Water use efficiency and economic approach

National Study, Bosnia and Herzegovina

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I. COUNTRY BACKGROUND RELEVANT FOR WATER RESOURCES MANAGEMENT IN B&H

1. Administrative and hydrological characteristics

Bosnia and Herzegovina (B&H) is a State comprising of two Entities, the Federation of Bosnia and Herzegovina (FB&H) and the Republika Srpska (RS) and District of Brcko. State B&H is the central authority but has only limited and specific powers, whereas the two Entities (FB&H and RS) and District Brcko are politically, administratively and legally autonomous entities.

The two Entities are asymmetrical in their institutional organization. The FB&H is composed of 10 Cantons subdivided into 84 municipalities, whereas RS comprises from 63 municipalities, without cantons.

Hydrologicaly, B&H territory covers two basins: Sava river (Danube) and Adriatic Sea basin. Of the total area of B&H (51,129 km^2) 75.7% belongs to the Danube (38,719 km^2), while 24,3% belongs to the Adriatic sea basin (12,410 km^2).

The Adriatic basin covers southern part of the country, while Sava river (Danube) basin the northern part of B&H territory. Hydrological border between two basins is crossing both F B&H and RS territories, so F B&H water administration is responsible for water management in one part of Sava river(Danube) as well as Adriatic basin and RS water administration is responsible for the other parts of those two basins.

Figure 1: Administrative borders in B&H

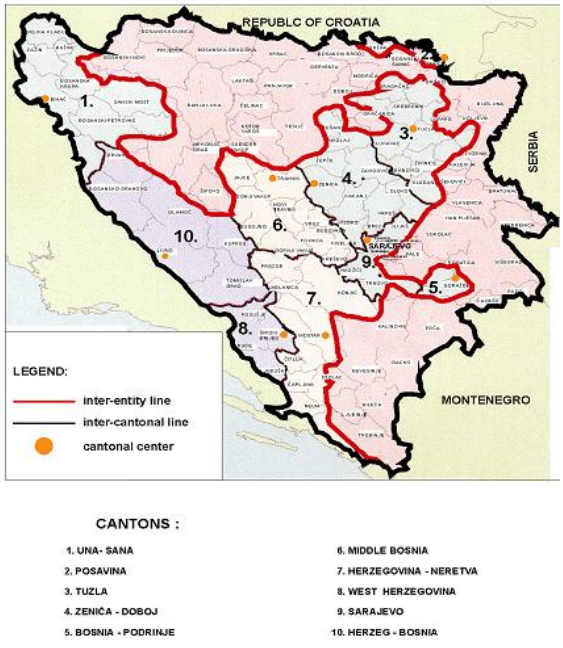

Figure 2: Hydrological border in B&H

2. Water policy and legislation in a B&H

The relevant legislation for water management in B&H are two Water Laws, one for Federation B&H and another for Republic Srpska. However, the new Water Laws in both entities are harmonized with each other and with the EU Water Framework Directive.

The responsibility for implementation of WFD in B&H is on both entity Ministries of Agriculture, Water Management and Forestry (F B&H and RS).. Entity Ministries are responsible for preparation of entity Strategies for Water Management until 2009 for the period of 12 years. These strategies must be coordinated and harmonized in order to provide a unique Strategy for the whole territory of B&H. In order to implement the Strategy, Water Management Plans for river basins have to be elaborated,

specifically for Sava river basin and Adriatic Sea basin. The responsible bodies for elaboration of Water Management Plans are Water Agencies, until 2012 for federation B&H, and 2015 for RS. These Plans will be revised and updated every 6 years. The working plans for the preparation of Water Management Plans will be announced to the public at least 3 years before adoption of the Plan.

Federation B&H, unlike Republic Srpska, has a specific situation where each of the 10 cantons have their own cantonal ministries responsible for the water management issues (in further text - cantonal ministries), and also their own cantonal water laws. Each Canton is responsible for water management within its borders, but it also has to be in accordance with the Federal Water Law. One of the tasks of cantonal ministries is to determine policies and strategies concerning water management, adoption of water management plans, program of measures, standards and regulations for achievement of good status of waters, water protection, etc. Municipalities which are constitutive part of cantons are responsible for their own water supply and wastewater collection and treatment. Municipalities are founders of Water Utilities.

In RS, which does not have cantons, municipalities have jurisdiction over local water protection. Each municipality in RS are responsible for their own water supply and wastewater collection and treatment. Municipalities are founders of water Utilities.

3. Institutional set - up in country relevant for water management

At the state level Ministry of Foreign Trade and Economic Relations B&H is responsible for coordination of activities and harmonization of plans between bodies of entity governments, as well as institutions at international level in the field of natural resources, environment protection, agriculture and energy. Ministry of Communications, also at the state level, is in charge for navigation on rivers and sea.

At the entity level Water management in Bosnia and Herzegovina is in the competence of the two entity Ministries of Agriculture, Water Management and Forestry. Parallel to that, each of the two entities (FB&H and RS) have (or are in process o establishment) two Water Agencies which are expert service to the ministries: Water Agencies for Sava river basin (Danube basin) and Water Agencies for Adriatic Sea basin.

In Republic Srpska, Water Agencies are not yet established, and currently Republic Directorate for Waters of Republic Srpska is the responsible body. However, Directorate for Waters in RS, according to the new Water Law adopted in 2006, will soon be transformed into two Water Agencies; one for Sava river basin, and another for Adriatic Sea basin. FB&H have established already Water Agencies.

