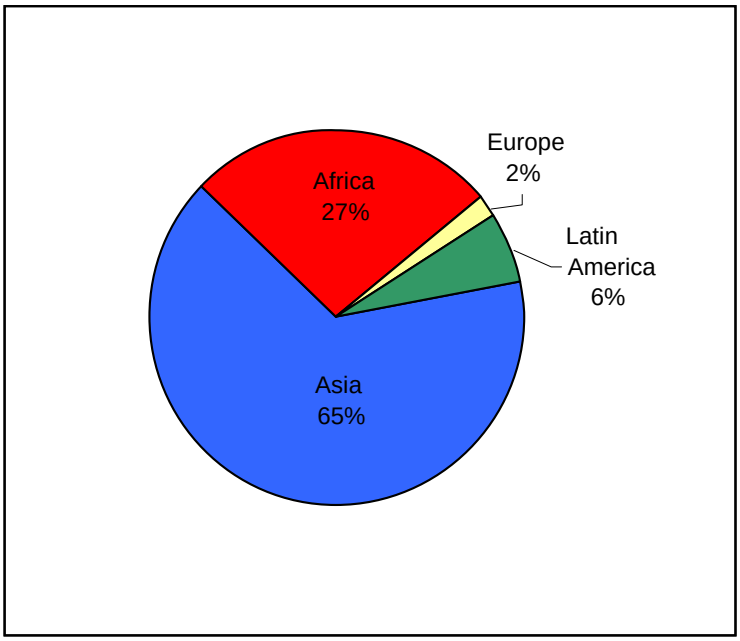

Figure 26 – Percentage of Population per Continents without Safe Access to Drinking Water

6.2.2 Sanitary Conditions Worldwide

Acceptable sanitary conditions imply disposal of wastewaters from households and commercial entities in a safe way, without endangering human health. Poor sanitary conditions may cause different water and human environment pollutions, as well as the dissemination of infections.

Based on the UN data from 2003, *2.4 billion people are not provided with adequate and acceptable sanitary conditions.* Acceptable sanitary conditions include: connection to a public sewage system, sanitary septic tank, toilet with discharge, and septic tank provided with a vent pipe.

The majority of the total number of the world population without the access to adequate sanitary installations is in Asia (80%), then in Africa (13%), Latin America (5%) i=and in Europe (2%) (see Figure 25)[3].

[3] "Water for People, Water for Life", The UN World Water Development Report, 2003

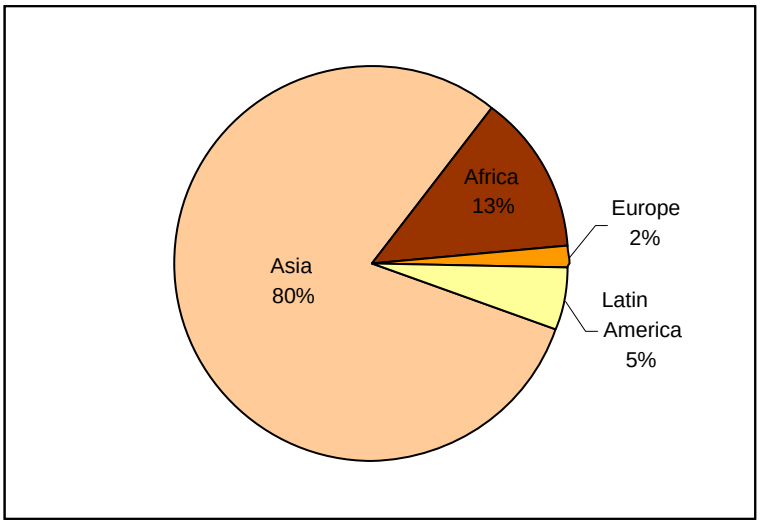

Figure 27 – Percentage of Population per Continents without Access to Adequate Sanitary Installations

6.2.3 Diseases Caused by Water Scarcity or Wastewater Discharge Worldwide

Lack of a safe access to water and sanitary installations has a significant impact on human health. Use of polluted water may lead to various, possibly fatal, infectious diseases. Furthermore, a cause to the fast dissemination of the infectious disease may also be poor sanitary living conditions.

The most widespread infectious diseases caused by water and poor sanitary conditions include *diarrhoea, typhus, and cholera,* as leading causes of disease and death in the developing countries.

Based on the UN data, over 3 million people a year dies from the diseases caused by the use of unsafe and polluted water. *Approximately 1.8 million of children die each year from the diseases caused by polluted water and poor sanitary conditions, which means that approximately 5,000 children die per day*. Around 2 million people a year die only of diarrhoea (including also cholera) caused by polluted water.

6.2.4 Minimum Required Water Quantities

It is difficult to estimate the quantity of water required on the daily basis for maintenance of minimum living conditions. Different data on minimum required water quantities are available in numerous studies. Based on the estimates of the World Health Organisation (WHO) and the UN Children's Fund, *minimum required water quantities*, to satisfy basic human needs (drinking water and hygiene maintenance) vary *between 20 and 40 litres per day*. In addition, in order to be considered available, water must be at a reasonable distance, or up to 200 m from the doorstep.

Water consumption, as emphasised above, is rather unequal, or extremely high in developed countries and unacceptably low in most of the developing countries. Thus an average person in Europe consumes below 200 litres of water per day, in Northern America even up to 400 litres, while an average person in the developing countries consumes only around 10 litres of water per day for drinking, washing and cooking.

7 CONCLUSION

Water concern is the task and responsibility of each individual. It means that every man on the planet Earth, regardless of his residence, should give personal contribution to provide future generations with living conditions. Therefore, all knowledge of water does not entitle a man, in any moment of his existence on the Earth, any right to unlimited water consumption and pollution.

Water resources, implying a life on the Earth, oblige us to rational consumption and sustainable use, thus each one of us must take care of water consumption and environment as water makes a particularly important part of it, and understand that polluting the environment, we pollute water as well. Each one of us can make that little step and express good will and civilised relation towards water and everyone in need of it, and each living being needs it. Do not forget that water is a part of us, and that by *water care, we care for ourselves, our children, and the generations to come...*

CIP – Cataloguing in Publication
National and University Library of
Bosnia and Herzegovina, Sarajevo

628.1:502.13](075.2)(076)

WATER for Life: Handbook for BiH Primary Schools /
[authors Bjelavac Jasminka ... [et al.];
[illustrations Nijaz Lukovac and Ninjel Lukovac]. -
Sarajevo: Hydro-Engineering Institute, 2011. - 38
pages: illustrations; 30 cm

ISBN 978-9958-614-04-4
1. Bjelavac, Jasminka
COBISS.BH-ID 18858502