|  |  |
| --- | --- |
|  |  |

**Environmental and Social Management Plan (ESMP)**

**for**

**Irrigation System in Sub-Project Areas of Klokot – Papari and Bakšaiš in City of Bihać (Final)**

Agriculture Resilience and Competitiveness Project

(ARCP)

May 2021

**GENERAL DATA**

|  |  |  |
| --- | --- | --- |
| Consultant: | Hydro-Engineering Institute Sarajevo | OIKON Ltd., Institute for applied ecology |
| Stjepana Tomića 1 | Trg senjskih uskoka 1-2, HR-10020 |
| 71000 Sarajevo | 11000 Zagreb, Republika Hrvatska |
| Tel: + 387 33 212 466/7 | Tel: + 385 1 5507 100 |
| Fax: + 387 33 207 949 | Fax: + 385 1 5507 101 |
| E-mail: [heis@heis.ba](mailto:heis@heis.ba) | E-mail: [oikon@oikon.hr](mailto:oikon@oikon.hr) |
| Web: <https://www.heis.ba> | Web: <https://oikon.hr> |
| Experts: | Dragana Selmanagić, M.Sc.C.E.  Erna Zildžović, B.Sc. in Economy  Vukašin Balta, Ph.D. in Geology  Senida Džajić Rghei, M.Sc.C.E.  Admir Aladžuz, M.Sc. in Biology/Ecology | Božica Šorgić, Ph.D. in Chemistry  Vladimir Kušan, Ph.D. in Forestry  Nela Jantol, M.Sc. in Biology  Marta Mikulčić, M.Sc. in Biology  Ivona Žiža, M.Sc. in Agronomy  Ksenija Hocenski, M.Sc. in Biology  Matija Kressonja, M.Sc. prot. nat. et amb.  Andrea Neferanović, M.Sc. silv.  Mateo Gudić, M.Sc. in Sociology  Silvia Ilijanić Ferenčić, M.Sc. in Geology |

**CONTENTS**

1 INTRODUCTION 1

1.1 Brief Project Description 1

1.2 The Aim of the Environmental and Social Management Plan 3

2 OVERVIEW OF PERMITTING NEEDS 3

3 PROJECT DESCRIPTION 5

3.1 Project Site Description 5

3.2 Agricultural Production Background 6

3.3 Description of the Previously Used Irrigation and Drainage Systems 6

3.4 Irrigation Water Demand and Drainage Demand 6

3.5 Assessment of Water Demands for Agriculture 7

3.6 Description of New Irrigation System 13

3.6.1 Technical solution for irrigation systems and equipment 13

3.7 System Operation and Maintenance 14

4 DESCRIPTION OF THE ENVIRONMENT AND SOCIAL SETTINGS 15

4.1 Physical Environment 15

4.1.1 Climate and Precipitation 15

4.1.2 Air Quality 16

4.1.3 Geology and Hydrogeology 16

4.1.4 Land 23

4.1.5 Forest 24

4.1.6 Water resources 24

4.1.7 Biological Characteristics 27

4.1.8 Protected Areas 29

4.1.9 Waste Management 30

4.2 Socio-economic characteristics 31

4.2.1 Main socio-economic characteristics of City of Bihać 31

4.2.2 Agricultural parcels covered by irrigation system 32

5 ASSESSMENT OF ENVIRONMENTAL AND SOCIAL IMPACTS OF THE PROPOSED ACTIVITIES 33

5.1 Impacts in the design/planning phase 33

5.1.1 Impacts on the River Sub-Basin 33

5.1.2 Land acquisition, restriction on land use and involuntary resettlement 33

5.2 Impacts in the Construction Phase 34

5.2.1 Land 34

5.2.2 Forest and forest land 34

5.2.3 Water Resources 34

5.2.4 Air quality 35

5.2.5 Noise 35

5.2.6 Biological Characteristics 35

5.2.7 Protected areas and ecological network 36

5.2.8 Waste generation 36

5.2.9 Cultural heritage 36

5.2.10 Occupational health and safety 36

5.2.11 Community health and safety 36

5.2.12 COVID-19 related OHS, Labor and Community Health and Safety risks 37

5.2.13 SEA/SH risks 37

5.3 Impacts in the Operation Phase 37

5.3.1 Land 37

5.3.2 Water Resources 37

5.3.3 Pest and Weed Management 38

5.3.4 Air quality 38

5.3.5 Noise 39

5.3.6 Biological Characteristics 39

5.3.7 Impacts on protected areas and ecological network 39

5.3.8 Waste generation 39

5.3.9 Community health and safety 40

5.4 Positive Environmental and Social Impacts 40

6 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN 42

6.1 Environmental and Social Impacts Prevention/Mitigation Plan 42

6.2 Environmental and Social Monitoring Plan 53

7 PUBLIC CONSULTATION 61

7.1 Details of the public consultation for the original EMP 61

8 ANALYSIS OF CAPACITY BUILDING AND TRAINING NEEDS 62

8.1 Training needs 62

8.2 Equipment Procurement 63

9 ANNEXES 64

**LIST OF TABLES**

Table 1 WB ESSs relevant for the project 2

Table 2 Instruments Required Pursuant to the Procedures of the WB and FBiH Laws 4

Table 3 Overview of project phases (agricultural areas) by locations 5

Table 4 Water demand of corn (mm/month) 8

Table 5 Water demand of spring wheat (mm/month) 9

Table 6 Water demand of potato (mm/month) 9

Table 7 Water demand of bean (grained, tall) (mm/month) 9

Table 8 Water demand of pumpkin (mm/month) 10

Table 9 Water demand of tomato (mm/month) 10

Table 10 Water demand of pepper (mm/month) 10

Table 11 Water demand of cucumber (mm/month) 10

Table 12 Water demand of apple (mm/month) 11

Table 13 Water demand of pear (mm/month) 11

Table 14 Water demand of plum (mm/month) 11

Table 15 Water demand of cherry (mm/month) 12

Table 16 Water demand of wild cherry (mm/month) 12

Table 17 Water demand of strawberry (mm/month) 12

Table 18 Average monthly climatic parameters for the period 1967–2016 – MS Bihać 15

Table 19 Characteristic flows of the Klokot river at WS Klokot 25

Table 20 Water quality at river Una 26

Table 21 Target species and habitats of the potential Natura 2000 site BA8300059 Plješevica 30

Table 22 Plan of Measures for Prevention/Mitigation of Environmental and Social Impacts for the Sub-Project areas of Klokot and Bakšaiš in City of Bihać 43

Table 23 Environmental and Social Monitoring Plan 53

Table 24 Required equipment 63

**LIST OF FIGURES**

Figure 1 Overview of project phases in City of Bihać 6

Figure 2 The planned irrigation system in the City of Bihać 13

Figure 3 Position of agricultural areas of Garavice in the City of Bihać (alluvium of Klokot and Una rivers) 17

Figure 4 Geology of agricultural areas in City of Bihać (alluvium of Klokot and Una rivers) 18

Figure 5 Tectonic characteristics of agricultural areas in the City of Bihać (alluvium of Klokot and Una rivers) 19

Figure 6 Hydrogeological map of agricultural area in the City of Bihać (alluvium of Klokot and Una rivers) 21

Figure 7 Soil types within the scope of a sub-project in the City of Bihać (Source: Preliminary design) 23

Figure 8 Water sampling locations 26

Figure 9 Vegetation along the Klokot River (photo: Oikon Ltd.) 27

Figure 10 Abandoned agricultural land (left) and vegetation along the Klokot river bank (right) (photo: Oikon Ltd.) 28

Figure 11 The area of the planned reservoir (photo: Oikon Ltd.) 28

Figure 12 Fauna recorded during field research, gadwall (left) i geese (right) 29

**ABBREVIATIONS**

|  |  |
| --- | --- |
| ARCP | Agriculture Resilience and Competitiveness Project |
| BiH | Bosnia and Herzegovina |
| COVID-19 | Coronavirus Disease |
| FBiH | Federation of Bosnia and Herzegovina |
| EF | Ecological flow |
| EIA | Environmental Impact Assessment |
| ESF | Environmental and Social Framework |
| ESMF | Environmental and Social Management Framework |
| ESMP | Environmental and Social Management Plan |
| ESS | Environmental and Social Standards |
| EU | European Union |
| FMA | Forest Management Area |
| FMET | Federal Ministry of Environment and Tourism |
| FMU | Forest Management Unit |
| IDP | Irrigation Development Project |
| IT | Information Technology |
| LC | Local community |
| LMP | Labor Management Procedures |
| MoAWMF | Ministry of Agriculture, Water Management and Forestry |
| OHS | Occupational Health and Safety |
| PIU | Project Implementation Unit |
| PPE | Personal Protective Equipment |
| PUC | Public Utility Company |
| RAP | Resettlement Action Plan |
| RPF | Resettlement Policy Framework |
| RS | Republic of Srpska |
| SEA/SH | Sexual Exploitation and Abuse / Sexual Harassment |
| SEP | Stakeholder Engagement Plan |
| USC | Una-Sana Canton |
| WB | World Bank |
| WUA | Water User Association |

# INTRODUCTION

## Brief Project Description

The World Bank (WB) is considering to support Bosnia and Herzegovina through the Agriculture Resilience and Competitiveness Project (ARCP). The project objective is to enhance agriculture sector resilience and increase competitiveness towards EU market accession. The project covers both Entities: the Federation of Bosnia and Herzegovina (FBiH) and the Republic of Srpska (RS). The implementation of the Project in the FBiH will be managed by the Project Implementation Unit (PIU) within the Ministry of Agriculture, Water Management and Forestry (MoAWMF).

The Project has 4 components, as follows:

* **Component 1.** Enhancing public support resilience and traceability, with sub-components:
  + Sub-component 1.1 Enhancing Agriculture Information Systems;
  + Sub-component 1.2 Supporting Climate-resilient agriculture;
* **Component 2.** Improving agriculture productivity, adaptation to climate change, and enhancing linkages with markets, with sub-components:
  + Sub-component 2.1. Strengthening Value Chain and Developing Productive Partnerships;
  + Sub-component 2.2. Improving irrigation and drainage systems for climate change;
* **Component 3.** Food Quality and Safety Enhancement adaptation, with sub-components:
  + Sub-component 3.1. Food Quality and Safety Standards;
  + Sub-component 3.2. Information Technology (IT) Systems for Food Safety Enhancement;
* **Component 4.** Project Management.

Planned activities within the sub-component 2.2 include construction/rehabilitation of irrigation schemes. FBiH has four implementation ready schemes (sub-projects) prepared as part of the Irrigation Development Project (IDP). There are 15 more potential schemes to be considered for support under ARCP according to the agreed criteria for which feasibility and design studies are yet to be conducted.

Four implementation ready sub-projects related to construction/rehabilitation of irrigation systems include following locations:

* Areas of local communities Svojat and Zelenika - Municipality of Živinice;
* Areas of Žepačko field, Bistričko field, Lupoglavsko field and Radovlja - Municipality of Žepče;
* Areas of Trnova and Šehovci - Municipality of Sanski Most;
* Areas of Klokot – Papari and Bakšaiš (sub-area Kralje-Vrkašići) - Municipality of Bihać.

This Environmental and Social Management Plan (ESMP) covers environmental and social impacts attributable to the irrigation system in the sub-project areas Klokot-Papari and Bakšaiš in City of Bihać in FBiH. Preliminary design of irrigation system in sub-project areas in City of Bihać[[1]](#footnote-1) (Una-Sana Canton-USC) was the basis for development of this document.

The ESMP was originally prepared for the now closed Irrigation Development Project, in August 2019 and in line with the World Bank Operational Policies (safeguards). The ESMP is revised in May 2021 to include provisions of the World Bank Environmental and Social Framework (ESF)[[2]](#footnote-2) and to ensure alignment of the ESMP with the provisions of the relevant Environmental and Social Standards (ESSs).

Table 1 WB ESSs relevant for the project

| **ESS** | **Name** | **Relevance to the Project** |
| --- | --- | --- |
| ESS 1 | Assessment and Management of Environmental and Social Risks and Impacts | This standard guides the preparation of environmental and social instruments including those that have been prepared for the BiH ARCP Project: (i) ESMF, (ii) SEP, (iii) RPF, (iv) LMP and this ESMP. |
| ESS 2 | Labor and Working Conditions | This standard guides the creation of sound worker-management relationships. The primary labor risk are: the risk of informal work, the risks of unpaid and underpaid work, work overload, poor terms and conditions of engagement, lack of occupational health and safety measures, and denied access to social security, pension or health insurance. Labor Screening and Compliance Checklist, and Monitoring and Evaluation procedures have been developed to be included as mandatory in the tender documentation providing compliance of third parties i.e., different contractors to the ESS 2 requirements. |
| ESS 3 | Resource Efficiency and Pollution Prevention and Management | This standard sets out the requirements to address resource efficiency and pollution prevention and management throughout the project life cycle. Considering that activities for this sub-project involve construction works, the major risk is that Contractors will not be aware of best practices to avoid or minimize pollution from project activities or avoid or minimize adverse impacts on human health and the environment. This ESMP will guide contractors to implement adequate pollution prevention and management measures. |
| ESS 4 | Community Health and Safety | This standard sets out the requirements to avoid or minimize community exposure to project-related traffic and road safety risks, diseases and hazardous materials and to have in place effective measures to address emergency events. |
| ESS 5 | Land Acquisition, Restriction on Land Use and Involuntarily Resettlement | This standard guides the procedures to avoid or implement involuntary resettlement and economic displacement with least possible impacts. |
| ESS 6 | Biodiversity Conservation and Sustainable Management of Living Natural Resources | This standard sets the requirement to avoid adverse impacts on biodiversity and habitats. It recognizes that protecting and conserving biodiversity and sustainably managing living natural resources are fundamental to sustainable development. This Sub-project will not be implemented in nationally and internationally recognized natural and critical habitats, protected areas, wetlands and Ramsar sites or locally designated nature sites. This ESMP provides guidance to avoid or minimize the respective impacts on biodiversity and implement mitigation measures as appropriate. |
| ESS 8 | Cultural Heritage | Objective of this standard is to protect cultural heritage from the adverse impacts of project activities and support its preservation. |
| ESS 10 | Stakeholder Engagement and Information Disclosure | This standard guides the inclusion of relevant stakeholders in the project lifecycle. In line with the requirements of this ESS, a Stakeholder Engagement Plan including a Grievance Redress Mechanism has been developed for this Project. The main risk is associated with appropriate implementation of SEP. |

## The Aim of the Environmental and Social Management Plan

The aim of the ESMP is to:

* Analyze the current legal framework relevant to the irrigation and drainage systems construction and rehabilitation projects;
* Analyze available data on the baseline state of social, physical and biological environment;
* Identify potential negative and positive environmental and social impacts of the project and propose mitigation measures,
* Propose a program of environmental and social monitoring.

# OVERVIEW OF PERMITTING NEEDS

After initial examination of the situation of irrigation development subprojects (screening) by the World Bank, it was concluded that any significant adverse effects were not expected and thus were originally classified as Category 'B' based on the operational policies on environmental assessment (OP 4.01). Under the ESF, this subproject is screened as that of Moderate risk, requiring preparation of an Environmental and Social Management Plan (ESMP).

A brief overview of the permitting requirements for the Sub-Project in City of Bihać is given below. A detailed review of the legal framework of environmental impacts assessments in Bosnia and Herzegovina is provided in the Environmental and Social Management Framework (ESMF) for the "Agriculture Resilience and Competitiveness Project in Bosnia and Herzegovina (ARCP)". This document provides a detailed analysis of the compliance of the Project activities with the provisions of the law regulating the protection of environment in Bosnia and Herzegovina, as well as the requirements of the World Bank Environmental and Social Framework (ESF).

Pursuant to the requirements of the Regulations of Plants and Facilities Requiring Environmental Impact Assessment and Plants and Facilities Allowed to Be Constructed and Commissioned Only after the Provision of the Environmental Permit („Official Gazette of FBiH“, No. 19/04), as well as Regulation on structures and interventions of importance for USC and structures, activities and interventions that can significantly affect the environment, life and human health, for which location information or urban approval is issued by the Ministry of Construction, Spatial Planning and Environment of USC („Official Gazette of Una-Sana Canton (USC)“, No. 3/16), projects related to the construction/reconstruction of irrigation systems are not subject to environmental impact assessment, or the environmental permit procedure.

Pursuant to the Law on Waters („Official Gazette of FBiH“, No. 70/06), irrigation and drainage development projects are subject to the water acts procedure which, in this case, is the responsibility of the Sava Basin Water Agency. The procedure of issuing water acts, and their relationship with the environmental permit, is described in detail in the Environmental and Social Management Framework.

Pursuant to federal and cantonal regulations on urban planning and construction, it is necessary for the irrigation and drainage construction project to obtain relevant construction approvals, namely Location Permit, Construction Permit and Use Permit.

Furthermore, this type of project is subject to the procedure of granting concession for the use of watercourses and water, regulated by the Law on Concessions („Official Gazette of USC“, No. 10/03, 07/09, 19/13, 9/17).

The following table summarizes all necessary instruments for the proposed **sub-project areas Klokot-Papari and Bakšaiš** in City of Bihać. It is important to emphasize that applicants for water acts, concession for exploitation of water resources and permits pursuant to the construction laws are future system users.

Table 2 Instruments Required Pursuant to the Procedures of the WB and FBiH Laws

| **Sub-Project** | **Risk Pursuant to the WB** | **Environmental Assessment Instrument** | **Instruments Pursuant to the Water Laws** | **Instruments Pursuant to the Construction Laws** |
| --- | --- | --- | --- | --- |
| Areas Klokot-Papari and Bakšaiš in City of Bihać | Moderate | Environmental and Social Management Plan | Water acts  Concession for water abstraction | Location permit Construction permit Use permit |

# PROJECT DESCRIPTION

## Project Site Description

The City of Bihać is located in the north-western part of BiH (Una-Sana Canton - USC) and covers an area of ​​900 km². It is territorially divided into 35 local communities and 59 settlements.

The geo-traffic position of the City of Bihać is extremely favourable, given that the City is located on the crossroad of the main corridors Western Europe - Mediterranean - Middle East. A number of international and main roads cross over the territory of Bihać, connecting this area with the wider environment.