At Cantonal level (in FB&H) Federation B&H, unlike Republic Srpska, has a specific situation where each of the 10 cantons have their own cantonal ministries responsible for the water management issues.

At Municipal level Municipalities are responsible for local water management and they are foundations of Water Utilities.

4. Statistical system in country relevant for water management

According to the B&H Law on statistic, competent authorities for organizing, processing and disseminating statistic are:

At the state level

BH Agency for statistic

At the entity level

FB&H Institute for statistic and RS Institute for statistic.

Data collecting and processing is almost completely harmonized between those three institutions.

II. WATER USAGE IN B&H

1. Drinking Water Supply

Central Municipal Water Supply Systems in B&H are managed by more than 120 Water Utilities in B&H, which are usually organized as Public companies, owned by Municipalities, Cantons (F B&H, Sarajevo Water Utility) or Cities (Mostar and Banjaluka, F B&H and RS respectively).

According to the information obtained from Water Utilities, percentages of households which are connected on centralized water supply system in bigger municipalities (more than 50 000 inhabitants) is more than 85%, and in smaller municipalities (up to 50 000 inhabitants) vary between 40-60%.

Population which is not covered by Central Municipal Water Supply System relies on their own community water supply systems or on individual wells.

Water Utilities are supplying different water users (households, public institutions, small business, industries etc.)

According to NEAP, Central Municipal Water Supply Systems, managed by Municipal Water Supply Utilities cover 56% of population in FB&H and 48% of RS.

Maintenance and repair was not carried out systematically before the war (before 1991) and during the war was completely stopped. Apart from that the war activities caused destroying of networks and water supply facilities. Unaccounted for water (UFW) ranges from 25 – 75% in different Water Utilities. Physical leakage is often more than 30%.

It is often case that financial problems of Water Utilities are generated due to inability to collect revenue. Since 2000 year, situation in Water Utilities regarding this issue was significantly improved comparing to the previous period. The collection rate in average could be estimated as more than 60%.

2. Irrigation

Bosnia and Herzegovina was even before the war country with much less irrigated surfaces then world average. However, due to the past war (1992 – 1995), some of irrigation systems were destroyed and out of usage, but some were reconstructed again after the war. According to the entity's Statistics (2006), B&H have 1 553 000 ha of cultivable lend and 1 005 000 ha of arable lend. According to Federal Strategy of Agriculture for 2006-2010, B&H irrigates only about 8000 ha of surface, i.e. about 0.5% of cultivable land. Irrigation is now mostly present in the southern, Mediterranean part of B&H as well as in northern part of B&H (close to Sava river), but also in some other parts of the country. The irrigation systems and water usage are managed by agriculture enterprises, associations and individual farmers. Currently data on quantities of water used for irrigation are not systematically collected as well as on data on modes of irrigation. Various strategic documents pointed out necessity of improvement of water irrigation in B&H, in order to develop intensive agricultural production.

3. Industry

According to NEAP, industry in B&H uses water from its own sources but also from the public water supply system. It is assumed that industrial production in Bosnia and Herzegovina is to a large extent smaller than at the beginning of 1990s (about 35% of the pre-war capacities). Due to this fact, the water consumption in the industrial sector has been reduced which also contributes to reduction in terms of pollution.

As for the recycling of water in industries, it was occasionally present in some industries, but currently has begun systematically in some industries by implementation of several projects ("Capacity building of cleaner production in B&H" and "Capacity Building in Integrated Pollution Prevention and Control in Bosnia and Herzegovina"). There are no data on total water quantities recycled within the industries.

III. CONSTRAINS AND PRIORITIES FOR PRODUCTION OF WATER EFFICIENCY INDEX

1. Constrains regarding calculation of Water Use Efficiency Index

As an overall evaluation, several constrains could be pointed out regarding calculation of Water Use Efficiency Index for B&H:

- Extreme lack of relevant data caused by not existence of water strategies, programs, plans and demand management policy in the country;
- Not existence of national system of Indicators of the country;
- Weak mechanism for enforcement of metering and reporting prescribed by existing laws and regulations;
- Lack of metering devices and facilities;
- Complex administrative structure – Entities' Institutions (n F B&H and RS) relevant for water issues do not always collect the same type of data or process them according to the same methodology. Some data for example are available for the Federation, but not for the RS, why it is sometimes difficult to gather required data for the whole B&H territory. As an example is the case with Water Agencies in B&H. As the hydrological border between Adriatic as well as Danube basin crossing F B&H and RS territory, there are two Water Agencies responsible for Adriatic basin (F B&H and RS Agencies), and also two water Agencies responsible for Sava river / Danube basin (F B&H and RS Agencies). In such situation, in order to collect data and information for one basin, one should search for that within two entities' institutions. As the entities' water Laws and regulations are quite harmonized, these institutions should collect the same type of data, but in practice it is not always the case, and also, most often is the case that Agency from one entity has available one type of data, but the Agency from another entity does not have. It results, at the end, in impossibility to gather the same data for the whole basin area and for the whole country as well.

  With the establishment of an Agency for Statistics at the state level has begun the harmonization of type of data and methodologies used for the whole country, but this process is not completed yet.

2. Data collection scope of work of competent Institutions

Generally, data on water issues are available in the following institutions in B&H:

- Statistical Agency B&H;
- Statistical Institutes in F B&H and RS;

  which collect only data on volumes of water abstracted and water delivered and only from Water Utilities. They do not collect any other data on water issues. Apart from that, data on water from local water supply systems, irrigation systems and industries which use their own sources (self-irrigation, self-industry) are not available in B&H Statistics.
- Water Agencies for Danube and Adriatic basin (in F B&H and RS)

  collect hydrological data (river water levels and flows), water quality data in rivers, as well as data from Water Utilities on water abstraction and water consumption. Unlike Statistic Institutes, they collect data (water abstraction and consumption) from local water supply systems, irrigation systems and industries which use their own sources (self water supply, self-irrigation, self-industry)
- Hydro Meteorological Institutes in F B&H and RS

  collect hydrological data (water levels, flows, precipitations), meteorological data.
- Water Utility Companies which have in their own accountings data on water abstraction and water consumption, data on payment rate, etc. They are obliged to deliver some of those data to the above mentioned Institutions.

3. Priorities in B&H regarding data collection improvement

Above mentioned Institutions collect types of data which are in line with their responsibilities according to the actual legislation and regulation. Most often, the main aim of collecting such data by Water Agencies and Water Utilities is charging of different water fees or charging for the services they provide (water abstraction fees, water supply tariffs, etc.).

Other institutions not directly involved in water issues (institutions responsible for agriculture, industry, energy) do not have obligation to collect or to transfer data on water use in their sectors.

According to all mentioned above, it can be concluded that basic priorities for Bosnia and Herzegovina are introduction of national system of indicators, according to which Statistic in B&H will process and publish data.

Also, development of water strategies, river basin plans and water demand policy, is of great importance for improvement of water use efficiency in country. In such situation, data collection relevant for water will be aimed to analyzing and proper managing of water resources in country, rather than only to charging fees what is mostly the case nowadays.

IV. METHODS USED FOR CALCULATION OF WATER USE EFFICIENCY IN B&H

1. General approach

According to the situation explained in Chapters 3, it is obvious that methodology for calculation of Water Use Efficiency Index proposed by Blue Plan is only partially possible. Thus, Chapter 5. will present calculation of Water Use Efficiency in B&H according to data currently available in B&H.

NOTE: Due to lack of type of data required for calculation of water efficiency Index according to Blue Plan methodology, the Questionnaires - Excel sheets provided by Blue Plan were not possible to use. Due to that reason, calculation of each specific component of efficiency index and relevant comments on availability, geographical coverage, period of publication, source of information is presented in Chapters 4.2. and 5. of this document.

2. Data available for each component of Water Use Efficiency Index

Drinking water efficiency

V1 - drinking water volume invoiced and paid by consumers

Data on water volumes invoiced to different consumers are available at B&H Statistical Institutes only from Water Utilities (central public supply systems). They are in a form of water volumes delivered (invoiced) to: households, agriculture, and industry. The same data are also collected in Water Agencies. (See chapter 5).

Data on drinking water volumes invoiced originating from entities which use their own water sources (local water supply systems, industry or irrigation systems) are not available in B&H statistics, but are only partially available in Water Agencies (in some Agencies data are lacking for irrigation systems, in some for local water supply systems etc). (See chapter 5).

Data on water paid are available only in Water Utilities' accountings, or in entities' accountings which use their own water sources, but that data are not collected and transferred to B&H Statistic or Water Agencies. (See chapter 5).

V2 - total drinking water volume produced and distributed

Data on water volume produced/abstracted are available at B&H Statistical Institutes only from Water Utilities (central public supply systems), but they are not in a form of volume of water produced by sectors or consumers (households, industry, irrigation etc.). Statistical Agencies are collecting data in a form of total water volumes abstracted/produced by type of sources (underground, rivers, lakes, etc.). The same data are also collected in Water Agencies. (See chapter 5).

Apart from data on water abstracted/produced originating from Water Utilities (central public water supply) the Water Agencies are collecting data from the entities which use their own water sources (local water supply systems, industry or irrigation systems). Agencies collect it in the form of volumes of water abstracted/produced by type of sources, but also in the form of water volumes abstracted/produced by sectors or consumers (households, industry, irrigation, etc.). Data in the form of water volumes abstracted by sectors or consumers are only partially available in Water Agencies (in some Agencies data are lacking for irrigation, in some for local water supply systems or industries) (See chapter 5).

NOTE 1:

According to the information received from the Water Agency for Adriatic Sea Watershed i F B&H, each Water Utility is in charge of metering or estimating their own abstracted water quantities, as well as water quantities actually delivered to the consumers. These quantities are very often rough estimations of the Water Utilities, since very few of them have water-meters at the source. In current practice, such data are delivered to the Water Agencies. Currently, delivered water quantities constitute a base for the

calculation and charging of the water abstraction fees. However, according to the information obtained from the Water Agency for Adriatic Sea Watershed, this will be changed soon, and water abstraction fees will actually be calculated based on the abstracted water quantities, but the tax base will be reduced. This measure will serve as an incentive for Water Utilities to reduce their water losses. The reliability of the received data on abstracted and delivered water from the Water Companies is sometimes checked by the water inspectors by measuring the flow at the water pumps. Water Agencies recently started financing installation of water-meters at the source to make sure that the obtained data is reliable and that it can be easily verified.