The City of Bihać is located between the Plješevica and Grmeč mountains. Bihać borders with the City of Cazin and the municipalities of Bosanska Krupa, Bosanski Petrovac and Drvar, and on the Croatian side with the municipalities of Donji Lapac, Korenica and Slunj.

The relief of the City of Bihać is diverse. It is made up mostly of fields, hills and mid-mountainous land. The average altitude is 224 meters, whereas most of the territory of the City is located on terrains up to 600 m above sea level, while its smaller part is located in the mountain and hilly-mountain belt with altitudes above 900 meters.

The town of Bihać belongs to the Una River basin and drains most of the northern slopes of the Dinaric Mountain Massif in BiH and Croatia. The Una River basin up to Bihać is bordered in the east by the Sana River basin and in the west by the Kupa, Korana and Glina basins. The project area is located in two local communities (LC), namely LC Klokot (Klokot-Papari) and LC Bakšaiš (Kralje and Vrkašić).

The project area is divided into 5 project phases for the purpose of considering pedological and agro-climatic characteristics, as well as due to its specificity according to the needs for irrigation, as shown in the table below.

Table 3 Overview of project phases (agricultural areas) by locations[[3]](#footnote-3)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Project phase** | **Zone** | **Average altitude (m)** | **Local community** | **Area (ha)** |
| 1a | A | 219 | Klokot | 15.43 |
| 1b | B | 213 | Klokot | 8.70 |
| 2 | 212 | Bakšaiš | 29.05 |
| 3 | C | 211 | Klokot | 8.35 |
| 4 | **213** | Klokot | 7.11 |
| **TOTAL** | | | | **68.65** |

Total surface of the project area of Klokot-Papari and Bakšaiš is 68.65 ha (Figure 1).

|  |
| --- |
|  |
| Figure 1 Overview of project phases in City of Bihać[[4]](#footnote-4) |

The project area is located on a relatively flat surface with minor variations in altitude. This applies in particular to the area of phases 1b, 2, 3 and 4. The highest point is within phase 1a and is 223 m and the lowest is within phase 3, which is 210 m.

## Agricultural Production Background

Given the climatic conditions and the diversity of the reliefs and the quality of the land, this area has always been important for agricultural production. Agricultural land in the City of Bihać covers 27,262 ha, of which 19,773 ha is private and 7,489 ha is state land. According to statistics, the largest part of the agricultural land consists of arable land (12,287 ha), meadows (8,796 ha) and pastures (5,677 ha).

Nowadays, the number of registered businesses for agricultural, hunting and forestry activities is increasing significantly. Exports and imports of agricultural products are also on the rise.

## Description of the Previously Used Irrigation and Drainage Systems

In the sub-project areas Klokot-Papari and Bakšaiš in City of Bihać there are currently no organized irrigation or drainage systems.

## Irrigation Water Demand and Drainage Demand

According to the Preliminary Design, water abstraction for irrigation will be carried out from the watercourse Klokot through a drainage canal and bringing it to a drilled well near the watercourse. The technical solution foresees the design of a dug well of DN 1600 mm diameter made of reinforced polyester next to the Klokot watercourse, whose head will be located at the pumping station facility.

The month with the highest water deficits is July. According to the hydromodule, from the Preliminary Design, the amount of water needed for irrigation for the most critical month is q24 = 0,403 l/s/ha. Such a hydromodule implies that the system is operating non-stop (i.e. 24 h/day).

The required water quantities according to the project phases is given below:

* Project Phase 1a - Total daily water demand for the critical month and current agricultural production is 33.0 m3/day. In case of transition to the planned structure of agricultural production, water consumption will increase to 439 m3/day.
* Project Phase 1b - The required amount of water under current conditions is 232.8 m3/day while this value will increase slightly (244.5 m3/day) for future planned agricultural production.
* Project Phase 2 - At the current state of agricultural production, during the critical month (July), crops need to be provided with 404.2 m3/day. The eventual implementation of the presented agricultural production plan would almost double the water demand, which would amount to 701.7 m3/day in such conditions.
* Project Phase 3 - Current water demand for the critical month is 22.8 m3/day. In the case of fully utilizing the unused areas are introducing the new crops, vegetables and fruits, the required amount of irrigation water would be 99.0 m3/day
* Project Phase 4 - The current daily water demand in the critical month is 13.8 m3/day. In the case of planned agricultural production in the future, the required daily amount of water for the month of July would increase to 98.7 m3/day.

From the above it is evident that the required water quantities for irrigation of the current state of agricultural production is 674.6 m3/day, while the total water quantities required for irrigation of the planned crops is 1582.9 m3/day.

Water will be abstracted from the Klokot watercourse via a drainage canal in order to open a faster water route from Klokot to the well. Water will be pumped from the well into a reservoir from where it will then be discharged to the hydrants through the distribution network, through which water, from the main pressure network, will be delivered to individual users.

According to the Preliminary Design, maximum surpluses of water in the study area occur in March (114 mm). Therefore, during dimensioning of the drainage system, it is necessary to use the value of the drainage hydromodule which is qod = 0,553 l/s/ha. In the project area, the future drainage system should be dimensioned so that it can accept and discharge 3.68 mm of water per day. It is important to note that the Preliminary Design, which was the basis for the preparation of this EIA, did not provide technical solutions for the drainage system in the area in Bihać.

## Assessment of Water Demands for Agriculture

To define water needs for irrigation of agricultural crops, it is necessary to determine the total water required during the growing season, i.e. the value of evapotranspiration. Evapotranspiration is the total amount of water that is lost by evaporation and transpiration processes from a given surface over a period of time. Evaporation corresponds to the value of water lost from the surface of the soil by evaporation, while transpiration corresponds to the value of water consumed by the plant via the root system. Evapotranspiration processes are influenced by climatic conditions (air temperature, wind, relative humidity and solar radiation), slope of the terrain, soil colour, land cover, etc.

To calculate water requirements within the Preliminary Design in the sub-project area of the City of Bihać (*Consulting services for the design of irrigation system project in the sub-project area of the City of Bihać, CODE: BA-IDP-IDA50980-CQ-CS-17-I.H.2.3-1, Ipsa Institut d.o.o., Sarajevo, Eptisa BH d.o.o., Sarajevo, December 2018*) monthly climate data from the Bihać Meteorological Station, were used. The period from 1967 to 2016 was analysed. Evapotranspiration of the analysed crops (ETc) was determined from the ratio of ET0 and established crop coefficients (kc). The value of the crop coefficient (kc) has been determined depending on the development phase of the crop and the length of its duration (*Allan et al., 1998; Steduto et al., 2012; Lazzara et al., 2010*).

To obtain the specific irrigation needs for an average, dry, and wet year, from the 50 analyzed years, those monthly values that occur with a probability of occurrence of 5/10 (average year), 1/10 (dry year), and 8/10 years were selected (wet year). The beginning of each crop vegetation implied that the soil moisture level is at the field capacity (FC) level.

Depending on the soil properties, the entire project area is divided into 3 zones:

* Zone A, which includes phase 1a,
* Zone B, which includes phases 1b and 2,
* Zone C, which includes phases 3 and 4.

In Zone A (Phase 1a), which is mostly covered by vertisol and which is at a slight elevation, a constant groundwater level of 3 m was used in the AquaCrop model calculation. In the case of Zone B (Phase 1b and 2), which is covered by humofluvisol. Due to the aforementioned characteristics of this soil type, and especially the higher sand content, a variable groundwater level was used, which in the winter is only 0.5 m, and then suddenly dropped to 2.5 m in the spring. Zone C (Phases 3 and 4) covers eutrically brown soil, which has a slightly higher clay content and is slower to vary groundwater levels, which means that plants have more time to use groundwater sources in the beginning of vegetation.

Production of arable, vegetable and fruit crops is planned in the project area.

Of the arable crops, it is planned to grow corn and wheat, potatoes and beans. Below are their monthly irrigation needs during a dry, humid and average year.

Table 4 Water demand of corn (mm/month)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Zone** | **Phase** |  | **IV** | **V** | **VI** | **VII** | **VIII** | **IX** |
| A | 1a | Average | 6 | 6 | 18 | 35 | 28 | 2 |
| Dry year | 39 | 42 | 76 | 102 | 85 | 18 |
| Wet year | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 1b, 2 | Average | 4 | 6 | 19 | 37 | 26 | 1 |
| Dry year | 32 | 44 | 82 | 106 | 81 | 8 |
| Wet year | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 3, 4 | Average | 2 | 2 | 6 | 7 | 0 |  |
| Dry year | 17 | 16 | 35 | 31 | 2 |  |
| Wet year | 0 | 0 | 0 | 0 | 0 |  |

Table 5 Water demand of spring wheat (mm/month)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Zone** | **Phase** |  | **III** | **IV** | **V** | **VI** |
| A | 1a | Average | 2 | 1 | 4 | 17 |
| Dry year | 19 | 20 | 44 | 77 |
| Wet year | 0 | 0 | 0 | 0 |
| B | 1b, 2 | Average | 1 | 2 | 5 | 16 |
| Dry year | 16 | 28 | 47 | 70 |
| Wet year | 0 | 0 | 0 | 0 |
| C | 3, 4 | Average | 0 | 0 | 0 | 1 |
| Dry year | 7 | 5 | 5 | 15 |
| Wet year | 0 | 0 | 0 | 0 |

Table 6 Water demand of potato (mm/month)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Zone** | **Phase** |  | **III** | **IV** | **V** | **VI** | **VII** | **VIII** |
| A | 1a | Average | 3 | 3 | 11 | 25 | 43 | 25 |
| Dry year | 26 | 31 | 78 | 90 | 115 | 90 |
| Wet year | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 1b, 2 | Average | 2 | 3 | 12 | 27 | 44 | 24 |
| Dry year | 23 | 30 | 80 | 95 | 117 | 87 |
| Wet year | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 3, 4 | Average | 1 | 0 | 2 | 5 | 10 | 3 |
| Dry year | 14 | 4 | 25 | 14 | 39 | 10 |
| Wet year | 0 | 0 | 0 | 0 | 0 | 0 |

Table 7 Water demand of bean (grained, tall) (mm/month)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Zone** | **Phase** |  | **IV** | **V** | **VI** | **VII** | **VIII** | **IX** |
| A | 1a | Average | 6 | 5 | 21 | 42 | 26 | 2 |
| Dry year | 33 | 35 | 81 | 116 | 93 | 16 |
| Wet year | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 1b, 2 | Average | 4 | 6 | 22 | 43 | 25 | 1 |
| Dry year | 25 | 35 | 85 | 119 | 90 | 9 |
| Wet year | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 3, 4 | Average | 3 | 1 | 5 | 10 | 3 | 0 |
| Dry year | 17 | 7 | 30 | 49 | 22 | 2 |
| Wet year | 0 | 0 | 0 | 0 | 0 | 0 |

From the above tables we can conclude that the highest quantities of water are needed during the dry-summer period, during June and July, and for the zone B.

As for vegetable crops, they can be grown outdoors or in protected areas. Depending on the type of cultivation, irrigation water needs vary significantly. Pumpkin growing is planned in the open field, while tomatoes, peppers and cucumbers are planned in the protected area.

Table 8 Water demand of pumpkin (mm/month)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Zone** | **Phase** |  | **IV** | **V** | **VI** | **VII** | **VIII** | **IX** |
| A | 1a | Average | 6 | 4 | 36 | 64 | 44 | 7 |
| Dry year | 34 | 26 | 91 | 130 | 111 | 40 |
| Wet year | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 1b, 2 | Average | 5 | 4 | 36 | 64 | 40 | 3 |
| Dry year | 26 | 24 | 93 | 132 | 106 | 23 |
| Wet year | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 3, 4 | Average | 3 | 0 | 4 | 12 | 1 | 0 |
| Dry year | 18 | 2 | 16 | 50 | 8 | 1 |
| Wet year | 0 | 0 | 0 | 0 | 0 | 0 |

Table 9 Water demand of tomato (mm/month)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Zone** | **Phase** |  | **III** | **IV** | **V** | **VI** | **VII** | **VIII** | **IX** |
| A | 1a | Average | 26 | 69 | 163 | 187 | 202 | 140 | 25 |
| Dry year | 34 | 100 | 194 | 234 | 249 | 187 | 33 |
| Wet year | 18 | 42 | 117 | 150 | 161 | 113 | 17 |
| B | 1b, 2 | Average | 13 | 56 | 159 | 185 | 201 | 139 | 13 |
| Dry year | 13 | 86 | 190 | 233 | 248 | 187 | 19 |
| Wet year | 8 | 35 | 114 | 150 | 160 | 112 | 7 |
| C | 3, 4 | Average | 9 | 9 | 88 | 135 | 147 | 31 | 9 |
| Dry year | 13 | 21 | 119 | 181 | 190 | 67 | 13 |
| Wet year | 2 | 2 | 44 | 98 | 107 | 14 | 2 |

Table 10 Water demand of pepper (mm/month)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Zone** | **Phase** |  | **III** | **IV** | **V** | **VI** | **VII** | **VIII** | **IX** |
| A | 1a | Average | 34 | 63 | 157 | 183 | 200 | 151 | 33 |
| Dry year | 39 | 84 | 186 | 229 | 248 | 201 | 43 |
| Wet year | 28 | 47 | 114 | 148 | 160 | 122 | 24 |
| B | 1b, 2 | Average | 21 | 58 | 151 | 179 | 196 | 145 | 27 |
| Dry year | 25 | 79 | 180 | 224 | 244 | 195 | 38 |
| Wet year | 14 | 43 | 108 | 144 | 156 | 115 | 19 |
| C | 3, 4 | Average | 9 | 23 | 124 | 158 | 171 | 94 | 2 |
| Dry year | 12 | 43 | 152 | 203 | 218 | 144 | 6 |
| Wet year | 2 | 9 | 82 | 123 | 132 | 65 | 1 |

Table 11 Water demand of cucumber (mm/month)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Zone** | **Phase** |  | **III** | **IV** | **V** | **VI** | **VII** | **VIII** |
| A | 1a | Average | 48 | 76 | 159 | 183 | 191 | 19 |
| Dry year | 58 | 101 | 189 | 229 | 235 | 28 |
| Wet year | 36 | 58 | 116 | 148 | 153 | 14 |
| B | 1b, 2 | Average | 26 | 70 | 153 | 178 | 187 | 18 |
| Dry year | 34 | 94 | 182 | 223 | 231 | 26 |
| Wet year | 14 | 52 | 110 | 144 | 149 | 13 |
| C | 3, 4 | Average | 18 | 37 | 131 | 160 | 165 | 8 |
| Dry year | 18 | 62 | 161 | 206 | 208 | 16 |
| Wet year | 0 | 20 | 88 | 124 | 127 | 5 |

From the above tables, for vegetable crops, we can conclude that the highest amounts of water are needed during the dry-summer period, during June and July, and almost equal for the zones A and B.

Of fruit crops, there are plans to grow apple, pear, plum, sweet cherry, cherry and strawberry.

Table 12 Water demand of apple (mm/month)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Zone** | **Phase** |  | **III** | **IV** | **V** | **VI** | **VII** | **VIII** |
| A | 1a | Average | 3 | 0 | 6 | 19 | 38 | 22 |
| Dry year | 28 | 10 | 57 | 73 | 110 | 84 |
| Wet year | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 1b, 2 | Average | 2 | 1 | 5 | 16 | 36 | 13 |
| Dry year | 24 | 10 | 52 | 69 | 107 | 57 |
| Wet year | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 3, 4 | Average | 1 | 0 | 2 | 10 | 22 | 6 |
| Dry year | 15 | 5 | 25 | 40 | 51 | 22 |
| Wet year | 0 | 0 | 0 | 0 | 0 | 0 |

Table 13 Water demand of pear (mm/month)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Zone** | **Phase** |  | **III** | **IV** | **V** | **VI** | **VII** | **VIII** |
| A | 1a | Average | 2 | 2 | 7 | 19 | 32 | 2 |
| Dry year | 22 | 25 | 65 | 74 | 100 | 15 |
| Wet year | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 1b, 2 | Average | 1 | 2 | 7 | 18 | 31 | 1 |
| Dry year | 19 | 26 | 63 | 73 | 98 | 13 |
| Wet year | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 3, 4 | Average | 0 | 0 | 2 | 10 | 12 | 0 |
| Dry year | 4 | 6 | 20 | 24 | 26 | 1 |
| Wet year | 0 | 0 | 0 | 0 | 0 | 0 |

Table 14 Water demand of plum (mm/month)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Zone** | **Phase** |  | **III** | **IV** | **V** | **VI** | **VII** |
| A | 1a | Average | 1 | 2 | 7 | 18 | 22 |
| Dry year | 18 | 23 | 63 | 71 | 80 |
| Wet year | 0 | 0 | 0 | 0 | 0 |
| B | 1b, 2 | Average | 1 | 1 | 5 | 16 | 20 |
| Dry year | 15 | 20 | 55 | 66 | 77 |
| Wet year | 0 | 0 | 0 | 0 | 0 |
| C | 3, 4 | Average | 0 | 0 | 2 | 9 | 10 |
| Dry year | 5 | 6 | 12 | 26 | 36 |
| Wet year | 0 | 0 | 0 | 0 | 0 |

Table 15 Water demand of cherry (mm/month)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Zone** | **Phase** |  | **III** | **IV** | **V** | **VI** | **VII** |
| A | 1a | Average | 1 | 0 | 4 | 8 | 7 |
| Dry year | 17 | 5 | 48 | 49 | 46 |
| Wet year | 0 | 0 | 0 | 0 | 0 |
| B | 1b, 2 | Average | 0 | 0 | 2 | 4 | 4 |
| Dry year | 2 | 2 | 24 | 30 | 26 |
| Wet year | 0 | 0 | 0 | 0 | 0 |
| C | 3, 4 | Average | 0 | 0 | 1 | 2 | 2 |
| Dry year | 5 | 1 | 20 | 22 | 14 |
| Wet year | 0 | 0 | 0 | 0 | 0 |

Table 16 Water demand of wild cherry (mm/month)

| **Zone** | **Phase** |  | **IV** | **V** | **VI** |
| --- | --- | --- | --- | --- | --- |
| A | 1a | Average | 5 | 8 | 32 |
| Dry year | 33 | 41 | 85 |
| Wet year | 0 | 0 | 0 |
| B | 1b, 2 | Average | 3 | 9 | 31 |
| Dry year | 26 | 43 | 87 |
| Wet year | 0 | 0 | 0 |
| C | 3, 4 | Average | 2 | 6 | 15 |
| Dry year | 18 | 21 | 34 |
| Wet year | 0 | 0 | 0 |

Table 17 Water demand of strawberry (mm/month)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Zone** | **Phase** |  | **III** | **IV** | **V** | **VI** |
| A | 1a | Average | 29 | 30 | 95 | 101 |
| Dry year | 32 | 40 | 114 | 127 |
| Wet year | 15 | 21 | 71 | 83 |
| B | 1b, 2 | Average | 29 | 30 | 95 | 101 |
| Dry year | 32 | 40 | 114 | 127 |
| Wet year | 15 | 21 | 71 | 83 |
| C | 3, 4 | Average | 29 | 30 | 95 | 101 |
| Dry year | 32 | 40 | 114 | 127 |
| Wet year | 15 | 21 | 71 | 83 |

From the above tables, for fruit crops, we can conclude that the highest amounts of water are needed in the dry-summer period, during June and July, and almost the same for the zones A and B.