NOTE 2:

According to the information received from the Water Agency for Adriatic Sea Watershed i F B&H, data on water from local water supply systems and irrigation systems are not available or they are only partly available. At the same time, this situation is expected to improve since the Water Agencies have started with the preparation of water strategy and other documents with information about water local supply and irrigation.

Irrigation water efficiency

E1 efficiency of water transport and distribution network.

V3 (Water volumes actually distributed to plots) and **V4** - (Total Volume of water for irrigation, upstream of networks).

As explained above, type of data required for calculation of this indicator (E1) does not exist in any Institution, or only some components exists. In fact, only available data are from central public supply systems on water volumes invoiced/delivered for agriculture and water volumes abstracted by types of sources (underground, rivers, lakes), and not by irrigation sector. Some Water Agencies have partial data on self-irrigation systems i.e. on water volumes invoiced (delivered) to those systems and on water volumes abstracted for irrigation of that systems, but they are not sufficient for calculation of E1. (See chapter 5).

E2 plot irrigation efficiency

Sm Data on irrigated surface according to mode of irrigation do not exist in any Institution. Data are available only for 1990 year (See chapter 5).

S Data on total surfaces Irrigated in the country is available in some planning documentation, as estimation. (See chapter 5).

Industrial Water Efficiency

V5 Recycled water volumes

This type of data is not available in any institution, but some of the industries might have this data in their own accountings.

V6 Gross volume consumed for industrial processes.

Only available data are from central public supply systems on water volumes invoiced / delivered for industry. Some Water Agencies have partial data on industries which use their own water sources, i.e. on water volumes invoiced (delivered) to those industries, but they are not sufficient for calculation of V2. (See chapter 5).

V. WATER USE EFFICIENCY INDEX CALCULATION

NOTE: It was not possible to calculate Total Water Efficiency Index according to the methodology provided by Blue Plan. Due to the reasons mentioned in the Chapters 3 and 4.2., as well as notes provided below each Table of this Chapter (5), the only way for calculating Approximate total efficiency index was the following:

Table 1: Total volumes of water abstracted/produced (km³/year) [1]

Year	Value [2]	Source
2006	From underground sources: 160614 From springs: 120624 From watercourse: 46761 From reservoirs: 5786 From lakes: 41422 From other Water supply systems: 8056 **TOTAL: 345983**	Agency for Statistic B&H
2005	From underground sources: 159912 From springs: 109833 From watercourses: 47560 From reservoirs: 3655 From lakes: 4510 From other Water supply systems: 8673 **TOTAL: 334143**	Agency for Statistic B&H
2004	From underground sources:162364 From springs: 108885 From watercourses: 50144 From reservoirs: 3654 From lakes: 4406 From other Water supply systems: 8615 **TOTAL: 338068**	Agency for Statistic B&H

Table 2: Volumes actually delivered (invoiced) [3]to consumers (km³/year) [4]

Year	Value	Source
2006	To households: 115794 To agriculture, forestry and fishery: 11702 To industry and construction activities: 33188 To other activities: 13901 To other water supply systems: 9900 **TOTAL: 184485**	Agency for Statistic B&H
2005	To households: 114001 To activities (agriculture, forestry and fishery industry and construction activities): 43681 To other water supply systems: 8686 **TOTAL: 166368**	Agency for Statistic B&H
2004	To households: 114315 To activities (agriculture, forestry and fishery industry and construction activities): 43850 To other water supply systems: 9493 **TOTAL: 167568**	Agency for Statistic B&H

[1] Data are relevant only for volumes of water abstracted by Central public Systems - Water Utilities, and do not include water abstracted by self-supply systems (local water supply systems or individual sources), why values provided in the above table do not reflect real water volumes abstracted in B&H.

[2] Data provided only as water abstracted/produced by type of sources. Data are not available in form of water produced and distributed by sectors nor by type of consumers (households, industry, agriculture etc.).

[3] Data reflect water volumes invoiced to consumers, but data on water paid by consumers are not available.

[4] Data are relevant only for volumes of water delivered by Central public systems - Water Utilities, and do not include water delivered by self –systems (local water supply systems or individual systems,) why values provided in the above table do not reflect real water volumes delivered in B&H.

Table 3: Total Water Efficiency Index [5](%) = total water delivered (invoiced)/total water abstracted (produced)

Year	Value	Source
2006	**184485 / 345983= 53**	Agency for Statistic B&H
2005	**166368 / 334143= 49**	Agency for Statistic B&H
2004	**167568 / 338068= 49**	Agency for Statistic B&H

- **Drinking Water Efficiency**

NOTE: It was not possible to calculate Drinking Water Efficiency according to the methodology provided by Blue Plan. Due to the reasons mentioned in the Chapters 3. and 4.2, as well as notes provided below each Table in this Chapter no(5), the only indicators which were possible for calculation were: Loss rates - Unaccounted for water rate (%) as well as Economic efficiency – Rate of Revenue collection from households (%). Data are provided from 10 typical (representative) Water Utilities in B&H, during 2005. So the individual and Average Unaccounted for water rate (%) as well as Average Revenue collection from households (%) for B&H are given in tables below.

Table 4: Population connected to water supplying network

Name of Municipality / Town	Srbac	Zenica	Orašje	Sarajevo	Čapljina	Konjic	Gornji Vakuf / Uskoplje	Bihać	Visoko	Srebrenik
Number of population in the Municipality / Town	23 000	145 000	22 000	484 334		34 141	23 000	68 000	40 000	40 000
Number / Percentage of the population connected to water supplying network	14000 /60	137 000 /95	5 500 /25	402 000 /83	22 000	20434 60	9 500 /41	64600 /95	20000 /50	19638 /50

Table 5 : Loss rates - Unaccounted for water rate (%) = total water volume invoiced [6]/total water volume produced

Year: 2005									
Source: Questionnaires obtained from Water Utilities									
Srbac	**Zenica**	**Orašje**	**Sarajevo**	**Čapljina**	**Konjic**	**Gornji Vakuf/Uskoplje**	**Bihać**	**Visoko**	**Srebrenik**
41	34	20	65	30	60	73	65	50	27
Loss rates - Average Unaccounted for water rate (%)					**46.5**				

[5] Approximate Total Water Efficiency Index calculated according to type of data currently available in B&H.

[6] Unaccounted for water rate is calculated on a base of total water volume produced and total volume invoiced by Public Water Utility, what means that , in some cases, it includes not only water produced and invoiced to houses than includes also some other consumer categories (public institutions, small business or in some cases industries).

Table 6: Economic efficiency-Revenue collection from households (%) = total water volume paid by households/total water volume invoiced to households [7]

Year: 2005									
Source: Questionnaires obtained from Water Utilities									
Srbac	Zenica	Orašje	Sarajevo	Čapljina	Konjic	Gornji Vakuf	Bihać	Visoko	Srebrenik
61.5	96		82	65	83	30	64	50	
Economic efficiency - Average Revenue collection from households (%)						66.4			

- **Irrigation water efficiency**

NOTE: It was not possible to calculate Irrigation Water Efficiency according to the methodology provided by Blue Plan. Due to the reasons mentioned in the Chapters 3. and 4.2, as well as notes provided below each Table in this Chapter (5).

As data on total water volumes for irrigation upstream of the network are not available, and only some data on water delivered (invoiced) were available, the E1 (efficiency of irrigation water transport and distribution network) was not possible to calculate.

The E2 (plot irrigation efficiency was possible to calculate only for 1990 year, as type of data required are not available for the period 1995 – 2007.

a) Efficiency of irrigation water transport and distribution network E1

Table 7: Volumes actually delivered (invoiced) to agriculture (km^3 / year)

Year	Value	Source
Up to 1990	30 280 [8]	Framework Water management Plan B&H, 1994
2006	11702 [9]	Agency for Statistic B&H

[7] Data provided refer to Central Public Water Supply Systems maintained by Municipal Water Utilities and do not include self supply systems (local or individual water supply systems) in Municipalities.

[8] Data collected for the pre-war period for B&H (before 1991); the situation in period after the war (1995 – 2009) is quite different in terms of functioning and managing the irrigation systems.

[9] Data are relevant only for volumes of water delivered by Public Water Utilities, and do not include water used for irrigation from other sources (irrigation systems managed by agriculture enterprises which use their own water sources, local irrigation systems etc). As most of the irrigation systems are supplied from their own sources, value provided in the above table is far from the real water volumes used for irrigation. This value include, apart from water for agriculture, also water forestry and fishing. Data are not available for any other year, except for 2006.

b) Plot irrigation efficiency E2

Table 8: Irrigated surfaces in the country according to modes of irrigation[10] (1000 ha)

Year	Value			Source
	Surface irrigation	Sprinkler	Localized irrigation (drop by drop	
1990	3.2	3.82	0.01	Statistical Yearbook of Yugoslavia 1991

Table 9: Total surfaces Irrigated in the country according to all modes (1000 ha)

Year	Value	Source
1990	7.03	Statistical Yearbook of Yugoslavia
2005	Approx. 8	Midterm development Strategy of Agriculture Sector in FB&H - 2006 – 2010;

Plot irrigation efficiency - E2 (for the 1990 year (%)	**3.2 x 0.5[11] + 3.82 x 0.6 + 0.01 x 0.85 /7.03 = 55**

Theoretical efficiencies used: E surface = 0,5, E sprinkler = 0,6, E localised = 0,85.

- **Recycling Index - Industry water Efficiency**

NOTE: It was not possible to calculate Irrigation Water Efficiency according to the methodology provided by Blue Plan. Due to the reasons mentioned in the Chapters 3. and 4.2., as well as notes provided below each Table in this chapter (5).

As data on recycled water volumes are not available (they might be available in some individual industries' accountings), and gross volume consumed from just industrial processes were not available (only available is data on volumes actually delivered/invoiced) to industries, it was not possible to calculate Recycling Index for B&H.

Table 10: Volumes actually delivered (invoiced) to industry (km^3/ year)

Year	Value	Source
2006	33188	Agency for Statistic B&H

[10] Data are available only for year 1990, and not for post-war period (1995 – 2008), data include only surface irrigated through big irrigation systems managed by agriculture enterprises. They do not include surfaces irrigated by local (uncontrolled) irrigation systems. However it was estimated that such (locally) irrigated surfaces covered about 3580 ha. So the total irrigated area was more than 10 000 ha.
(Source: Framework Water management Plan B&H, 1994.).

[11] Data are relevant only for volumes of water delivered by public Water Utilities, and does not include water delivered from industries which use their own water sources, why value provided in the above table is far from the real water volumes used for industry, this value include apart from water for industry also water for construction activities, data is not available for any other year.