## Description of New Irrigation System [[5]](#footnote-5)

### Technical solution for irrigation systems and equipment

At the sub-project location, the designed solution for irrigation of the Klokot and Bakšaiš (Kralje-Vrkašić) involves the abstraction of water from the Klokot watercourse through a drainage canal in order to open a faster water path from the Klokot river to the bored well (Figure 2).

Alongside the Klokot watercourse, outside the water body, a dug well of DN 1600 mm diameter is designed, the head of which will be at the pump station. The well will be made of reinforced polyester with perforations through which water from the drainage layer connected to the watercourse would flow into the well. An appropriate filter for treatment of the abstracted water will also be located in the pumping station facility. This filter has the role of filtering sand and other substances in the irrigation water that has been abstracted.

Through the designed solutions, it is planned to secure the banks of the Klokot river bank with large pieces of rubble stone. The facility of the pumping station (well house) will accommodate electrical cabinets (power cabinet and automation cabinet), well head with lid, as well as a crane for mounting and dismantling pumps with fittings.

The elevation of the plateau, where the pumping station will be placed, has been raised by 0.50 m (cantered at 216 m above sea level) in relation to the 1/100 years water level of the Klokot river. After the filter, the pressure pipeline pushes the water into the planned reservoir located at an elevation of 293 m above sea level. The volume of the reservoir is 500 m3, made of steel sheets with a rubberized filling placed on the inside and holding water.

The pressure pipeline from the pumping station to the reservoir is L=1,424.18 m long, profile DN160/130.80 for working pressure of NP16 bars, and wall thickness of 14.60 mm.

The main distribution pipeline from the reservoir to the end point in the network is L=2,722.33 m of profile DN225/198,20 for working pressure of NP10 bars, and wall thickness of 13.40 mm.

|  |
| --- |
|  |
| Figure 2 The planned irrigation system in the City of Bihać[[6]](#footnote-6) |

An appropriate number of hydrants are distributed along the route, at distances of 80-100 m. The hydrants are located along the main pipeline or at the ends of the distribution pipelines. Hydrants with two outlets are planned, to which flexible hoses can be connected so that the reach of the hydrant can be extended to a longer length. The hydrants are intended to be in the manhole, which is 30 cm from the ground, and the exit from the hydrant is 50 cm above the ground. In the manhole, in addition to the fittings, it is envisaged to put cobblestone of medium granulation-drainage, so that the water that leaks from the hydrant and flows past the lid will be drained into the terrain.

Hoses are connected to the hydrants and diameter of the hose depends on the output of the hydrant. The distribution pipeline is planned to cover the entire irrigation area.

The location of the reservoir is above the local road, with a micro-location suitable for the construction of an above-ground type reservoir with a capacity of 500 m3. An open reservoir is planned. It is necessary to plan the construction of the access road to the micro-location of the reservoir, which could allow the motor vehicle to access it.

The well pump is designed so that the required flow is provided by two working pumps, so that during periods when there is no irrigation, control and eventual repair of the pumps can be done (Q=9,165 l/s; Hman=110,00 m). No spare pump is provided. The pumps in the well will be additionally protected with a control valve. The planned concept with the pumping station (well house) is that the equipment will not be exposed to the effects of rain, snow and high summer temperatures.

During the preparation of the project documentation, due to compliance with the regulatory plan, there was a decrease in the total area to be irrigated. Of the originally planned area of ​​86.6 ha, 68.65 ha will ultimately be irrigated.

## System Operation and Maintenance

The project foresees that future users, owners of irrigation fields, will form the so-called Water Users Association (WUA) to be responsible for the use and maintenance of the system. It is expected that WUA will be able to manage the system. Initially, they will need adequate assistance in managing and maintaining the system which is expected to be provided by a local utility company. All costs of use and maintenance will be borne by WUA members. Sub-component 2.2 of the ARCP Project envisages strengthening the capacity of the WUA related to operation and maintenance of the irrigation system.

# DESCRIPTION OF THE ENVIRONMENT AND SOCIAL SETTINGS

## Physical Environment

### Climate and Precipitation

The climatic data required for the analysis of agro-climatic conditions, the calculation of the general water balance of the soil, the determination of hydromodules of drainage and irrigation, and the determination of specific needs of agricultural crops for irrigation, were taken from the Federal Hydro-Meteorological Institute, Sarajevo. In terms of climate, the project area is covered by the meteorological station (MS) Bihać (246 m above sea level) from which all the necessary climate data were taken, for a period of 50 years (1967 - 2016).

This station is only 3.41 km away from the centre of the project area, and is also located at a similar altitude. MS Bihać continuously, for many years, monitors all necessary climatic parameters, i.e.: maximum and minimum air temperature (°C), relative humidity (%), air pressure (mbar), cloudiness (%), wind speed (m/s) , insolation (h) and precipitation (mm).

Bihac generally has a moderate-continental and moderate-mountainous climate. Summers are very warm and dry, with occasional short or long showers, and winters cold with heavy precipitation, mostly rain. During the calendar year, about 80 days have a temperature below zero. Frost occurs from October to April, and snow from November to April.

The average annual air temperature is 11.1 °C. January is the coldest month, with an average monthly air temperature of 1.3 °C, while July is the warmest, with an average monthly air temperature of 20.8 °C (Table 18).

Table 18 Average monthly climatic parameters for the period 1967–2016 – MS Bihać

| **Climatic parameter** | Average monthly (°C) | | | | | | | | | | | | Annual | Veg. |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII |
| Mean air temp. (°C) | 1.3 | 2.6 | 6.6 | 10.9 | 15.7 | 19.0 | 20.8 | 20.1 | 15.9 | 11.4 | 6.7 | 2.2 | 11.1 | 17.1 |
| Max. air temp. (°C) | 4.9 | 6.7 | 11.9 | 16.6 | 21.7 | 25.1 | 27.6 | 27.1 | 22.4 | 16.9 | 11.0 | 5.8 | 16.5 | 23.4 |
| Min. air temp. (°C) | -2.4 | -1.4 | 1.9 | 5.4 | 9.5 | 12.7 | 14.1 | 13.7 | 10.5 | 6.8 | 2.9 | -1.2 | 6.0 | 11.0 |
| Precipitation (mm) | 96 | 100 | 100 | 112 | 116 | 107 | 97 | 100 | 134 | 123 | 141 | 116 | 1341 | 664 |
| Relative humidity(%) | 79 | 76 | 69 | 67 | 68 | 70 | 69 | 72 | 77 | 78 | 78 | 80 | 74 | 71 |
| Wind speed (m/s) | 1.8 | 1.8 | 1.9 | 1.9 | 1.7 | 1.6 | 1.4 | 1.3 | 1.4 | 1.5 | 1.8 | 1.7 | 1.6 | 1.5 |
| Insulation (h) | 2.0 | 3.0 | 4.4 | 5.4 | 7.0 | 7.9 | 9.1 | 7.9 | 5.7 | 3.8 | 2.6 | 1.8 | 5.0 | 7.2 |

Precipitation in the area of Bihać, compared to the central or eastern part of Bosnia and Herzegovina, is relatively abundant. They are also characterized by a very uniform annual schedule, which indicates favourable agro-climatic conditions. On average, the biggest amount of precipitation occurs in November (141 mm) and the least in January (96 mm). Annual precipitation is 1341 mm, of which 49.51% falls during the growing season (April - September). It should be noted that there is no arid month throughout the year, that is, in almost all months the average precipitation exceeds the 100 mm threshold.

The average annual relative humidity is 74%. The average duration of insulation is 5.0 h/day and the sunniest month is July with 9.1 h of sunlight per day. The average annual wind speed is 1.6 m/s.

### Air Quality

In the area of ​​the City of Bihać, as well as at the location of the sub-project, there are no exact data on air quality, since there is still no monitoring of air quality. The main pressures on the state of air quality in the area of Bihać are caused by households, followed by the existing industrial plants, landfills and certain processes in agriculture and forestry. Considering that in the Bihać area most households solid fuel for heating, the biggest pressure on air quality is the burning of wood, fossil fuels and other types of biomass. Combustion of large amounts of these materials releases a number of harmful substances (carbon dioxide, methane, sulfur dioxide, ammonia, non-methane volatile organic compounds, heavy metals, carbon monoxide, etc.) that negatively affect air quality. Illegal dumping sites and legal unsanitary landfill in the area of ​​the Cty of Bihać pose a great threat because of the unresolved issue of wastewaters and gases emitted into the soil and air. In addition, emissions of organic and inorganic pollutants from waste also have a detrimental effect on the soil, air, and flora and fauna in these areas.

As for the pressures caused by agricultural activities, this primarily refers to emissions of greenhouse gases and other pollutants associated with the management of organic fertilizers and the incineration of agricultural residues.

Regarding the problem of traffic in the area of the City of Bihać, it can be said that occasional air pollution probably occurs in narrower urban zones, but this pollution is not measured.

Una-Sana Canton should soon get its first station for measuring air quality, which will be installed in Bihac. Throughout the year, results will be obtained once a month, and if necessary, steps will be taken to preserve the life and health of the population. Monitoring and servicing of the station will be performed by the Federal Hydrometeorological Institute and employees of the Meteorological Station in Bihać.

### Geology and Hydrogeology

**Morphological and hydrographic characteristics**

The project location foreseen for agricultural production within the area of Bihać Municipality in the morphological sense is mostly flat area, with a maximum altitude not higher than 2.4 m.

In this sense, the exception is the slight elevation of Garavica (227.9 m), which disturbs the monotonous flatness of the described area, and thus the maximum altitude interval, approximated by a value of 15.1 m.

The research area is defined by the river Una and its tributary Klokot, which flow along their alluvial plateau. The area is contoured from the east and south by indicated watercourses, while in the north and west the contour line of agricultural areas is defined by the direction of the drainage canals that drain the wider coverage of the swamp areas Pecikovići and Vrkašić towards the Klokot and Una streams (Figure 3).

|  |
| --- |
| BihG_Navodnjav-Model |
| Figure 3 Position of agricultural areas of Garavice in the City of Bihać (alluvium of Klokot and Una rivers) |

Hydrography of research area is predominantly represented by the river Una and its tributary Klokot, as the most significant watercourse in this part of the region which can provide the necessary water supply in case of possible dry periods (hydrological minimums), during the calendar year, which enables a smooth process of agricultural production on the territory of the City of Bihać.

This fact actually acts as an incentive to encourage and stimulate faster project implementation because in the hydrogeological sense (considering the good water permeability of the alluvium), it enables a faster flow of groundwater within the porous environment of the research area. It should also be emphasized that in the substrate of the lowest position of the alluvium, which indicate close contact with the lesser permeable Neogene (2M2), the occurrence of periodic flooding of agricultural surfaces during the occurrence of hydrological maximum is very possible.

**Geological structure of the study area**

The geological structure of the terrain of the wider study area is characterized by the extraordinary complexity of lithology as well as tectonic setting. Accordingly, the area is predominantly composed of Mesozoic and Cenozoic sediments, whose disturbance by faulty tectonics is pronounced to a considerable extent.

The litho-stratigraphic characteristics of the rock material and the tectonic composition of the area are a very significant indicator of the hydrogeological characteristics of the terrain, which, in connection with the noticeable flow of the Una River during the period of hydrological maximum, can have a significant impact in terms of raising the flood wave in the area of Bihać, which realistically has the negative impact on wells, which supply a large number of inhabitants of the area with water.

The oldest formations of the study area belong to the lower Triassic (T1) and were found south of Bihać (outside the study area).

In accordance with the above statement, it is necessary to emphasize that in the area intended for agricultural production in the zone of Bihać, the oldest registered formations are the marked Upper Cretaceous deposits (K21 + 2), which lean against the Lower Cretaceous sediments (K**13-5**). in the immediate substrate (the occurrence of the Klokot spring is recorded within these limestone formations). In general, Upper Cretaceous (K2) is more pronounced in the outlying areas of the city of Bihac, and it should be noted that Cenomanian-Turonian deposits (K**21+2**) are mainly composed of layered limestone, with occasional scud dolomites (Figure 4). The limestone are grey-brown and light grey. The thickness of the layers varies from 0.5 to 1.0 m, and the total thickness of these sediments reaches a value of 500 - 700 meters.

|  |  |
| --- | --- |
|  |  |
| Figure 4 Geology of agricultural areas in City of Bihać (alluvium of Klokot and Una rivers) | |

Middle Miocene (2M2), is especially emphasized in the area of the Bihac field, where its maximum thickness (approximately 500 m) has been recorded vertically. These sediments lie on basal conglomerates and breccias (1M2), with which they are sometimes found in lateral alternation. They are made of white and grey-yellow well-stratified limestone with intercalations of calcareous sandstone, tuffs and coal. Limestone are often alternated with calcareous marls, which gradually make the transition to clay marls. After limestone and marl deposition, clastic deposits (marls, conglomerates and breccias, clays, marl clays with layers of coal, sand and gravel) occurred in some parts of the basin.

Quaternary (Q) formations in the study area have a very large surface representation. They are represented by the Holocene (Q2) formations, which manifest themselves as products of various physic-chemical processes (tufa, talus, swamp sediments, diluvium and alluvium).

The Holocene (Q2), as already emphasized, is characterized by the presence of a spectrum of components, represented through multiple mapped lithological units. In this regard, according to the chronology within the study area, the following are particularly distinguished:

* Bar sediments (b) cover a large area around Bihać. They consist of multi-coloured clay, muddy sands and gravels, covered with humus material in the surface.
* Alluvial deposits (al) which follow the riverbeds of Una and Klokot rivers in the study area. The lithological structure of these sediments is formed by a gravelly and sandy component, and sandy clays.

**Tectonic characteristics**

The area of the City of Bihać is extremely complex in terms of tectonic definition, which is also an important segment of the hydrogeological characteristics of the terrain. In the structure of this area, solid compact rocks have a large representation, whose structural setting is characterized by predominantly ruptured deformations with the characteristics of block tectonics.

Large faults, as boundaries between individual structural blocks, generally have a Dinaric orientation, while lower zones and lower order faults have different spatial orientations. The following tectonic units were distinguished on the basis of differences in lithofacial development in the study area (Figure 5):

* Structural-facial unit "Bihacko Field - Bosanski Petrovac"
* Structural - facial unit "Mala Kapela - Lička Plješevica"

|  |  |
| --- | --- |
|  |  |
| Figure 5 Tectonic characteristics of agricultural areas in the City of Bihać (alluvium of Klokot and Una rivers) | |

*The structural - facial unit of Bihaćko Field - Bosanski Petrovac* is a tectonic lowered block between the Gata - Čekrlija - Ripač fault zone and several faults covered by tertiary sediments deposited on the stretch Izačić - Klokot - Žegar - Sokolac - Ripač.

The Cretaceous deposits at Klokot and Prišlen represent relatively smaller elevated blocks. The smaller faults at the contact of Cretaceous and Tertiary, near Izačić have a partially reverse character. Tertiary masses are generally inclined towards the central parts of the basin represented by these formations.

*The structural - facial unit of Mala Kapela - Lička Plješevica* has a complex geological structure, which is tectonically marked in the study area by the block "Trovrh - Lička Plješevica".

*The Trovrh - Lika Pljesevica tectonic block* includes the mountain massif of Gola Plješevica, built exclusively of Cretaceous sediments. It has a Dinaric orientation, and in structural view it is a synclinorium whose core contains the youngest creations of the Upper Cretaceous. In the northeast, or southwest of the synclinorium, there is a noticeable contouring of the fault zones. The northeast is represented by a regional vertical fault with development towards the Bihać field, and in parallel with it there is a large fault, the northwest-southeast direction, indicated by the toponyms Trovrh - Licko Petrovo Selo - Baljevac - Zavalje (outside the study area).

**Hydrogeological characteristics of the study area**

Hydrogeological characteristics of the research area are directly related to the geological composition and structure of the total area, i.e. its lithostratigraphic characteristics and tectonics. In this sense, the geological characteristics of this terrain primarily involve rock composition, their structure and genesis.

In accordance with these elements, the primary division of the paleogeographic-structural units was performed, as elaborated in previous considerations. In this respect, their basic division will be presented, as a basis for regional characterization of the area by hydrogeological characteristics in the research area, where more groups of aquifer sediments can be identified.

In this regard, when referring to karst aquifers, it is important to emphasize that between the fault planes there is a characteristic presence of crack structures that intersect the base rock without regular orientation, but which generally do not affect the direction of groundwater movement. The cracks are generally filled with sandy material and calcite material.

All this, as well as cavities of irregular shapes which give the character of mechanical and chemical erosion within the limestone component of the sediments in question, indicate the character of their aquifer.

In this regard, it is noted that several cavernous-crack type wells were formed in the study area, and the fact of the appearance of a large number of sinkholes in the close environment of the floodplain speaks of the character of environmental degradation, where under adverse hydrological conditions (period of increased precipitation), underground water appears on the surface.