VI. POLICIES, STRATEGIES AND PLANS IMPLEMENTED TOWARD WATER EFFICIENCY IMPROVEMENT

1. Entity Strategies for Water Management

Bosnia and Herzegovina did not elaborate a National Strategy for improving water use efficiency, and there is no official information that elaboration of such document is planned in the near future.

However, according to the entity Water Laws, there is an obligation of each entity to elaborate their own Strategies for Water Management, which is a first step towards elaboration of River Basin Management Plans. The Strategies will determine water management policy in B&H. Objectives of the Strategies are the following:

- reducing pollution, prevention of degradation and achievement of good water status,
- improving sustainable water use,
- ensuring equitable access to water,
- fostering social and economic growth,
- ecosystem protection,
- reducing the risk from floods and other negative effects of water,
- ensuring public participation in decision making related to water,
- preventing and solving conflicts related to water protection and water use,
- fulfillments of responsibilities from international contracts which are binding for B&H.

Federation B&H has commenced the elaboration of the Strategy for Water Management in December 2007, and it will be completed by the end of 2008. Among other issues, this Strategy will, specifically, estimate the water quantities delivered to the consumers, changing trend of specific water consumption, implementation and efficiency of measures for reduction of losses, quality and quantity of water abstracted, etc. Also, this Strategy will analyze the extent of undertaken measures for improvement of agricultural production by irrigation.

According to the Inception Report of the Federal Strategy for Water Management, some of the objectives and activities for the future development of water sector, which will be further elaborated within the Strategy, are: rationalization of water consumption, bigger investments for gradual reduction of water losses, awareness raising on the significance and necessity of rational water use, etc. The Inception Report does not contain objectives in terms of percentages of future reduction of water losses, but that issue is expected to be a part of the Strategy itself.

After the elaboration of the Strategy for Water Management, FB&H will proceed with he elaboration of River Basin Management Plans, which are scheduled to be completed until 2012.

In 2006, Republic Srpska, as a step towards the Strategy for Water Management (elaboration of which has not yet commenced), has elaborated the Framework Plan for Development of Water Management in RS. Some of the basic objectives of the Framework Plan are:

- to serve as a starting point for elaboration of Strategy for Water Management, and also for Development Strategy of Republic Srpska,
- to serve as a ground for defining spatial needs for development of water infrastructure.

  The Framework Plan defines criteria, conditions and limitations for further development of water infrastructure and for the whole water sector management.

  According to the same document, current water losses in water supply systems are about 50%. One of the strategic objectives for the future development, defined in the document is "improvement of water use efficiency and rational water use". Also, in the sector of water supply, this document stipulates the following:

- increase of population covered with the public water supply system, or, depending on the settlement size, their complete coverage in the next 15 to 20 years,
- higher level of water services, without any water reductions,
- radical decrease of water losses, from the current 50% to the aimed 20%,
- reduction of specific water demand, to the level of 160 l/inh./day, and thus reduction of specific water production,
- ensuring that water systems can finance their own investments, and cover all the O&M costs.

  There is no indication of the deadlines for achieving this objective.

  Regarding irrigation, there is a general remark in the document that the development of irrigation systems in RS is very low, where only 2.4% of arable land is actually irrigated. The document, however, recognizes that the focus of the future development of irrigation systems, apart from constructing new ones, should be on improving the water productivity of irrigation. According to the document, the first priority is revitalization of the existing irrigation systems, where those systems have to have improved performances, primarily in the aspect of rationalization of water consumption. Also, new irrigation systems have to be planned in such way to ensure high water productivity. One of the identified efficiency indicators which should be used in irrigation is the unit of product related to the unit of used water ("crop per drop"). This document also defines that the future aim of RS is to be in the group of countries having up to 10% of irrigated arable land.

The Water Law and the mentioned Framework Plan do not give any specific indication of the year when the elaboration of the Strategy for Water Management RS will commence. However, the River Basin Management Plans are scheduled to be completed until 2015.

2. National environmental action plan (NEAP)

In 2003 Bosnia and Herzegovina has elaborated the National Environmental Action Plan (NEAP), goal of which was identification of a short and long-term priority actions and measures providing the basis for preparation of a long-term environmental protection strategy in accordance with the economic, political and social situation in Bosnia and Herzegovina. Eight priority areas of NEAP were established through a joint multidisciplinary approach, where one the areas is - Water resources/wastewater.

Based on the analysis of the current situation in all areas of environmental protection it was determined that the area of water resources and wastewaters represents the first priority of the NEAP. Pollution prevention and prevention of irrational and uncontrolled use of water represents a necessary measure for protection of water which is one of the most important resources of BiH.

One of the priority measures identified in NEAP for water supply is "identification and minimization of water losses in water supply systems where losses are up to 60%". This measure is set as a mid-term measure. No further specification are given on this issue.

For irrigation, NEAP defines "rehabilitation of existing and construction of new irrigation systems in adequate regions" for a med-term period, as well as "construction of multi-purpose water accumulation (reservoirs)" for irrigation purposes.

One of the key improvements for the current situation in the field of water supply and unavailability of data, which is suggested by the NEAP, is preparation of strategies, studies and models for water management, as well as introduction of water information system.

3. Mid-Term Development Strategy B&H

The Mid-Term Development Strategy B&H has been elaborated in 2003 in order to provide framework guidelines for the development of the country in numerous relevant sectors, such as: macroeconomic and fiscal framework, business environment, privatization, financial sector, labor market, the combat against corruption, foreign trade regime, public administration reform, statistics, education, social protection, health care, agriculture, forestry, water management, environment, infrastructure, energy, information technologies, mine action and industry. This Strategy applies for the period 2004-2007. The Strategy was

elaborated in a period when B&H needed development in all economic sectors, so the Action Plan of the Strategy has foreseen a large number of measures to implement, but without completed list of priorities within the sectors. This Strategy was revised in 2006 in order to update the document and to adjust the priority measures to the present situation, considering that a lot of things have changed and improved in the country since the Strategy has originally been elaborated.

Objectives of the Strategy regarding the water management issues are:

- To improve legal and institutional framework:
- to adopt relevant legislation, which implies harmonization of the Water Law with WFD (this is already accomplished by adoption of the new Water Laws),
- to set up adequate institutional organization of water sector, in accordance with WFD,
- to establish sustainable financing system in water sector.
- To improve existing infrastructure:
- to improve existing flood protection system,
- to provide sufficient water for water supply,
- to improve protection of water quality,
- to improve integrated and inter-sector planning of water resources exploitation.

  Related to water management, one of the priority measures defined in the Mid-Term Development Strategy BiH, is to "physically repair and organizationally strengthen water supply systems" which includes the following:
- ensure adequate supply of safe water to towns and cities,
- reduce the losses in water supply systems by 10% (from estimated 55% today to 45%),
- reduce the number of inhabitants not connected to water supply systems by one-third,
- improve the collection systems for water supply and sewage services, and pass regulations to legalize illegal connections and local water supply systems, to contribute to ensuring commercial sustainability of the system,
- protect existing and potential sources of potable water, including those in rural areas,
- improve and monitor quality of water used by rural populations.

The implementation of these measures should happen until 2007.

Related to agriculture, one the priorities according to the Strategy is to "improve irrigation systems" with no further details. Mid-Term Development Strategy also emphasizes the need to "provide sufficient water quantities for irrigation of arable land, thus creating conditions for intensive agricultural production".

VII. PROJECTS IMPLEMENTED AIMING AT IMPROVEMENT OF WATER DEMAND MANAGEMENT MEASURES

Different projects have been implemented in the last 10 years regarding reduction of UFW in water supply systems, introducing WDM practices, improving operational and financial state of the systems (drinking water, irrigation, industries). These projects, however, were part of some international aid but also local projects usually requested by water supply utilities or industries themselves.

1. Projects in water supply sector

1.1. USAID Program ˝Assistance to Water Utilities in B&H˝

This program is one of a series of USAID-funded programs for water utility strengthening that began in 1999. The objective of program was to strengthen the capability of water utilities in providing satisfactory water and wastewater services to their customers in a business-like manner, i.e., to become efficient and financially self-sustaining.

The first phase of this program included a detailed field diagnosis of conditions in selected ten water utilities considered as representative. Weaknesses were recognized in three aspects of their functioning: Legislative, Technical and Financial.

Second phase of program started in March 2002, under the project "Assistance to Water Utilities in B&H - Pilot Water Utilities Doboj, Orašje, Konjic, Tuzla˝, aiming at eliminate weaknesses recognized in the first phase.

Overall objective of this project was to strengthen the institutional and financial sustainability and operational efficiency of selected water utilities, to make them self-sustainable public companies and to qualify them for commercial credits from the World Bank and/or other lenders.

Project covered legal, technical and financial components and in accordance to that, the different activities and tools were implemented in order to improve water utility's management and operation.

Achieved results completely confirmed that the overall project objective was met in the areas of increasing water utilities' revenues, development of effective metering programs, full understanding and further reducing unaccounted-for-water losses, development of networks mapping and GIS, development of effective accounting and budgeting systems, establishment of more realistic tariff rates.

1.2. Training program supported by USAID - Unaccounted for water reduction and water demand management training

The objective of the training was to provide skills and knowledge to participants for development of Water Demand Management and Unaccounted for Water (UFW) Reduction Programs for their own utilities. Target for B&H water utilities was to reach a UFW level of 30%, which is believed to be reasonable and achievable for the incoming period. The training program included topics like water demand management concept, water audit procedure, organization in water utilities relevant to UFW reduction, efficient metering and methods for testing big water meters in place, leak detection methods, mapping or setting proper tariffs.

1.3. Projects on measurement, detection and reduction of leaks in water supply networks in B&H

- Flow measurement, detection and reduction of leaks in water installations in Distribution Centre "Merkur" – Konjic. Before this project, leaks in the installations were 122 m^3/day, but after measurement and leak detection activities, they reduced to 28 m^3/day, year 2006;