Given the faultiness and cavernousness, and the presence of a large number of cracks that also occur as a result of the tectonic activity of the area, it can be reasonably concluded that the area represented by carbonate sediments, in hydrogeological terms, indicates an aquifer environment potentially very suitable for water supply.

The importance of water supply, when it comes to the aquifer of intergranular porosity, is also (given its established representation) of great importance.

According to the defined hydrogeological environment (referring to the presentation of geological structure and tectonic setting, as well as the results of the conducted research, according to the structure of the rock mass porosity), the classification of rocks in the study area according to the water permeability characteristics was made, and in this regard they are divided into the following groups (Figure 6):

* Rocks of intergranular porosity;
* Rocks of cavernous-cracking porosity.

According to the filtration characteristics of the rock material, the following division was made:

* Water-permeable rocks;
* Watertight rocks.

According to the hydrogeological function of the lithostratigraphic units, the division of these materials was carried out on conductors and reservoirs, as well as hydrogeological rock insulators, i.e. hydrogeological barriers.

According to the presented, and in relation to the material composition of the rock masses, the structure of the porosity, the mutual spatial position of the separated geological units and the general water permeability, the following hydrogeological environments are distinguished:

* Water permeable environment with good permeability characteristics (intergranular and cavernous- cracking);
* Low permeability to watertight environment.

|  |  |
| --- | --- |
|  |  |
| Figure 6 Hydrogeological map of agricultural area in the City of Bihać (alluvium of Klokot and Una rivers) | |

*The water permeable environment of intergranular porosity* is represented within the alluvial surface, predominantly within the Una riverbed, as well as diluvial loose covers on the steep sloping sides. By material composition, here are alluvial and terraced - reservoir deposits, predominantly gravelly-sandy composition and slope debris of dolomitic-limestone composition, with individual blocks, which "float" in debris mass. Although within the alluvial sediments there are more favourable conditions for the formation of groundwater reservoirs, due to the karst aquifer in the base, the water mainly migrates into the karst groundwater.

*The water permeable environment of cavernous- cracking porosity* is separated in the carbonate rocks of the Mesozoic and Cenozoic, which in this case implies the Upper Cretaceous limestones (K**21+2**). In these sediments, due to tectonic deformation, considerable cracking and karstification, specific surface and underground hydrography is expressed, conditioned by the complexity of the tectonic processes and the activity of the hydrochemical factor marked by the dynamics of the watercourse.

In this regard, it can be stated that the subject environment is characterized by good water permeability and transmissivity (especially at deeper levels), where it represents water-abundant areas of great distribution, which are emptied in deeply cut river valleys. According to the structure of porosity, they form reservoirs of free groundwater of broken type, along a network of cracked canals deep in the rock massif, which certainly depends on the depth and degree of karstification of the carbonate aquifer. Groundwater is most often drained at the level of the local erosion base, through hot springs of variable abundance.

Cretaceous limestones represent the basic aquifer environment, which largely empties along the perimeter of Bihać Field (Klokot).

The direction of groundwater flow, as already emphasized, is influenced by a tectonic setting with fault structures, which generally defines privileged directions of movement.

The older faults, extending northwest - southeast, predominantly serve as barriers, while the younger (transverse) faults allow underground flow to the northeast.

There are several ways of storing groundwater reserves in this area, which include:

* Cretaceous limestone-dolomite component, represented on the surface of the terrain, through which direct infiltration of atmospheric precipitation takes place;
* Underground inflow from the aquifer, mainly directed from the west and southwest.

The water-permeable environment is also distinguished in parts of the terrain, where limestone and dolomites alternate in the geological column. Generally, this environment is characterized by alteration of permeable and poorly permeable rocks where dolomites predominate, in which aquifers of variable abundance are formed.

The limestone, dolomites and breccias of the Upper Cretaceous (K**21+2**), as well as the wider limestone environment with calcareous marl of the Middle Miocene (**2**M**2**), belong to the mentioned category of rock material.

*The low permeability to watertight environment*, according to the observed environment, has a very pronounced distribution. As already pointed out, they are present within a very limited extent on the surface within the considered terrain. However, their spatial representation is much more pronounced through the vertical component of development. In this respect, these sediments, given their water permeability characteristics, represent a powerful substrate hydrogeological isolator. In this regard, the sands, sandy clays, marls and conglomerates of the Middle Miocene (**2**M**2**), in the area of ​​Bihać Field, are especially emphasized, which are designated as the preferential hydrogeological isolator of the Cretaceous aquifer environment.

**Conclusions**

Due to the pronounced tectonics in the subject area, where solid, compact rocks are strongly represented in the structure of the terrain, the structural setting is characterized by predominantly ruptured deformations, with the characteristics of block tectonics, while plicative deformations are much rarer. Large faults, as boundaries between individual structural blocks, have mostly Dinaric orientation, while lower faults and fault zones are different spatially oriented, thus enabling connection of underground flow within the catchment area.

Based on the conducted observations and defined lithofacial characteristics of the area, it is concluded that typical karst hydrography has been developed over a wider area of research. In this sense, the great tectonic deformation, cracking and karstification of rock masses, and their interconnection, have a considerable influence on the underground flow within the study area.

In this regard, besides the size of the catchment area and its morphological characteristics, the aspect of water permeability of the rock material in the study area definitely includes the problem of watering, that is, the flooding of the area in the immediate vicinity of the Una River. Here it is necessary to emphasize the need for hydrotechnical interventions (riverbed and coastal area restoration, which enables faster and better flow through the riverbed of larger volume), which reduces the slowdown, i.e. preventively provides protection of the coastal zone from floods.

Generally, a low permeability and watertight environment, which directly gravitates to the Una basin, has an unfavourable effect on the flooding of the area in its immediate environment, since during heavy rainfall (especially in conditions of higher surface area and more pronounced inclination of slopes) it provides a strong inflow of surface water, which with intense rainfall causes saturation of the alluvial plain at the lowest elevations relatively quickly, fulfilling the conditions for the overflow of water from the Una riverbed into the environment.

The good water permeability of the sediment environment is expressed through the favourable and unfavourable aspect in terms of the formation of the floodplain. In this regard, it can be said that there is a legality in the hierarchy of aquifers that affects the fluidity of the research area.

The unfavourable circumstance is expressed in the form of the immediate presence of aquifer sediments, shallowly represented cracks and cavernous porosities, which results in the appearance of springs on the surface gravitating to the Una River, causing a similar problem of flooding of the area, which is the case in low-permeability or watertight environment in the basin in question.

A favourable circumstance is expressed in terms of the presence of deep faults, which also results in a deep crackness and cavernousness of the area, which, through numerous crack systems and sinkholes, divert surface water to the underground, whose dynamism is manifested outside the floodplain of the watercourse in question.

Hypsometry and the volume representation of alluvium, as well as the pronounced presence of swamp formations within it, can also be characterized as an important segment of the strong influence on the flooding of this area. In this sense, it can be stated that besides the pronounced river meandering in the wide alluvial plain of Una (zone Klokot - Garavice - Humačke Bare), the base area is predominantly represented by sediments with lower water permeability characteristics, which significantly diminishes its ability to self-drain (drainage).

### Land

Hydromorphic soils have been developed in the sub-project area of the City of Bihać according to climatological, geological and soil characteristics. The hydromorphic soil distribution is characterized by the occurrence of permanent or occasional excessive wetting of groundwater within 1.0 m of soil depth. Thus, the impermeable horizon and excessive humidity also cause a lack of oxygen in such soils. As these soils are occasionally excessively moist or in direct contact with running or groundwater, they can be a potential source of contamination for groundwater and watercourses.

Vertisol and, to a lesser extent, eutric brown cambisolos and fluvisols in lowlands have been developed in the area of zone A, which covers phase 1a. Within zone B, comprising phases 1b and 2, eutric brown cambisols and fluvisols developed. Within zone C, consisting of phases 3 and 4, eutric brown cambisols, gleysols on fluvial deposits developed (Figure 7).

|  |
| --- |
| D:\POSAO\SUO\BIH\2019\BIHAC\pedo.tif |
| Figure 7 Soil types within the scope of a sub-project in the City of Bihać (Source: Preliminary design) |

Pursuant to the "Regulations on Uniform Methodology for the Classification of Agricultural Land into Convenience Categories" ("Official Gazette of the Federation of BiH", No. 43/11), land/soil may be suitable (P) or unsuitable (N) for intensive cultivation or cultivation of particular crops. Soil classes determine the degree of suitability, which means that P-1 is good arable land, P-2 is moderately restricted arable land, while P-3 is limited arable land. The N-1 class consists of soils that are temporarily unsuitable, while the N-2 classes are permanently unsuitable for cultivation and/or multi-use in agriculture. Given the types of land listed above, according to their production capacity, they belong mostly to suitable soils.

Also, according to the "Development Strategy of the Municipality of Bihać 2014 - 2023", it is stated that the lands in the municipality are the most represented lands of IV grade, followed by lands of III class, V class, II class, VI class, VII class, I class and finally land of VIII class.

Inspection of the digital orthophoto and the current state of the agricultural land (Zone B, Phase 2), it was determined that the areas under the current intensive agricultural production, i.e. planned, are located about 1.8 - 2.5 km air distance from the Klokot spring. The application of various plant protection products, pesticides, could have an impact on the soil as well as on the whole ecosystem if it's not properly applied since it is a karst relief.

### Forest

The area of the subproject is located in the northwestern part of Bosnia and Herzegovina, within Una-Sana Canton. In orographic terms, the Una-Sana area is characterized by diverse relief, from karst steep slopes of Plješivica in the west and the Una river canyon, hilly terrain of Grmeč mountain, to predominantly gentle terrain of Cazinska Krajina, where the project is located. Biogeographically, this area belongs to the Eurosiberian-North-American vegetation region. According to the map of the real forest vegetation of Bosnia and Herzegovina (Stefanović and Beus, 1983), forests of sessile oak and hornbeam (*Querco-Carpinetum*) predominate in the wider area of planned project.

State forests of this area are under the jurisdiction of Ministry of Agriculture, Forestry and Water Management of Una-Sana Canton and are managed by the local forest management company „Una-Sana Forests Ltd.“, headquartered in Bosanska Krupa through seven forest offices, including Forest Office Bihać. Forests of this area belong to the Forest Management Area (FMA) „Unsko“ which includes twelve Forest Management Units (FMU). Planned operation is located in the „Gata“ FMU. Total area of FMA is 69,549.6 ha, of which „Gata“ FMU occupies 2,430.5 ha.

According to the Forest Management Plan for FMA „Unsko“ (validity period 1.1.2012.-31.12.2021.), high forests cover 41 % and coppice forests 44 % of the total area. There are no high forests in the „Gata“ FMU and coppice forests cover 1,342 ha. The rest of the area is represented by the forest plantations (585 ha), shrubbery, non-productive and foul land.

Average wood stock for the whole forest management area for high coniferous forests is 79.51 m3/ha and for broadleaved forests 229.44 m3/ha. Average wood stock for coppice coniferous forests is 0,34 m3/ha and for broadleaved forests 123.02 m3/ha. Total annual increment for high coniferous forests is 1,92 m3/ha and for broadleaved forests 5.02 m2/ha. Total increment for coppice coniferous forests is not measured and for broadleaved forests is 4.45 m3/ha.

### Water resources

For proper planning of any hydro-engineering systems it is necessary to have a good knowledge of the hydrological conditions prevailing in the study area. In the case of hydromelioration systems, whether it is irrigation or the drainage of excess water, hydrological analysis need to be carried out to consider the availability of the water resources of the area, their spatial distribution and flow balance.

The basis of the hydrological network in the area of Bihać is the Una River, whose left tributary is the Klokot River, which flows through the project area.

Klokot springs near the town of Bihać near the village of the same name, at the foot of the Plješevica mountain massif, about 6 km from the town itself, and flows into the river Una downstream of Bihać. Klokot spring is one of the largest karst springs in Bosnia and Herzegovina. The minimum yield is estimated at about 3 m3/s, of which 250-280 l/s is used for the water supply of Bihać. The Klokot River catchment area is located on the territory of the City of Bihać in BiH, and on the territory of municipalities Plitvička jezera and Udbina in the Republic of Croatia. The length of the river is about 4.5 km, the average width is 18-22 m, and the depth of the surface flow is 5-7 m. It flows in the west - east direction. The average water temperature ranges from 8 to 10 degrees.

The following table shows the characteristic flows of the Klokot river at the Klokot water metering station, which is closest to the project area.[[7]](#footnote-7)

Table 19 Characteristic flows of the Klokot river at WS Klokot

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Water metering station/ Location** | **Mean water** | **Low water** | | | **EF dry part of the year** | **EF wet part of the year** | **High water** |
| Qmean | Q1/2. | Q1/10 | Q1/20 | Qmax 1/100 |
| Klokot | (m3/s) | | | | | | |
| 12.8 | 5.2 | 3.6 | 2.99 | 4.68 | 7.02 | 137 |

One of the most important factors affecting the volume of water use is quality in the physic-chemical, bacteriological and hydro-biological sense.

The classification of surface water according to quality is made on the basis of two groups of criteria:

* General, which characterize the ecological status of water;
* Specific, which include hazardous and toxic substances that enter the aquatic environment as a result of various industrial and other anthropogenic impacts and activities.

In the Water Management Plan for the Sava River Basin in the Federation of Bosnia and Herzegovina (2016 - 2021) the ecological and chemical status of the water body in the area of the Klokot watercourse in the period 2011-2013 was defined as good and the overall status based on monitoring results, for the same period, is also defined as good.[[8]](#footnote-8)

During the development of the Preliminary design, three analysis of physical-chemical and microbiological status of water from the Klokot and Una rivers were carried out. Analysis have shown that the water is of good quality for irrigation, except that the water is of low temperature and that the water, before being released into the system, should be heated to the required temperature so that the planned crops do not experience shock.

|  |
| --- |
|  |
| Figure 8 Water sampling locations |

Results of the analysis of physical-chemical and microbiological parameters of water quality at selected locations at rivers Una and Klokot are presented in tables below.

Table 20 Water quality at river Una

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameters | Unit | Una | |  | | Klokot | | |
| 07.11.2018. | 07.12.2018. | | 08.01.2019. | 07.11.2018. | 07.12.2018. | 08.01.2019. |
| Physical-chemical analysis | | | | | | | | |
| Water temperature | °C | 9,8 | 8,3 | | 6,1 | 9 | 9,1 | 8,5 |
| Turbidity | NTU unit | 0,73 | 10,9 | | 1,02 | 1,3 | 1,41 | 1,64 |
| pH value | pH unit | 7,93 | 7,9 | | 8,03 | 7,59 | 7,77 | 7,72 |
| Electrical conductivity | µScm-1 | 463 | 457 | | 451 | 426 | 477 | 424 |
| Sodium - Na | mg/l | 2,31 | 2,1 | | 2,1 | 3,25 | 3,5 | 3,5 |
| Nitrogen | mg/l | 0,859 | 0,416 | | 3,051 | 1,194 | 4,46 | 4,4 |
| Hydrogen carbonates - HCO3 | mg/l | 276,94 | 275,72 | | 274,5 | 284,26 | 283,04 | 274,5 |
| Chlorides | mg/l | 7,1 | 5,822 | | 3,905 | 3,72 | 3,72 | 3,55 |
| Sulfates - SO4 | mg/l | 24 | 15 | | 15 | < 2,00 | 2 | 2 |
| Phosphates - PO4 | mg/l | 0,05 | 0,02 | | 0,05 | 0,07 | 0,03 | 0,08 |
| Boron - B | mg/l | 0,7 | 0,2 | | 0,2 | 0,7 | < 0,2 | < 0,2 |
| Microbiological analysis | | | | | | | | |
| Fecal coliform bacteria (Escherichia coli) | cfu/100 ml | 25,7x104 | 2,6x102 | | 5,4x103 | 13,4x103 | 2x102 | 3,4x103 |
| Fecal streptococci (Enterococcusfeacalis) | cfu/100 ml | 35,9x104 | 4,6x102 | | 1,6x103 | 11,8x103 | 2,3x102 | 5,5x102 |

### Biological Characteristics

According to the ecological and vegetation division of BiH, the area of Bihać municipality belongs to the north-western area of Bosnia and Herzegovina, Federation of Bosnia and Hergecovina and administratively belongs to Una-Sana Canton. The area of the planned project biogeographically belongs to the humid oak – hornbeam forests (Querco-Carpinetum association) inhabited by communities of broom and common oak in habitats affected by groundwater. The tree layer is dominated by *Quercus robur*, *Carpinus betulus*, *Tilia tomentosa*, *Tilia cordata*, *Acer campestre*, *Fraxinus angustifolia*. The layer of shrubs is inhabited by: *Ligustrum vulgare, Euonymus europaeus, Rubus fruticosus* and *Ruscus aculeatus,* while the herbaceous plants are characterized by the species: *Anemone nemorosa, Ranunculus ficaria, Galanthus nivalis, Lathyrus vernus, Veronica chamaedrys, Euphorbia amygdaloides, Polygonatum multiflorum, Brachypodium silvaticum, Sanicula europea, Carex sylvatica, Mycelis muralis, Maianthemum bifolium* ect. (Habitat Interpretation Sheets Natura 2000 habitat types occurring along the Sava River (2008-2009) as part of ''Protection of Biodiversity of the Sava River Basin Floodplains'' project).

The area is dominated by active farmland and abandoned agricultural areas where shrubby terrestrial flora grows. Ruderal species such as blackberry (*Rubus* sp.), netle (*Urtica* sp.) and shrubby (*Ailanthus* sp.), common dogwood (*Cornus sanguinea)*, willow (*Salix sp*.) and hop (*Humulus lupulus*) grow along the river Klokot (Figure 9 and Figure 10).

There is a meadow in the area of the planned reservoirs and wooded area on the slopes of the hill with oak sessile (Quercus petraea) and hornbeam (Carpinus betulus) (Figure 11).

|  |  |  |
| --- | --- | --- |
| A close up of a tree  Description automatically generated | | |
| Figure 9 Vegetation along the Klokot River (photo: Oikon Ltd.) | | |
| A tree on a dirt road  Description automatically generated | A close up of a tree  Description automatically generated | |
| Figure 10 Abandoned agricultural land (left) and vegetation along the Klokot river bank (right) (photo: Oikon Ltd.) | | |
| A small house in the background  Description automatically generated | | A tree in a forest  Description automatically generated |
| Figure 11 The area of the planned reservoir (photo: Oikon Ltd.) | | |

Since the area of the planned project is largely within the agricultural area, there can be found common species of small mammals: forest mouse (Apodemus silvaticus), down (Glis glis), rat (Rattus rattus), rabbit (Lepus europaeus) and mole (Talpa europaea). From large mammals we can expect: wild boar (Sus scrofa), roe deer (Capreolus capreolus), fox (Vulpes vulpes), badger (Meles meles), eagle (Canis aureus) and wolf (Canis lupus), which according to the FbiH Red List belongs to the category endangered taxa (EN). On the bank the river Klokot, the presence of an aquatic mammal, Eurasian otter (*Lutra lutra*) was also expected, which was also proclaimed endangered to the FBiH Red List of fauna, while the beaver (*Castor fiber)* was declared a regionally extinct species (EW).

Because of the proximity of the rivers Klokot and Una and the presence of neglected cultivated areas, many species of birds can be expected here, such as birds from the groups: Passeriformes, Ciconiiformes, Galliformes, Falconiformes and Accipitriformes. The most populated species of birds are: common magpie (*Pica pica*), domestic pigeon (*Columba livia*), hooded crow (Corvus cornix), common raven (*Corvus corax*), house sparrow (*Passer domesticus*), jay (*Garulus glandarius),* blackbird (*Turdus merula*), gadwall (*Anser strepera*) and common buzzard (*Buteo buteo*) (Figure 12).

In the wider area along the rivers Klokot and Una there can be expected some amphibian species like frogs and newts, while from the reptile species, snakes and turtles. Because of the presence of mixed habitat types in the wider area, there can occur a large number of invertebrates, mainly insect (Insecta), spiders (Arachnida) and snail (Gastropoda).

|  |  |
| --- | --- |
| A flock of seagulls standing next to a body of water  Description automatically generated | A close up of a tree  Description automatically generated |
| Figure 12 Fauna recorded during field research, gadwall (left) i geese (right) | |

Some of the characteristic fish species in the waters of Una-Sana Canton are: brown trout (*Salmo trutta*), Danube salmon (*Hucho hucho*), rainbow trout (*Oncorhynchus mykiss*), grayling (*Thymallus thymallus*), chub (*Leuciscus cephalus*), common nase (*Chondrostoma nasus*), sunbleak (*Leucaspius delineatus*), gobbler (*Alburnodeis bipunctatus*), barbel (*Barbus barbus*), carp (*Gobio obtusirostris*), funnel (*Tinca tinca*), common carp (*Cyprinus carpio*), silver carp (*Carassius gibelio*), pike (*Esox lucius*), bullhead (*Cottus gobio*) (Una-Sana Canton Environmental Plan 2014 - 2019, Ministry of Construction, Physical Planning and Environment of Una-Sana Canton). According to the FBiH Red List of Fauna, Danube salmon (Hucho hucho) has the status of endangered taxa (EN), while the sunbleak (Leucaspius delineatus) has the status of sensitive taxa (VU).

### Protected Areas

In the wider project area (up to 2 km), there are no protected areas by the Environmental Protection Act of Bosnia and Herzegovina Federation („Official Gazette of BiH“, no. 66/13).

The sub-project area is about 15 km distant from the National Park Plitvice in the Republic of Croatia and about 20 km distant from the National Park Una in BiH.

#### Ecological network

According to the Environmental Protection Act of Bosnia and Herzegovina Federation („Official Gazette of BiH“, no. 66/13) there will establish a European ecological network of protected areas called Natura 2000 in the Federation of Bosnia and Herzegovina.

The network will include specially protected areas according to the Council Directive 92/43/EEC of the conservation of natural habitats and of wild fauna and flora and Council Directive 79/409/EEC; 2009/147/EC and it will comprise areas that will enable the survival of target species of natural habitats, wild animal and plant species.

Natura 2000 areas have not yet been declared in Bosnia and Herzegovina.

The area of the planned project is not within the proposed Natura 2000, but at a distance of 100 m from the area of the planned reservoir there is the area BA8300059 Plješevica. The target species of the area are listed in Table 22.

Table 21 Target species and habitats of the potential Natura 2000 site BA8300059 Plješevica

|  |
| --- |
| Target species |
| *Aegolius funereus* |
| *Aquila chrysaetos* |
| *Aquilegia kitaibelii* |
| *Bonasa bonasia* |
| *Bubo bubo* |
| *Cottus gobio* |
| *Canis lupus* |
| *Dendrocopos leucotos* |
| *Dryocopus martius* |
| *Eudontomyzon vladykovi* |
| *Hucho hucho* |
| *Lanius collurio* |
| *Lynx lynx* |
| *Ursus arctos* |
| *Rhodeus amaurus* |
| *Tetrao urogallus* |
| Target habitats |
| 8210 Calcareous rocky slopes with chasmophytic vegetation |
| 6170 Alpine and subalpine calcareous grasslands |
| 3270 Rivers with muddy banks with *Chenopodion rubri* p.p. and *Bidention* p.p. vegetation |
| 4060 Alpine and Boreal heaths |
| 6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels |
| 6510 Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis) |
| 6520 Mountain hay meadows |
| 4080 Sub-Arctic *Salix* spp scrub |
| 5130 Juniperus communis formations on heaths or calcareous grasslands |
| 91K0 Illyrian Fagus sylvatica forests (Aremonio-Fagion) |
| 91L0 Illyrian oak-hornbeam forests (Erythronio-carpinion) |
| 91R0 Dinaric dolomite Scots pine forests (Genisto januensis-Pinetum) |
| 8310 Caves not open to the public |
| 9140 Medio-European subalpine beech woods with Acer and Rumex arifolius |
| \*9180 Tilio-Acerion forests of slopes, screes and ravines |
| \*91E0 Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) |
|  |

### Waste Management[[9]](#footnote-9)

In the City of Bihać, the public utility company in charge of solid waste management is Public Utility Company (PUC) "Komrad". About 98% of the territory of the City of Bihać is covered with waste management services. The urban area of Bihać is covered by daily waste collection and transport, while other local communities are covered by weekly waste collection and transport, which has been satisfactory so far. Waste from the area of the City of Bihać is disposed of at the unsanitary landfill Gorjevac-Kruškovača. The location of the landfill is located on the left side of the main road Bihać - Bosanski Petrovac, some 15 km away from Bihać.

The landfill is located on an area of 15,000 m2, and the area where waste is currently disposed of is approximately 5,000 m2. About 65,800 m3 of waste is disposed of at the landfill annually. The main characteristic of the existing waste disposal at the Gorjevac-Kruškovača landfill is a partially controlled disposal procedure, without the usual sanitary disposal technology.

Municipal waste from households is disposed of at this landfill, while metal waste and old tires are separated. Municipal waste also includes industrial waste, although it often contains substances that qualify as hazardous waste, which would require special treatment outside the existing landfill. Slaughterhouse waste and dead animals are disposed of in previously excavated pits, and then sprayed with chlorine and quicklime, and backfilled with excavated material. The amount of slaughterhouse waste is very small.

Since there is no separate collection of waste at the source, most of the industrial and health care waste ends up in municipal waste. Hazardous waste, such as waste oils industrial plant engines, is mostly temporarily stored in the factory area, until it is taken over by authorized operators for these types of waste. One part of the chemical waste is stored within the institutions/facilities until the final disposal, while part of this waste, as well as detergents, are simply discharged into the sewerage. Medical hazardous waste (pathological waste, infectious waste, medical waste, chemicals and sharp objects) from the hospital is incinerated. One part of the medical waste ends up in municipal waste collection containers and poses a great danger to health and the environment. Injections from health institutions usually end up in containers and are disposed of in a landfill. Pharmaceutical waste (expired drugs) is returned to suppliers.

A major shortcoming in the current waste collection and disposal system is precisely the categories of hazardous waste. In addition to the mentioned medical waste, there is animal waste that is also infectious, electronic waste, tires, motor and other oils, other types of hazardous waste that are regulated by special regulations.

## Socio-economic characteristics

### Main socio-economic characteristics of City of Bihać

According to the official census data for BiH from 2013, there were a total of 56,261 inhabitants living in City of Bihać. However, in 2018, there were 56,207 inhabitants in City of Bihać[[10]](#footnote-10).

With a population density of 62.5 inhabitants/km2, City of Bihać falls in the category of rarely populated municipalities, i.e. below the average of Una-Sana Canton with 65.3 inhabitants/km2 and below the average of FBiH with 84.1 inhabitants/km2.

Most of the population lives in rural areas, i.e. 70.5% of the total population, while 29.5% live in urban areas of City of Bihać[[11]](#footnote-11).

The number of inhabitants in the settlements that belong to the project area, according to data from the Development Strategy of City of Bihać 2014-2023, was as follows: Bakšaiš 3.460 inhabitants and Klokot-Papari 1.440 inhabitants.

In economic terms, City of Bihać falls in the group of developed municipalities in Bosnia and Herzegovina. According to the statistics for 2018, there were 1,874 legal entities, 1,182 branches of legal entities, while the number of independent businesses or trades was 1,140. The largest number of registered legal entities was in the wholesale and retail, followed by other service sectors, and the manufacturing industry and construction sectors.

Out of the total area, the agricultural land occupies an area of 19,895 ha. In the structure of agricultural land the largest share is arable land 53% (10,573 ha), followed by meadows with 34% (6,680 ha), pastures 11% (2,207 ha), and orchards with 2% (435 ha). Out of the total area of arable land, only 18% is cultivated.[[12]](#footnote-12)

According to the ownership structure and size of plots, 73% of plots are privately owned and 27% are publicly owned, with the majority of plots up to 1 ha in size.

From the data on the size of the plots, it can be concluded that they are fragmented, which represents an obstacle for more intensive agricultural production. The problem of fragmented plots is present in the whole Una-Sana Canton and also in the FBiH. In the territory of Bihać, the most frequent are the lands of IV class, followed by the lands of III class, V class, II class, VI class, VII class, I class and finally the land of VIII class. For the further development of agriculture, it is necessary to put in use the land that is currently not cultivated, as well as to gradually introduce an irrigation system.[[13]](#footnote-13)

### Agricultural parcels covered by irrigation system

According to data from the Preliminary design, the project area i.e. the planned irrigation infrastructure in the City of Bihać is located in the following Cadastral Municipalities (CM): CM Kralje and CM Klokot.

According to preliminary data, the planned infrastructure for irrigation in City of Bihać will include 256 parcels in CM Kralje and 20 parcels in CM Klokot, which may be subject to some kind of expropriation. These parcels are either located in the pipeline route or in the location of system facilities. In CM Kralje ownership of 239 parcels is private and 17 parcels are public property. In CM Klokot ownership of 18 is private and 2 parcels are public property.

Acquisition of and restrictions to land use resulting from development needs of this sub-project will be guided by the Resettlement Policy Framework and compensation, rehabilitation and restoration standards transposed in the Resettlement Action Plan to be prepared.

# ASSESSMENT OF ENVIRONMENTAL AND SOCIAL IMPACTS OF THE PROPOSED ACTIVITIES

## Impacts in the design/planning phase

### Impacts on the River Sub-Basin

#### Water quantities

The input hydrological data, as well as the calculation of the ecological flow (EF) for water intake on the Klokot River are taken from the "Preliminary design - Consultancy services for the design of the irrigation system in the sub-project area of the City of Bihać". The verification and accuracy of the hydrological data retrieved has not been considered in this Environmental Management Plan. Below is the analysis of the impact of abstracted water quantity on the calculated EF.

For all project areas, the total water quantity planned to be abstracted for the future agricultural production in the area is Q= 1,583 m3/day, or 0.018 m3/s.

Ecological flow rate for the dry part of the year is QEPP = 4.68 m3/s.

From the above it can be concluded that the water quantity planned to be abstracted for irrigation will have a minor impact on endangering the EF.

#### Impact of water use for irrigation on other possibilities of water use

It is known that the Klokot spring, upstream of the project area, is used for the water supply of Bihać. The abstracted water quantity ranges from 250-280 l/s.

It is assumed that the Klokot watercourse is not used for drinking downstream of the water intake to be used for irrigation. If used, it is considered that the amount of 0.018 m3/s will not significantly endanger the ecological flow and other downstream users in the basin.

### Land acquisition, restriction on land use and involuntary resettlement

Implementation of sub-project will include expropriation of property for the construction of water intake, pumping station, water reservoir and acquisition of easement rights for the placement of irrigation pipeline.

The impacts will be limited given that only the system facilities will require permanent land acquisition. The area required for construction of these will not be major in scale. The compensation for establishment of easement rights will be in line with the entitlement matrix compliant to ESS5 as set forth in the RPF and ultimately transposed in the RAP. Physical displacement is highly unlikely, as these areas host agricultural cultivation plots. There are no settlements nor dwellings in the project area.

The livelihoods of the farmers in the sub-project area could be impacted if they are unable to farm on the land and/or do not have alternative lands for farming during the project construction phase. The impact may be temporary, lasting during the constructional phase, but could have negative impacts on livelihoods. However, given that the sub-project is being implemented for the long-term economic benefits that landowners will have in the future, it can be concluded that the benefits of the sub-project far outweigh the possible short-term losses.

## Impacts in the Construction Phase

### Land

Construction works, including the removal of the surface horizon of soil (humus), digging, as well as the presence of machinery and workers at the construction site may have a negative impact on the quality of the land/soil.

Excavation, vegetation clearance, levelling and other land preparation works and opening of access roads will expose and loosen the soil making it susceptible to erosion and subsequent loss of top soil. There is also the potential for compaction of soil from the use of heavy machinery.

Also, while the irrigation system is under construction, since construction trucks and machinery will be used, there is a possibility of leakage of fuels and lubricants.

The aforementioned effects are of temporary character, and the disrupted physiological and chemical characteristics of the soil will be restored to its original state. An impact may be significant if good construction practices are not applied in accordance with Annex 1 that will be recommended by this Plan and will be used to restore the land to the previous state.

### Forest and forest land

Impacts on forests and forest land in the construction phase are of minimal significance since for the construction of planned reservoir (with a total volume of 500 m3 ), access road and main distribution conduit, only a small part of forest edge has to be removed, and it is a coppice oak-hornbeam forest that has no significant economic value. During construction, negative impact may occur due to damage to peripheral trees, but the impact is assessed as minimal.

### Water Resources

Bearing in mind the fact that the works will be carried out in alluvial segments of the inter-granular porosity and that the water-intake structure and pump stations will be built on the riverbanks of the Klokot River, it is estimated that the construction works could adversely affect the quality of surface and groundwater, as follows:

* Increased sedimentation and erosion caused by excavation works, which will affect water quality;
* Pollution of surface and groundwater through spillage or disposal of oil and oil products, motor oil and similar waste materials derived from the equipment and vehicles on the construction site;
* Changes in the quality of surface water due to uncontrolled disposal of excavation waste in the river/water course;
* Changes in the quality of surface water due to uncontrolled disposal of solid waste in the river/water course;
* Changes in the quality of surface and groundwater due to uncontrolled discharges from the on-site toilets.

All afore mentioned impacts are temporary impacts and normal flow regimes, which support the aquatic ecosystem, will be established after completion of the construction works. This Study will propose mitigation measures to reduce adverse impacts during the construction phase and provide reinstatement.

Pollution of watercourses which may also occur as a result of improper disposal of solid and liquid waste, as well as excavation waste, will be mitigated by appropriate waste handling measures. Water quality analysis will be made mandatory prior to the start of works on profiles on Klokot River (downstream of the water-intake).

### Air quality

Air quality is not monitored in the area of the City of Bihać. According to citizens, the main sources of air pollution are the combustion of fossil fuels in combustion plants for the purposes of heating of private and industrial buildings (*Source: Local Environmental Action Plan of the Municipality of Bihać 2012-2017 (LEAP), Bihać, March 2012*).

During construction works such as construction of reservoir, drilling of well, laying of pipes for irrigation purposes, an increased concentration of pollutants in the air, primarily dust and exhaust gases from motor vehicles, can be expected. Activities that will lead to the occurrence of pollutants in the air are primarily: construction of temporary access roads, earthworks, transportation of uncovered building materials and movement of machinery and vehicles on the construction site, especially on unpaved roads. Impact on air quality is expected in the area several hundred meters away from where the work activities will take place. However, no legally permitted concentrations of air are expected to be exceeded, and thus no significant impact on the surrounding population. All impacts will occur with the location of the construction work. The impacts are temporary in nature, that is, they will cease upon completion of the works.

### Noise

Noise emissions will occur during the execution of construction works as a result of the operation of machinery and motor vehicles for the needs of the construction site, which will be most pronounced when performing works near residential buildings. Construction work will generally take place during the working hours of the day, but depending on the nature of the work, it is possible that certain activities will be performed outside the specified time frame. Therefore, daily working hours in the areas that may be most affected will be prescribed through mitigation measures. This impact is assessed as temporary and less significant.

### Biological Characteristics

#### Flora and fauna

During construction, changes and occupation of the habitat will occur due to the works of cleaning of existing and digging of new channels for the main distribution pipeline and hydrants as well as construction of wells with a pumping station. Part of the occupation of habitat will be temporary (only during the construction, after which the vegetation will be naturally restored) and part will be permanent. Permanent occupation of the habitat will occur in the area of the reservoir (total volume of 500 m3) and the access road to the reservoir. Given that the area of intervention is under anthropogenic influence dominated by abandoned and arable farmland with low biodiversity, the impact on biodiversity is not considered to be significantly negative.

The impact of above-ground reservoir on habitat occupancy is not considered to be significantly negative in relation to the forest cover area of the wider project area. The construction of wells, access roads and digging trenches for distribution pipeline on the banks of river Klokot will result in permanent removal of coastal vegetation. Due to the small project area and the existing anthropogenic impact dominated by abandoned agricultural areas with low biodiversity, this impact is not considered significant. The construction works on riverbank will result in occupancy of the habitat potentially important for endangered and sensitive fish species such as Danube salmon (*Hucho hucho*) and sunbleak (*Leucaspius delineatus*). However, due to the developed riparian vegetation around the project area, the impact is considered acceptable.