- Flow measurement, detection and reduction of leaks in water installations in 16 Distribution Centers of "Amko Commerce" – Sarajevo. Before this project, leaks in the installations were 144 m^3/day, but after measurement and leak detection activities, they reduced to 55 m^3/day, year 2005;
- Flow measurement, detection and reduction of leaks in water installations in companies "Mill and Bakery" – Ljubače Tuzla. Before this project, leaks in the installations were 244 m^3/day, but after measurement and leak detection activities, they reduced to 117 m^3/day, year 2004;
- Flow measurement, detection and reduction of leaks in water installations on the territory of Neum Municipality. Before the project, leaks in the installations were 1028 m^3/day, but after measurement and leak detection activities, they reduced to 517 m^3/day, year 2004;
- Flow measurement, detection and reduction of leaks within International Airport Sarajevo. Before the project, leaks in the installations were 305 m^3/day, but after measurement and leak detection activities, they reduced to 47 m^3/day, year 2004;
- Flow measurement, detection and reduction of leaks in water installations on the territory of Sokolac Municipality. Before the project, leaks in the installations were 122 m^3/day, but after measurement and leak detection activities, they reduced to 89 m^3/day, year 2004;
- Flow measurement, detection and reduction of leaks in water installations in Civil Engineering Company "Tehnograd GMT" – Tuzla. Before the project, leaks in the installations were 276 m^3/day, but after measurement and leak detection activities, they reduced to 142 m^3/day, year 2003;
- Flow measurement, detection and reduction of leaks in water installations in Civil Engineering Company "Pijace" – Tuzla. Before the project, leaks in the installations were 562 m^3/day, but after measurement and leak detection activities, they reduced to 96 m^3/day, year 2003.

2. Projects in irrigation sector

2.1. WB Small Scale Commercial Agricultural Development Project

Within the World Bank Project «Small Scale Commercial Agricultural Development Project" possibilities were analyzed for self-sustainability of irrigation system. Two pilot sites were selected, Ljubuški filed region in FBH and Trebinje filed region in RS. Project analyzed present state within the pilots, from the point of management, institutional, legal, technical and financial aspect that was relevant for irrigation system. It was estimated that present level of agricultural land use in pilots was 10-30% in Ljubuški and 30-50% in Trebinje. Water intakes were from natural streams, and rate of abstracted water quantities was unknown. Present practice regarding institutional arrangements, management, maintenance, collection rate and financing in both regions is partly implemented according to existing laws as in FBiH as in RS. Practically, those systems were mainly used and managed by individual farmers, mostly without any supervision. During the war and after, within municipalities Ljubuški and Trebinje, there were no collection of water charges from users so system stayed without any income needed for maintenance or capital investments. Based on analysis of the current condition, this study gave following recommendations related to institutional and financial arrangements, which would gradually provide self-sustainable functioning of this activity:

- Institutional proposals - Establishment of Water User Association for irrigation (WUA). These associations represent an adequate organizational form of expressing and achieving interests, but also taking over the responsibility of users of irrigation system and/or land reclamation system. Thus, and adequate and efficient management would be assured, as well as maintenance, financing and implementation of other activities necessary for self-sustainable functioning of irrigation system.
- Financial recommendations - Theoretical basis and methodology for setting the water prices has been suggested, as well as phase introduction of water prices based on suggested methodology. In the first phase (2-3 years) should be maintained the way of determining the price of water as it was before the war, i.e. fixed charge should be paid by the size of surface under irrigation system (regardless if it is currently irrigated or not) + variable part which would be paid by the quantity of delivered water. This variable part would be estimated/measured on the main water intakes, and the quantity of delivered water charged proportional to irrigated land surface. In the next phase, after the fulfillment of necessary conditions during the first phase, method of setting the water price would be

applied, based on real costs generated by users, taking into account quantities of consumed water, electricity and type of crop on the land.

3. Projects in industrial sector

Since the industrial production has been increasingly developing in the last few years, it will result in increasing of the water consumption. For that reason it is necessary to introduce timely measures that will be in accordance with IWRM (Integrated Water Resource Management) and WDM for this field. According to this, it is necessary to involve public/private partnership in sector, apply targeted subsidies/tax benefits for water-saving systems, establish depollution funds, provide awareness raising campaigns and training of managers, etc.

One of the possible measures that should be taken is introduction of cleaner production, i.e. application of BEP (best environmental practices) in industry facilities. On one hand, these measures can contribute to significant BOD5 reduction, and on the other hand, bring economic profit, i.e. savings of raw material, water and energy-generating products in these industries. Cleaner production in B&H industries is introduced into national policy and strategy as a tool for accomplishing environmentally sustainable industrial development. Its application in industrial facilities in B&H is based, by adoption of set of environmental laws in B&H (FB&H and RS, in 2003), on EU directive for integral pollution prevention and control (IPPC).

Application of cleaner production is not a usual practice in B&H industries. First activities in this field were made during 2002, through implementation of project "Capacity building of cleaner production in B&H" – EC LIFE Third Countries Program. Project was implemented by nongovernmental organization "Center for Environmentally Sustainable Development" with technical assistance of MAP regional Center for cleaner production from Barcelona, Spain and Croatian Center for cleaner production from Zagreb. Project was implemented in 9 industrial facilities in B&H where cleaner production measures were applied. It is calculated that implementing CP in industries, water savings and reduction of wastewaters varies between 24 to 81%, with average of 60%.

Another project which is currently being implemented is "Capacity Building in Integrated Pollution Prevention and Control in Bosnia and Herzegovina" (IPPC – B&H). The timeframe of this project's implementation is 2006-2008. The overall objectives of this project are:

- To minimize adverse impacts on human health and the environment as a result of industrial activity in Bosnia and Herzegovina;
- Strengthening the implementation of integrated environmental prevention and pollution control in B&H;
- Promoting the use of Best Available Techniques (BAT) in industrial sector;
- Strengthening of the implementation of Law on Environmental Protection.

Of course one of the BATs is reuse of water in industry, which is part of this project as well. Due to the fact that the project is still ongoing, results of the project are unavailable.

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