Due to the movement of mechanization and workers, the risk of new invasive foreign species of flora and fauna increases. To prevent invasive species from spreading, it is necessary to provide measures such as: cleaning machinery and vehicles before use in project area, and after construction works restore the habitat to the initial natural state. In case of a finding of an invasive species, it is necessary to try to prevent its spread and to remove it.

Emission of noise, dust, particles and gas will occur due to construction works which can disturb local fauna. These impacts are limited to the narrower area of ​​construction and are temporary, so they are considered acceptable. Effects can be alleviated by appropriate good building practices: organization of construction sites, regular maintenance of equipment, sound attenuators, etc.

### Protected areas and ecological network

The planned irrigation system is not within the protected area and the nearest protected areas are located 30 km from the project area, so it is not expected to have a negative impact on them.

The planned irrigation system is not within the area of the planned ecological network, but the planned reservoir is located 100 meters from the area of the planned ecological network Natura 2000 **BA8300059 Plješevica** and there is possible negative impact on target bird species using the meadow area for feeding (predators) in the form of harassment during construction work. However, these impacts will be short term and will be moderate impact of habitat loss.

### Waste generation

Vegetative material and excavated soils which are unsuitable for reuse for works will form the bulk of generated waste, as well as inert construction waste. Servicing and maintenance of machinery and equipment and installation works may generate waste such as scrap metal, empty lubricant containers, plastic, rubber, etc. Also, packaging materials, wrappers, used polythene bags, food wastes, used water bottles, etc. will be generated from use by construction workers.

### Cultural heritage

There are no known cultural heritage sites in the sub-project location. In the event of chance finds, the Contractor and the PIU will deal with it taking into account national legal requirements that are fully consistent with UNESCO and good international practice as well as the chance-find procedures as set in the Project’s ESMF.

### Occupational health and safety

Occupational health and safety issues associated with the proposed project construction include:

* workers exposed to toxic gases, noise, dust and vibrations;
* risk of accidents and injury from the use of machinery and equipment and materials management at the construction site, such as:
  + trip and fall hazards;
  + excavations hazards;
  + equipment falling on workers;
  + lifting of heavy structures;
  + hazards related to materials handling (e.g., lifting, struck by, crushed between, etc.);
  + welding and hot work;
  + work with electrical installation and equipment.

### Community health and safety

The major risks tied to community health and safety relates to project activities taking place outside of the construction site, but nonetheless also the project operation within the limits of the construction sites. One of the prominent risks is the traffic and road safety risks to the affected communities throughout the construction period. These risks mainly stem from increased traffic on transport routes from and to potential waste deposit areas to be used by the contractors during construction works, as well as for transportation of construction materials to the construction site.

Project communities may also be at risk from accidents from the unsecured excavations (i.e. canals).

The main distribution pipeline route and the pressure pipeline route will intersect with one of the local roads. Also, one part of the main distribution pipeline route is planned alongside of another local road. Construction works at these locations may render portions of the roads and existing foot paths inaccessible, temporarily closed or unmotorable during the constructional phase. This may create inconvenience and increase travel time to and from the affected communities.

### COVID-19 related OHS, Labor and Community Health and Safety risks

Project workers may be exposed to COVID-19 especially for some of the construction activities that require close contact of two or more workers. Considering that works are carried out outside, the risk of transmission is somewhat smaller compared to the indoor activities, but still the risk is very present if adequate prevention measures are failed to be implemented and existing protocols are not followed..

### SEA/SH risks

Taking into account the nature of the construction projects and characteristics of labor force market in BiH, it is expected that the number of female workers at the construction sites will be minimal, if any, so the risk related to SEA/SH at the construction site is low. The risk of SEA/SH to the local communities can also be considered low given the local context, and appropriate measures and awareness raising activities in place.

## Impacts in the Operation Phase

### Land

In addition to many positive effects of the irrigation system, adverse effects are possible. The main problem in the field of agriculture is the non-application of environmental protection standards in farms and the lack of a system for monitoring the use of quantities and types of pesticides and fertilizers.

According to before mentioned and the karst area, potential negative impacts on land that may occur during use are soil and groundwater pollution due to overuse of plant protection products and, consequently, disturbance in the ecological balance of the irrigated land area.

Also, soil contamination can occur by raising groundwater containing an increased amount of pollutants (heavy metals, nitrites, nitrates) due to incidents.

These undesirable consequences can be reduced or completely prevented by constant monitoring of the area and proper and constant education of farmer-users with the principles of integrated agricultural production.

### Water Resources

Erosion may result in the transport of soil sediments into the sub-project area and downstream into the Klokot river. This, coupled with the high nutrient content of the wastewater from the farms, could lead to the proliferation of weeds in the river and affect water use downstream of the sub-project area.

Other possible source of pollution of the river is the transport of agrochemicals in runoff water. Chemical products in agriculture, including phyto-pharmaceutical products, mineral and organic waste may reach surface or groundwater through transportation filtering mechanisms and surface runoff and thus affect water quality. In terms of prevention of cumulative impacts, it is necessary to apply preventive measures, which relate primarily to the on-going education of farmers about the proper methods of irrigation and drainage, good agricultural practices including integrated pest prevention measures, briefly summarized below.

Taking into account that the water from the river Klokot is used for irrigation, the Monitoring Plan will foresee regular quality analysis not only to determine the impact of the project on water quality, but also to determine the water quality to be used for irrigation in order to avoid negative impacts of such water on crops and land.

As the project area is located downstream of the Klokot spring (about 2 km) which is used for water supply of Bihać area, it is evident that this irrigation project will not affect the water quality of the Klokot spring.

There is a potential risk of water overuse in the farming practices, such as in irrigation, cleaning/washing of various materials, tools, machines, or agricultural products. The analysis of water quantities planned to be abstracted for irrigation in the sub-project area has shown that it will have a minor impact on the available water quantities in the Klokot river and no impact on endangering the ecological flow of the Klokot river, as presented in Section 5.1. Also, water abstracted for irrigation will have no impact on decreasing the level of underground water in the river Klokot alluvium. However, even so, water for irrigation should be used efficiently as possible.

### Pest and Weed Management

During the usage of the irrigation system, it is possible to introduce additional undesirable pests and weeds by forming favourable conditions (humidity) for their development. This impact can be reduced by taking proper steps of pest and weed control: correct and timely recognition, biology and life cycle knowledge, monitoring of abundance and use of biological methods wherever possible. In addition, on-going training on good agricultural practices for farmers-users is necessary, including integral pest prevention measures as required by the Integrated Pest Management Plan, which forms an integral part of the Environmental Management Framework. The main purpose of implementing the Integrated Plan is to prevent and reduce the use of pesticides while at the same time maintaining the pest population at an acceptable level. The Integrated Pest Management Plan should provide farmers with the necessary information on good agricultural practices to reduce the burden of environmental pollution caused by the excessive use of pesticides and reduce the risk to human and animal health by completely excluding pesticides from use. Since Bosnia and Herzegovina on 02.03.2010 has ratified the Stockholm Convention on Persistent Organic Pollutants whose purpose is to limit or prohibit the production, use, emission or import and export of very toxic substances known as Persistent Organic Pollutants (POPs), it is not permitted to use pesticides and industrial chemicals found on the list defined by the convention. Also, pests and weeds management should meet all the requirements set by the World Bank as well.

### Air quality

No impact on air quality is expected during the operation. Occasionally, during agricultural work, emissions from agricultural machinery that may be considered negligible will occur. By using modern machinery and fuel in accordance with the Regulation on the Conditions for Measurement and Control of Sulphur Content in Fuels (“Official Gazette FBiH”, No. 06/08), these emissions can be further reduced.

### Noise

Increased noise emissions are not expected when using the irrigation system. Increased noise levels can occur during the maintenance of irrigation systems, during the cleaning of drainage channels using machines, then using agricultural machinery and pump operation. Maintenance work on irrigation systems and drainage canals is occasionally performed and does not represent a permanent source of noise and has very little effect on increasing the noise level. The use of agricultural machinery is also sporadic and the intensity and duration of noise are limited in time. With the proper and regular maintenance of the system, agricultural machinery and the implementation of noise protection measures, no negative impact on the existing noise level is expected. Proper pump selection can avoid noise emissions during pump operation.

### Biological Characteristics

#### Impacts on flora and fauna

During the use and maintenance of the system, the risk for the spread of alien invasive species of fauna and flora in channels is increased. In case of invasion of an invasive species, try to prevent its spread and remove it.

The use of agricultural areas causes water, soil and air pollution, which directly affects habitats and species.

The agricultural impacts on freshwater ecosystems are manifested mainly through the intake of a large amount of nutrients (fertilizers that are drained into drains), which in this case reach the Klokot river and indirectly in Una river.

The negative impact of the development of intensive agriculture is also reflected in the pollution by pesticides and other chemical agents that, upon entering the aquatic ecosystem, can directly affect aquatic invertebrates, fish and amphibians and, consequently, the birds and mammals that feed on them. A direct negative impact is manifested in the reduction of animal resistance to parasites and diseases (*Christin, M.-S., Gendron, A. D., Brousseau, P., Menard, L., Marcogliese, D. J., Cyr, D., Ruby, S., Fournier, M., 2009. Effects of agricultural pesticides on the immune system of Rana pipiens and its resistance to parasitic infection. Environmental Toxicology, 22 (5): 1127-1333*).

For this reason, it is necessary to carry out water monitoring within the project area using the irrigation system for the purpose of early detection of potential eutrophication water degradation processes.

During the use of the irrigation system, some of the water will be taken in by the pumps, which will result in a reduction in the water amount downstream of the water intake or pumping stations. Water quantity is important habitat abiotic factor of aquatic fauna, especially fish, and it is necessary to ensure a minimum flow rate, ie ecological acceptable flow of 1204-1520 m3/s in order to avoid significant negative impacts on the fauna.

### Impacts on protected areas and ecological network

The planned irrigation system is not located within the protected area, and the closest protected areas are located about 30 kilometers from the catchment area and will not be adversely affected.

The planned irrigation system is not within the area of the planned Natura 2000 ecological network and will not be adversely affected.

### Waste generation

Waste to be generated during the operational phase include:

* non-hazardous waste, such as: packaging waste, wood sticks, plastic foils for shadings, metal wires, organic biodegradable waste (crop residue), livestock manure, waste from machinery such as old tires, etc.);
* hazardous waste, such as: packaging of the chemicals and biocides after the substance has been used, oils and lubricants from machinery, etc.

### Community health and safety

Irrigation projects contribute to conditions conducive to good health - food security and economic progress that allows rural households greater purchasing power for medicines and health services. However, there may also be adverse impacts on human health manifested through the development of waterborne infections (contagious diseases are mainly transmitted by mosquitoes, flies and snails that propagate in shallow coasts, aquatic weeds, spillways...) (*Dougherty TC, Hall AW , Wallingford HR Environmental Impact Assessment of Irrigation and Drainage Projects, 1995, FAO - ODA*). Contagions are mainly caused by hydraulic structures with stationary water e.g. drainage ducts, which can be prevented by their design in such a way as to allow for self-discharge. Aquatic weed cleaning is extremely important in reducing health risks for humans.

Human health impacts may also arise because of the use of pesticides that do not meet the criteria prescribed by the Bank to have a negligible negative impact on human health. Improper use of pesticides and fertilizers can lead to contamination of surface water and groundwater, which can result in drinking water contamination and thus endanger human health. Also, in the preparation and application of pesticides, in the event of inadequate user protection, poisoning may occur with pesticides, by inhalation, by skin or by ingestion. It may be acute (one-time high intake of pesticides, direct skin contact) or chronic (long-lasting and constant intake of smaller amounts of pesticides). Therefore, when using pesticides, it is necessary to use protective equipment (rubber gloves, rubber boots, protective clothing, headgear, glasses and nose and mouth mask).

## Positive Environmental and Social Impacts

The construction of the irrigation system will ensure the economic, social and environmental benefits to the land users and local communities in this area. Experiences of similar projects show that the project will have many positive impacts on the environment through the promotion of good land use practices, methods of cultivation and pest management.

Sub-project should help to strengthen local capacity in an environmentally sustainable approach to agriculture development.

Potential positive impacts on the environment through the implementation of this project include:

1. better control over the use of water resources;
2. a more rational use of water resources through improved operation and maintenance;
3. reducing the risk of water pollution from chemicals by implementation of integrated pest management plan[[14]](#footnote-14);;
4. reducing the risk of pollution of surface and groundwater by using a large number of private pumps and generators, which are currently being used without adequate control and to take measures to prevent impacts from spills of fuels and lubricants;
5. the association of water users allows them greater representation in the multi-sectoral agreements about the future of water use;
6. effective waste management through greater community participation.

In addition, the implementation of the project with the above mentioned positive environmental impacts can be expected to have positive effects on the biological characteristics of the area and, even more so, with a more rational dosage of fertilizers, pesticides and the like.

# ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

## Environmental and Social Impacts Prevention/Mitigation Plan

Environmental and Social Management Plan is prepared based on the results of the environmental and social assessment and includes measures for reduction of possible adverse impacts to be applied during the project implementation, including the estimation of costs and the responsibility for their implementation.

Mitigation measures are classified as:

* Mitigation measures during the planning phase prior to construction,
* Mitigation measures during the construction phase,
* Mitigation measures during the operation phase,
* Mitigation measures during the project removal phase.

Mitigation measures during the design and planning phase (prior to the construction works) refer to: revision of technical documentation, provision of all relevant permits, as well as planning related to the selection of water supply sources, concession, land expropriation, and the implementation method.

Mitigation measures during the construction phase mostly refer to the implementation of good construction practices to avoid adverse impacts on the soil stability, water and soil quality, air quality and the level of noise. Mitigation measures related to social impacts refer to OHS, community health and safety and restrictions to land use. Their implementation is under the responsibility of the Contractor for execution of works and shall be included in the works contract together with the Environmental and Social Monitoring Plan. The costs of these measures shall be included in the construction costs, although they mostly include good management measures and usually require no substantial funds. The Client and the appointed Site Supervisor will supervise the implementation of mitigation measures and the Monitoring Plan.

The list of good construction practices and the Waste Management Plan to be included in the works contract are given in Annex 1 and 2.

Mitigation measures during the operation phase refer to the mitigation of adverse impacts as a consequence of inadequate system operation and maintenance, and use of phyto-pharamceutical products.

Table 22 Plan of Measures for Prevention/Mitigation of Environmental and Social Impacts for the Sub-Project areas of Klokot and Bakšaiš in City of Bihać

| **Phases** | **Problem** | **Mitigation Measure** | **Costs** | | **Institutional Responsibilities** | | | **Comments** | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planning** | **Implementation** | **Planning** | **Implementation** |  | |
| Planning / Designing | Ensure harmonization of designs with relevant construction, water, environment and concessions legislation | Perform: revision of project documentation, provision of urban permit, prior water consent (for irrigation and drainage system) and concession for water use. | Part included into system design costs. | Cost estimation will be available through main design. | PIU | PIU | Obligatorily involve competent Water Agency for Sava River Watershed | |
| Planning / Designing | Negative public reactions due to the lack of information and activity coordination | Carry out public consultation with the future irrigation system users and persons affected by the project on project segments and adverse impacts mitigation plan. | - | - | PIU | PIU in cooperation with the designer | Obligatorily involve owners of the land to be irrigated which will be subject to expropriation | |
| Planning / Designing | Potential damage to the existing infrastructure and structures, especially underground installations (water and sewage pipelines, etc.), causing disruptions in the provision of services to the consumers | Precisely locate infrastructural facilities and underground installations in cooperation with competent institutions on all government levels.  Relocate the route or project solution of the irrigation system to minimize or avoid possible damage.  Arrange cooperation with communal and other service providers to undertake required joint steps in prevention of service supply interruption or provide prompt information to the public on temporary service interruption. | - | - | Designer | PIU in cooperation with the designers and competent local authority representatives | - | |
| Planning / Designing | Higher employment possibilities and generation of revenues for the local community | Qualified local population shall be given preference upon employment. | - | - | PIU | Contractor | Regulate problems through bidding documentation. | |
| Planning/  Designing | Impact on the environment and human health through infections arising in hydraulic structures with stationary water (e.g. drainage ducts). Infections are mostly transmitted by mosquitoes, flies and snails, which are propagated in shallow waters, watery weeds, and overgrowths. | Prevent the creation of a suitable environment for the development of infections by design of hydraulic structures with standing water in such a way as to enable them to be self-discharging or under certain conditions by means of appropriate pumps. | Part included into system design costs. | Cost estimation will be available through main design. | Designer | PIU in cooperation with the designer. | During next phases of project documentation development, ensure the discharge of hydraulic structures with stationary water. | |
| Planning / Designing | Reduction of flow in Klokot river | Define acceptable activities for the exploitation of water of the river Klokot.  The analysis in the design phase has already shown that the water quantities to be extracted for irrigation are determined as insignificant. | - | - | PIU, competent institutions | PIU in cooperation with the designer and competent authority representatives | It is necessary to agree on the efficient functioning of the irrigation and exploitation system of the river Klokot | |
| Planning / Designing | Energy inefficiency | The most energy efficient option of irrigation should be given highest priority. | - | - | Designer | PIU in cooperation with the designer. |  | |
| Planning / Designing | Water inefficiency | Instalment of water meters at farm plots. | -- | - | Designer | PIU in cooperation with the designer. |  | |
| Planning / Designing | Impact on private land and assets and business activities | Develop Resettlement Action Plan (RAP) in accordance with the WB ESS5.  Timely consultation and collaboration with affected parties. | - | The cost estimate will be available through the RAP. | PIU | PIU |  | |
| Planning / Designing | Disabled agricultural production | Avoid crossing over the agricultural plots, whenever possible. | - | - | Designer | PIU in cooperation with the designer. |  | |
| Planning (Designing) / Construction | Influence on cultural heritage | Create a "chance find" procedure for dealing with random archaeological finds of cultural heritage, defined as a physical cultural heritage that is unexpectedly found during the implementation of the project. Implement the Procedure during the construction work, and ensure that the appropriate staff and the Contractor are trained on the requirements of the Procedure.  The "chance find" procedures should include:   * Warning of project staff on the possibility of detecting archaeological finds of cultural heritage, * Fencing the area to prevent further disruption or destruction, * Notifying competent authorities of findings / locations. | - | Cost estimation will be available through main design. | Designer, Contractor | PIU in cooperation with the designer, contractors and competent authority representatives | The procedure is being prepared in the planning phase, i.e. prior to construction and implemented during the construction of the irrigation system | |
| Construction | Soil erosion and land sliding as a consequence of deforestation, clearing and excavation activities | Provide slope protection (through bank compaction, rip-rapping, vegetative stabilization).  Designate an earth material storage area, with topsoil set aside for re-use.  Carry out replacement planting or transplanting vegetation.  Implement Waste Management Plan presented in Annex 2. | - | - | Contractor | Contractor | Regulate through construction works contract. | |
| Construction | Contamination of soil by grease and fuel from mechanization | Monitor the operation of the mechanization and maintain it regularly. The Contractor is obliged to enclose evidence on proper operation of the vehicle in accordance with the regulations on the emission of harmful gases.  Prepare and implement the Construction Site Organisation Plan and Emergency Preparedness and Response Plan. | - | - | Contractor | Contractor |  | |
| Construction | Water and soil pollution due to poor waste disposal | Prepare a site-specific Waste Management Plan.  Short term storage in some locations.  Disposal of waste for recycling by the authorized operators.  Earth and the other inert material should be used for "landscaping".  Reusing and recycling waste wherever possible.  It is forbidden to incinerate waste in the open and on-site.  Any hazardous waste will be separated on site, adequately stored and handled to a licensed operator for its management and final disposal.  Implement Waste Management Plan presented in Annex 2. | - | - | Contractor | Contractor | Regulate through construction works contract. | |
| Construction | Water and soil pollution due to the discharge of waste sanitary waters from the construction site | Installation of ecological toilettes for workers | - | - | Contractor | Contractor | Regulate through construction works contract. | |
| Construction | Increased turbidity of surface and groundwater as a result of construction works | Same measures as for erosion control and slope stabilization.  Set up sediment traps along river and/or gabions along banks to filter out eroded sediments.  Conduct the works during dry weather.  Prepare and implement the Construction Site Management Plan.  Implement Waste Management Plan presented in Annex 2. | - | - | Contractor | Contractor | Regulate through construction works contract. | |
| Construction | Oil and grease contamination of surface and ground waters due to poor equipment maintenance and repair, and refuelling on the construction site | Avoid servicing and refuelling on the site.  In case of on-site refuelling and vehicle maintenance, use safety foils.  Provide absorbent material in case of fuel spillage.  Handle used oiled materials pursuant to the Waste Management Plan.  Prepare and implement Construction Site Management Plan and Emergency Preparedness and Response Plan including good construction practices from Annex 1, measures from Preliminary Water Approval and measures from the Waste Management Plan provided in Annex 2. | - | - | Contractor | Contractor | Regulate through construction works contract. | |
| Construction | Introduction and spreading of invasive species | All machines and other equipment need to be cleaned from sediment and vegetation.  On all machines and other equipment, check whether there are invasive species (plants, invertebrates) and if so, remove them. All contaminated machines and equipment should be washed with high pressure water (preferably with hot steam under pressure).  When it is possible it is advisable to leave machines and equipment dry for at least four weeks before being used in another watercourse. | - | - | Contractor | Contractor | Regulate through construction works contract. | |
| Construction | Disruption of vegetative cover | After the construction, the damaged area is covered with indigenous vegetation. Apply measures of good construction practice in Annex 1. | - | - | Contractor | Contractor | Regulate through construction works contract. | |
| Construction | Permanent loss of area under trees | As much as possible, avoid cutting down trees outside the area needed for water reservoir, access road, as well as pressure and distribution pipeline. Also, when performing construction work, avoid damage and destruction of trees in the edge areas with the machinery. Any removed trees will be re-planted in the vicinity of the area. |  |  | Contractor | Contractor | Regulate through construction works contract. | |
| Construction | Dust emission from earthworks and construction work. | Use paved roads for access to construction sites to the greatest extent possible.  Control the speed of the vehicle to minimize the emission of dust.  When transporting the powdered material, cover the vehicles in order to reduce the pollution of the atmosphere and the impact on biodiversity and the population.  In case of very dry weather, water the access roads and earth surfaces.  Compact deposited earth material.  Prepare and implement the Construction Site Management Plan that includes the measures of good construction practice provided in Annex 1. | - | - | Contractor | Contractor | Regulate through construction works contract. | |
| Construction | Emissions from machinery and vehicles | Regular equipment and vehicles maintenance.  Regularly inspect vehicles for compliance with the emission regulations. |  |  | Contractor | Contractor |  | |
| Construction | Noise generation from heavy equipment and vehicles | Use modern machines and vehicles that emit lower noise levels and less affect the surrounding population and fauna.  Ensure sound attenuators for heavy machines.  Plan to move equipment at a time when there are not big daily traffic jams.  Perform construction works during the day, avoid work after 17 o'clock, especially when the works take place within the settlement, near the houses.  Regularly maintain machines and vehicles. |  |  | Contractor | Contractor |  | |
| Construction | Disabled agricultural production | Construction works on farms during vegetation period will be avoided as much as possible.  Ensure that farmers already cultivating portions of the project site will be allowed to continue temporarily farming at areas of the land which will not be affected by construction.  Ensure that affected persons are adequately informed, in advance, of the scope, magnitude and schedule of the proposed project, its implications for their continued farming over the construction period. These measures will minimise the  problem of confrontation and conflicts and will reduce this impact significantly.  Ensure all grievances/concerns by farmers and local communities are resolved prior to construction work. | - | - | PIU in cooperation with the contractor | PIU in cooperation with the contractor | Regulate through construction works contract. | |
| Construction | Risk of exposure of workers to toxic gases, noise, dust and vibrations | Implement all abovementioned measures related to mitigation of toxic gases, noise, dust and vibrations.  Provide sanitary and hygiene facilities for the workers.  Prepare and implement Construction Site Organization Plan and OHS Management Plan.  Require from all workers to abide by the OHS Management Plan.  Provide workers with task‐appropriate personal protective equipment (PPE).  Ensure that workers follow procedure on obligatory use of PPE and that they have received training on OHS. | - | - | Contractor | Contractor | Regulate through construction works contract. | |
| Construction | Risk of accidents and injuries at work, such as:   * trip and fall hazards; * excavations hazards; * equipment falling on workers; * lifting of heavy structures; * hazards related to materials handling (e.g., lifting, struck by, crushed between, etc.); * welding and hot work; * work with electrical installation and equipment. | Provide warning signs along the irrigation system construction route.  Provide sanitary and hygiene facilities for the workers.  Prepare and implement Construction Site Organization Plan and OHS Management Plan.  Require from all workers to abide by the OHS Management Plan.  Provide workers with task‐appropriate personal protective equipment (PPE).  Ensure that workers follow procedure on obligatory use of PPE and that they have received training on OHS.  Ensure only qualified machine operators with skills and experience operate the machines. | - | - | Contractor | Contractor | Regulate through construction works contract. | |
| Construction | Risk of COVID-19 | Prepare and implement procedures for cases of COVID-19 outbreak.  Control entry and exit from site/workplace, rearrange work tasks or reduce number of workers on the worksite to allow social/physical distancing, provide appropriate forms of personal protective equipment (PPE). | - | - | Contractor | Contractor | Regulate through construction works contract. | |
| Construction | Increased traffic due to heavy equipment/vehicle movement/works in vicinity of local roads  Decreased public access through the construction area | Notify the public of the construction works through local media and notice boards at local communities.  Prepare and implement Traffic Management Plan.  Schedule equipment movement during lean daytime traffic hours.  Provide traffic aides/flagmen, traffic signs to help ensure the free and safe flow of traffic;  Provide an alternate route for pedestrian and vehicles in coordination with the local authorities or provide safe passageway through the construction site.  Prepare and implement Construction Site Organization Plan including good construction practices from Annex 1. | - | - | Contractor | Contractor | Regulate through construction works contract. | |
| Construction | Increased risks for the population from traffic accidents and construction works | Notify the public of the construction works through local media and notice boards at local communities.  Prepare and implement Traffic Management Plan.  Provide appropriate warning signs, lighting, protective fences, etc.  Comply with traffic rules.  Clean the construction site from construction waste both during the construction phase and after the completion of the works, when closing the construction site.  Through institutional and administrative arrangements with the municipal health centre, provide sanitary supplies and medical assistance at the construction site.  Prepare and implement Construction Site Organization Plan. | - | - | Contractor | Contractor | Regulate through construction works contract. | |
| Construction | Risk for the population from accidents from the unsecured excavations | Notify the public of the construction works through local media and notice boards at local communities.  Provide appropriate warning signs, lighting, protective fences, etc.  Prepare and implement Construction Site Organization Plan. | - | - | Contractor | Contractor | Regulate through construction works contract. | |
| Construction | Risk of SEA/SH | Develop and implement Code of Conduct which reflects the contractor’s core values and overall working culture and includes provisions relating to SEA/SH.  Implement awareness raising on SEA/SH issues. | - | - | Contractor | Contractor | Regulate through construction works contract. | |
| Construction | Indirect impact on environment by purchasing material from unlicensed companies | Use the existing quarries and concrete bases for the supply of material.  Use licenced suppliers for other materials. | - | - | Contractor | Contractor | Regulate problems through bidding documentation. | |
| Operation | Inadequate use of irrigation system | Regularly monitor work, maintain and repair system facilities. | - | - | Users | Users |  | |
| Operation | Reduction in water quantities downstream due to water use | Provide system capacity as planned. Monitor the use of water in the system.  Always provide an ecologically acceptable flow (EF). In case of insufficient amount of water to secure the EF, stop the water abstraction. | Integrated into the system designing costs. |  | PIU | PIU and System Users |  | |
| Operation | Over abstraction of  water | Precisely define crop water requirements.  Develop Irrigation System Management Plan that will provide system users with viable irrigation schedule and train water users how to use it. The Plan shall provide regular calibration and maintenance of water management devices.  Designate and appoint person(s) or land owner(s) for regular monitoring of soil quality and irrigation system assessment. | - | 5,000 BAM/year for calibration and system maintenance | PIU and Users | PIU and Users |  | |
| Operation | Noise emission from vehicles and agricultural mechanisation | Use modern machines and vehicles that emit lower noise levels and less affect the surrounding population and fauna.  Regularly maintain machines and vehicles. | - | - | Users | Users |  | |
| Operation | Increased risk of spreading foreign invasive species of fauna and flora | In the case of invasive invasion, it is necessary to try to prevent it from spreading and remove it. | - | - | Users | Users |  | |
| Operation | Impact on the environment and human health through infections emerging in hydraulic structures with stationary water (e.g. drainage ducts) and are mainly transmitted by mosquitoes, flies and snails that propagate in shallow shores, watery weeds and overgrowths. | Regular emptying of channels and performing frequent cleaning of water weeds. |  |  | PIU | PIU and Users. | In accordance with the project design for irrigation and drainage, the designer will prepare the Irrigation and Drainage Management Plan and conduct the training of system users | |
| Operation | Environmental and human health impacts due to inappropriate use of phyto-pharmaceutical products (pesticides) and natural and mineral fertilizers | Controlled application of agro-chemicals based on the Integrated Pest Management Plan as an integral part of the Environmental Management Framework.  Training of the farmers on the good agricultural practices including proper selection, dosage and timing of agro-chemical applications to ensure maximum plants and soil absorption. Use only the agro-chem allowed/ cleared by the National Institute for Plant Protection.  Use safety equipment during the use of phyto-pharmaceutical products.  Accomplish cooperation with associations of beekeepers to prevent the increased mortality of bees. | Integrated into the system designing costs. | - | PIU | PIU and System Users | The designer will prepare the Irrigation System Management Plan pursuant to the Terms of Reference for irrigation system designing and conduct the training of system users. | |
| Decommissio-ning | Adverse environmental impacts due to inadequate disposal of waste resulting from the decommissioning of the irrigation/drainage system and/or during routine maintenance.. | Adequately dispose the waste pursuant to the Waste Management Plan (Annex 2) to authorized disposal sites.  Recycle the waste susceptible to recycling. | - | 50 BAM/ton of waste | System User | Contractor | - | |

## Environmental and Social Monitoring Plan

Table 23 Environmental and Social Monitoring Plan

| Phase | Which Parameter to Monitor? | Where to Monitor? | How to Monitor  / Type of Monitoring Equipment? | When to Monitor  – Monitoring Frequency or Continuous Monitoring? | Why is Monitoring Required? | Costs | | Responsibility | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Planning | Implementa-tion | Planning | Implementa-tion |
| Planning/  Designing | Negative public reactions due to the lack of information and activity coordination | In local community | Examining the grievance/ complaints records | Upon receipt of complaints from citizens | To prevent impacts in due course | - | - | PIU | PIU |
| Planning/  Designing | The quality of surface water for irrigation (heavy metals, nitrates, nitrites, pH, electrical conductivity, temperature, chlorides, microbiological parameters, pesticides) | At the location of water intake on river Klokot | Standard laboratory equipment | During design preparation or prior to start of works | To determine the quality of water for irrigation | Integrated into the system designing costs. | - | Designer | Authorized Laboratory |
| Planning/  Designing | Analysis of physical, biological and chemical parameters of land | Determine at least three sampling profiles at a sufficient distance | Standard laboratory equipment | During design preparation or prior to start of works | To determine the quality of land for irrigation | Integrated into the system designing costs. | - | Designer | Authorized Laboratory |
| Planning/  Designing | Land acquisition/involuntary resettlement | In local community | Examining the grievance/ complaints records | Upon receipt of complaints from citizens | To prevent impacts in due course | - | - | PIU | PIU |
| Construction | Damage to the existing infrastructure and structures, especially underground installations (water and sewage pipelines, etc.) | At a construction site | Visual surveillance | Continuously during the execution of works and site removal | To determine the damages | - | - | Contractor for Supervision of Works | Contractor for Supervision of Works |
| Construction | The appearance of eroded surfaces and landslides near the construction site | In the immediate vicinity of the construction site | Visual surveillance | Continuous  during construction and decommissioning | To affirm soil erosion and landslides caused by construction works | - | Integrated into the supervision costs | Contractor for Supervision of Works | Contractor for Supervision of Works |
| Construction | Contamination of soil by grease and fuel from mechanization | At a construction site | Visual surveillance | Continuously during the execution of works and site removal | To determine the impact of works on soil quality |  | Integrated into the supervision costs | Contractor for Supervision of Works | Contractor for Supervision of Works |
| Construction | Analysis of surface water quantities and quality parameters of river Klokot:   * pH * flow * turbidity * conductivity * suspended particles | On river Klokot downstream from water-intake | Standard laboratory equipment and water quantity and quality monitoring methods for surface water | Prior to start of activities  In the case of citizen complaints | To define impacts of construction works to the quality of surface water | - | 1.000 KM per sample | Contractor for Supervision of Works | Authorized Laboratory |
| Construction | 1. Presence of oil layer on surface water courses  2. Analysis of surface water flow and quality parameters:   * COD, * Total mineral oils. | 1, 2. On river Klokot downstream from water-intake | 1. Visual  2. Standard laboratory equipment and water quality monitoring methods for surface water | 1,2. Upon the supervisor's order and upon receipt of complaints from citizens | To define impacts of construction works to the quality of surface water | - | 1.000 KM per sample | Contractor for Supervision of Works | Authorized Laboratory |
| Construction | Waste management during the works execution;  Separation of hazardous and non-hazardous waste. | At a construction site | Visually and by comparison with the waste management report | Continuously during the execution of works and site removal | For ensuring proper waste management | - | Integrated into the supervision costs | Contractor for Supervision of Works | Contractor for Supervision of Works |
| Construction | The area which has been subjected to restoration of landscape / vegetation.  Number and species of plants replanted. | At a construction site | Visual surveillance and comparison with the Rehabilitation Plan for Degraded Areas | Upon implementation of Rehabilitation Plan for Degraded Areas | For the purpose of land and vegetation reinstatement | - | Integrated into the supervision costs | Contractor for Supervision of Works | Contractor for Supervision of Works |
| Construction | The appearance of foreign invasive species | At the location of the project | Visual identification | One time before the works begin | To determine the presence of foreign invasive species | - | - | Contractor | Contractor |
| Construction | Monitoring condition of crops | At a sub-project location | Visual surveillance | In the case of citizen complaints | In order to determine the impact of construction works on condition of crops | - | - |  |  |
| Construction | Air pollution | At a construction site | By a licensed air quality monitoring laboratory using statutory methods | Prior to start of works for baseline after that  In the case of citizen complaints | To determine if concentration of air pollutants exceed the relevant air quality target values or limit values | - | - | Contractor | Authorized Laboratory |
| Construction | Increasing noise level | At a construction site | By a legal person who is authorized for noise measuring using standard equipment | Prior to start of works for baseline after that  In the case of citizen complaints | To determine the possible noise level above limit values | - | - | Contractor | Legal person authorized for noise measuring |
| Construction | Presence of cultural / archaeological findings | At a construction site | Supervision of earthworks | During earthworks | For the sake of preservation of cultural heritage | - | Integrated into the supervision costs | Contractor | Contractor for Supervision of Works |
| Construction | Existence of hygienic conditions for workers;  Use of PPE;  Number of workers with health problems related to work on the construction site;  Number of recorded accidents;  Number of COVID-19 cases among workers. | At a construction site | Visually and examining the records | Continuously during the execution of works and site removal | To determine implementation of OHS measures | - | Integrated into the supervision costs | Contractor | Contractor for Supervision of Works |
| Construction | Impact on the population because of restrictions in land use rights and in business activities | In local community | Examining the records | Upon receipt of complaints from citizens | To prevent impacts in due course | - | Integrated into the supervision costs | PIU and Contractor | PIU and Contractor |
| Construction | Complaints received due to decreased public access, increased traffic and site disarrangement. | At a construction site | Visually and compared to the Construction Site Organization Plan and Traffic Management Plan. | Continuously during the execution of works and site removal | To define compliance with the Construction Site Organization Plan and Traffic Management Plan and avoid negative impacts on population. | - | Integrated into the supervision costs | Contractor | Contractor for Supervision of Works |
| Construction | Number of recorded accidents of local population due to construction works. | In local community | Examining the records | Continuously during the execution of works and site removal | To prevent impacts in due course | - | Integrated into the supervision costs | Contractor | Contractor for Supervision of Works |
| Construction | Number of recorded incidents related to SEA/SH | In local community | Examining the records | Continuously during the execution of works and site removal | To prevent impacts in due course | - | Integrated into the supervision costs | Contractor | Contractor for Supervision of Works |
| Construction | Quality of completed works  Quality of the installed material | At a construction site | Visually and examining the records | Continuously during the execution of works and site removal | Poor supervision and construction works quality assessment may cause damages to the environment, poor structures and use of low quality materials, which may lead to structure damages and expose irrigation system users to risks and possible accidents | - | Integrated into the supervision costs | Contractor | Contractor for Supervision of Works |
| Operation | Irrigation system damage due to improper management | On project location | Visually and examining the records | Continuously | To ensure proper management of irrigation system | Integrated into the maintenance costs | Gross salary for the person in charge of the system maintenance | System Users | System Users |
| Operation | Quantity of water intake (l/s) | On water intake and pump station | Flow meter readings and keeping records | Continuously | To provide adequate water management in the system and compensate deficits, to provide submission of data to the competent water management institution and paid a special water fee | Integrated into the maintenance costs | Gross salary for the person in charge of the system maintenance | System Users | System Users |
| Operation | Precipitation (mm/day) | On project location | Pluviometer reading and recording | When necessary | To define the quantity of precipitation and the quantity of water in the irrigation system | 50 KM per pluviometer | Included in the salary of the person in charge of the system maintenance | System Users | System Users |
| Operation | Wind velocity and direction | On project location | Anemometer reading and recording | Continuously | To determine parameters relevant to agriculture | 150 KM per anemometer | Included in the salary of the person in charge of the system maintenance | System Users | System Users |
| Operation | Air temperature | On project location | Thermometer reading and recording | Continuously | To determine parameters relevant to agriculture | 10 KM per thermometer | Included in the salary of the person in charge of the system maintenance | System Users | System Users |
| Operation | Quantity of water used for irrigation on parcels | On user water meters | Water meter reading and recording | Continuously | To define the quantity of delivered water | Integrated into the construction costs | - | System Users | System Users |
| Operation | Surface water quality for irrigation (heavy metals, nitrates, nitrites, pH, conductivity, temperature) | At the location of water intake on river Klokot | Standard laboratory equipment and water quality monitoring methods for surface water | Monthly | To monitor water quality for irrigation |  | 300 KM/ per sample | System Users | Authorized Laboratory |
| Operation | Flow and water level in the riverbank of Klokot | Upstream and downstream of the water intake | Hydrometric measurements and water meter measurements on measuring profiles and keeping records | By the dynamics specified by the Water Act and the applicable laws | Flow for the purpose of controlling the flow regime in the Klokot watercourse and insurance of the Ecological Flow | Built in construction costs |  | System Users | Authorized Laboratory |
| Operation | Soil quality including pH value, heavy metals, phosphorus, nitrogen, Na, Ca, salts and pesticides | On representative plots within the project location | By taking at least one soil sample | Once a year | To define impacts of agricultural activities to soil quality | - | 1000 KM per sample | System Users | Authorized Laboratory |
| Operation | Surface water quality (heavy metals, nitrates, nitrites, pH, conductivity, temperature, chlorides, microbial parameters, pesticides) | On river Klokot downstream from water-intake | By surface water sampling | Twice a year in typical hydrological situations | To define impacts of agricultural activities to surface waters | - | 1700 KM/ per profile | System Users | Authorized Laboratory |
| Operation | The appearance of foreign invasive species | At the location of the project | Visual identification | Monthly | To determine the presence of foreign invasive species | - | - | System Users | System Users |
| Operation | Monitoring of crop status | On project location | Visual identification | Continuously |  |  |  | System Users | System Users |
| Operation | Occurrence of weed plants and pests | On project location | Visual identification and counting units | Daily | To determine the needs for use of phyto-pharmaceutical products | - | - | System Users | System Users |
| Operation | Bee mortality | At beekeepers in the region | Unit counting | As required | To define the impact of irregular use of phyto-pharmaceutical products | - | - | System Users | System Users |
| Operation | The occurrence of diseases that are associated with improper handling of phyto-pharmaceuticals | At project location | Through a survey on the occurrence of illnesses at training workshops for farmers on good agricultural practices involving the use of agrochemical resources. | Annually | To determine the impact of improper application of phyto-pharmaceuticals on human health | - | - | System Users | System Users |

# PUBLIC CONSULTATION

The original Environmental Management Plan (EMP) prepared in 2019 was disclosed with public consultations held in August 2019, the details of which are given below. The revised ESMP will be disclosed on the websites of PIU and City of Bihać and will be subject to public consultations which are in line with the World Bank Guidelines on conducting public consultations during the Covid-19 Pandemic. This means that the ESMP will be provided to all interested parties and stakeholders, as well as general public, in a digital format where the comments received will be registered and reflected upon in the ESMP.

## Details of the public consultation for the original EMP

Prior to the public hearing, the draft "EMP for the Irrigation System in the Sub-Project Areas Klokot-Papari and Bakšaiš in the City of Bihać" was publicly posted on the website of the PIU Forestry and Agriculture Project Implementation Unit (http://portal.piusum.ba). The public was informed about the date and place of the public hearing on the City of Bihać website.

Public hearing on EMP for irrigation system in sub-project areas of Klokot-Papari and Bakšaiš areas in the City of Bihać was held on 20/08/2019 at the Kamenica Elementary School building, starting at 10:00.

The hearing was attended by 21 participants. The Minutes of the Meeting are provided in Annex 4.

# ANALYSIS OF CAPACITY BUILDING AND TRAINING NEEDS

## Training needs

Implementation of Environmental and Social Management Plan is responsibility of:

* In the planning and preparation phase: PIU and project designer,
* In the construction phase: the contractor and supervisor of works,
* In the operation phase: irrigation system users, owners of individual parcels that will likely be associated in the Water Users Association.

It is presumed that the appropriate level of knowledge and skills necessary to prepare project documents, to carry out construction works and construction supervision is present within the local stakeholders and in this sense is not necessary to implement specific measures to educate personnel for the implementation of the ESMP in the planning and construction phase.

On the other hand, the existing owners of the land, the future users of the irrigation systems, have a basic knowledge of growing certain crops, use traditional agricultural methods and just few of them had previously used irrigation systems, and implemented measures of integrated pest management. Although it is assumed that in the transition period, customers of the irrigation systems would have the technical support of the City over communal utilities in the management and maintenance of the main system to hydrants, and the technical assistance of experts from agriculture to use irrigation systems to achieve maximum yield, it is expected that in due time complete control switch in the hands of the Association of Water Users. It is assumed that the future Water Users Associations will have a responsible person or more for operation and maintenance of the main system to hydrants, and that all users will be responsible for part of a system from the hydrant to their own land.

Therefore, the focus of the training program should focus on the future managers and users of irrigation systems.

When it comes to future managers, they need to be trained for the sustainable management of the irrigation system. The core of knowledge on sustainable management of irrigation systems is among the experts in the field of hydraulic and / or mechanical engineer who specialized in the maintenance of pumping and piping systems employed in higher education institutions or equivalent institutions and consulting companies.

When it comes to future users of irrigation systems, they need to be trained for:

1. selection of equipment for irrigation,
2. elements of the dosage of water,
3. sustainable use of irrigation systems to achieve maximum effect,
4. The use of good agricultural practice, among others those relating to the use of methods of integrated pest management and applications of organic or mineral fertilizers.

With respect to the first three points, within the Project will be prepared Manual/Guidelines for the operation and maintenance of the system that will help clients, customers and the municipal department in their future work related to system management and maintenance.

It is recommended to maintain a seminar on the location of sub-project for agricultural enterprises, municipal/cantonal authorities, representatives of the Water Users Association, and other interested local residents where Manual / Guidelines for the operation and maintenance should be presented.

Regarding the remaining point 4, using good agricultural practice, the core of knowledge about land management and use of phyto-pharmaceuticals are located in agricultural universities and their institutes. Based on the laws relevant to agriculture and the application of phyto-pharmaceuticals farmers must undergo appropriate training programs, which should be ensured by the faculties and their institutes. Training program is necessary to include all members of the Water Users Association, and other interested people. Training program should cover issues such as:

* the most significant problems that farmers face in the field;
* ways to overcome the problems;
* the benefits and impacts associated with the use of fertilizers and pesticides,
* use of good agricultural practice, among others those relating to the use of methods of integrated pest management and applications of organic or mineral fertilizers.

## Equipment Procurement

Bearing in mind the proposed monitoring of environmental impacts, it is necessary that future system users purchase the appropriate equipment for monitoring the impact. The users should be trained in equipment usage. The list of the equipment is given in following table.

Table 24 Required equipment

|  |  |  |
| --- | --- | --- |
| Type | Number of Units | Unit Costs |
| Water meters for measuring water quantities | 1 per individual user | 200 KM |
| Anemometer for measuring wind speed and direction | minimum 1 | 150 KM |
| Thermometers for measuring air temperature | minimum 1 | 10 KM |
| Pluviometer for measuring precipitation | minimum 1 | 50 KM |

# ANNEXES

**ANNEX 1. GOOD CIVIL CONSTRUCTION PRACTICES**

Before the construction begins, the Contractor is required to prepare **Construction Site Management Plan**, according to the Decree on Construction Site, Compulsory Documentation on Construction Site and Construction Participants („Official Gazette of FBiH“, No. 48/09, 75/09, 93/12, 74/13, 89/14, 99/14 and 53/15)

In the Construction Site Management Plan, the Contractor is obliged to include the following:

1. **Environmental protection and monitoring measures during the construction of irrigation systems as defined in the Environmental Management Plan**
2. **Requirements regarding good construction practice of performing the works as follows:**

General Requirements

* Contractors are obliged to apply good environmental construction practice during all construction activities, and to reduce the damage caused to vegetation, soil, groundwater, surface water, landscape, as well as disturbance of settlements and local communications to the lowest possible extent.
* Application of environmental protection and mitigation measures, as well as monitoring, will be implemented in parallel with the construction activities. They start at the time when workers, equipment and/or material are mobilized to the construction site, and end with the completion of construction works when all workers, equipment and/or material leave the construction site and upon completion of the environmental reinstatement activities.
* The contractor is obliged to appoint a Health, Safety and Environment Coordinator, responsible for the compliance with the laws and objectives of the environmental protection, occupational safety and fire protection.
* The Contractor needs to ensure order, discipline and professional responsibility of all employees on the construction sites. Work and residence must be restricted exclusively to the construction works zone and damage to private property, land and crops must be avoided. The Contractor shall provide regular contact with the local population representatives (local community council) to enable information exchange or find solutions to possible disputes (originating from violation of ownership rights, damage caused during construction works, etc.).

Supply and Transport of Materials

* When purchasing materials for the construction of irrigation systems and reservoir rehabilitation, the Contractor shall select the manufacturer/supplier who performs in compliance with the valid environmental permits, if required pursuant to the Law on Environmental Protection of the Federation of B&H, or other environmental standards recognized in Bosnia and Herzegovina/or EU.
* Aiming at prevention of dust emissions, the Contractor shall transport asphalt, gravel, stone, earth and other material in trucks provided with tarpaulin covers. Transport of stone and gravel shall be carried out in moist condition. Driving speed shall not exceed 30 km/h. The Contractor shall avoid unnecessary driving of vehicles.

Construction Site Organization

* Construction should start (if possible) at the time of the year when dry soil advantages can be utilized, i.e. when compacting and degradation throughout the works are minimum.
* Adequate machines and/or protection plates shall be used to prevent compaction during soil removal, for example with rails or low pressure pneumatics on locations implying compaction possibility. Adequate procedures for separate removal, handling, storage and replacement of humus and subsoil shall be applied.
* The contractor shall establish temporary disposal sites for construction materials; provide space for rinsing of concrete pumps and mixers, as well as space for washing of vehicle tires with adequate cleaning agent. Temporary disposal sites for excavation material (topsoil) shall be reduced to maximum 2 m of height, in order to prevent compaction caused by the soil weight, and the storage time is to be reduced to minimum.
* The Contractor shall ensure that all construction equipment has been licensed and approved in accordance with local regulations, and if possible, certified in compliance with the EU standards.
* The Contractor shall use modern machines and vehicles that meet environmental standards in terms of emission of harmful gases (complete combustion). The Contractor shall also use filters for reduction of emissions of soot particles, and fuel with favorable chemical structure (low sulphur content) and efficient/safe decantation.
* The Contractor shall use modern machines and vehicles producing noise (engines, exhaust system). This mainly entails the supply of new machines or measures for installation of additional sound insulation, as well as constant maintenance. In addition, it is recommended that the machines operate only in the period from 7 a.m. – 5 p.m. in all sections of the route distanced less than 60 m from the nearest residential facility.
* The Contractor shall use biodegradable lubricants and gear oils. Maintenance, filling and cleaning of machines must be carried out off the site and outside the area applying surface water.
* The Contractor shall specify and follow control measures for the dust generated throughout equipment handling and/or rehabilitation works. The Contractor must submit the plan proposing material transport roads, and shall also provide statements on the proposed dust control method in places where transport through the settlements is unavoidable.
* Develop construction site organization design with appropriate solutions for drainage and treatment of sanitary wastewater, as well as storm water, from the construction site zone. Use appropriate sewage systems to discharge wastewater from the site, and if necessary, collect it in waterproof tanks and treat it pursuant to the prescribed method (whether on-site, or at a remote location) prior to the discharge into the recipient or the urban sewage system.
* The Contractor shall ensure that machines and vehicles parking lots as well as labor accommodation containers are not located inside the forest areas, and do not impact watercourses or affect endangered flora and fauna.
* The Contractor shall ensure protection of areas sensitive to erosion by means of stabilization agents (temporary banks, fences, ditches) and replanting upon the completion of construction works.

Execution of Construction Works

* In order not to endanger the land stability, in unstable or conditionally stable terrains, construction works shall be carried out in shorter intervals.
* During earthworks, humus layer shall be deposited in piles not exceeding 2 m in height and protected from pollution to maintain its fertility.
* In order to reduce adverse impacts on the river and river banks to the minimum, construction activities located in or near surface water bodies, shall be carried out during low water season, or most often in the period from July to September. It is recommended to take this into account during the preparation of the activity timetable.
* All manipulations with oil and its derivatives in the process of construction and supply of machinery shall be performed with maximum protection measures to avoid spillages. All packaging for oil and other oil derivatives must be collected and transported to the controlled Contractor’s landfill, and further disposed by the competent municipal enterprise. In case of accidents, fuel or lubricant spillages in the environment, urgent interventions pursuant to the procedures for the discharge of fuel and lubricants are required.
* Washing of machines and vehicles shall not be carried out within the construction works zone.
* Wastewater from the on-site toilets shall not be discharged into the ground or water streams.
* Waste management shall comply with the Waste Management Plan (details given below).
* Deposition of excavated material and any other solid waste in water bodies shall be forbidden.
* Driving machines inside rivers, streams, or onto their banks should not be allowed except in situations when it cannot be avoided due to construction of a special structure.
* River bed bottoms shall be protected and not completely blocked during trenching in order to protect existing water-corridors for uninterrupted communication between the species living at the bottom and the species freely swimming in the water. Further natural restoration of existing banks is to be ensured through covering damaged areas with suitable vegetation.
* The Contractor shall implement adequate traffic control measures, in accordance with the law, during the Contract duration, and the measures must first be approved by the Supervision Engineer. Traffic safety management measures shall include temporary illumination and adequate signalization during trenching and rehabilitation works.
* The Contractor needs to appoint permanent staff to be engaged on traffic safety issues, and be responsible for the implementation of traffic safety measures and traffic measures prescribed by the national laws, including: (I) inspection of the condition and position of the equipment for traffic control in use; (II) design review – part related to traffic control equipment necessary to provide safe and efficient traffic flow; (III) correction of all traffic deficiencies where applicable; (IV) inspection of work sites, equipment handling and storage, material handling and storage related to traffic safety.
* The Contractor shall not leave trenches unattended and shall fence and signalize all open trenches to prevent accidents.

Organization of Construction Site after Completion of Works

* The Contractor must also remove all special structures and sites used to support construction works including temporary buildings and their foundations, temporary installations (electric power, water, sewage) and equipment (sedimentation tank), temporary roads reinstatement (especially in the forest area and on private properties) and working plateaus reinstatement, removal of fences, signs and notices.
* The Contractor shall remove all construction waste.
* All construction sites and other influential areas affected by construction activities shall be reinstated depending on the future land use.
* Reinstatement activities shall start immediately after pipe burying.
* Construction area shall be seeded with species preserved in topsoil and supplemented by adequate material if needed.
* Agricultural areas shall be returned to a state suitable for landowners to re-plant their own seed crops.

**ANNEX 2. WASTE MANAGEMENT PLAN**

**1. INTRODUCTION**

Waste management refers to the implementation of the prescribed waste handling measures including collection, transportation, storage, re-use and disposal of wastes, as well as the control over these activities. Pursuant to the provisions of the Law on Waste Management (“Official Gazette of FB&H”, no. 33/03, Article 3 and 19), the operator of the installations requiring environmental permits produces the Waste Management Plan. Although this infrastructure project does not require environmental permitting, due to the possibility of waste generation and significant environmental impacts in the construction and operation phases, this Plan has been created. On the other hand, the Contractor is obliged to prepare the Construction Site Management Plan, according to the Decree on Construction Site, Obligatory Documentation on Construction Site and Construction Participants (Official Gazette of the Federation of BiH, No. 48/09, 75/09, 93/12, 74/13, 89/14, 99/14 and 53/15). This plan should also include waste management at the construction stage. In accordance with the previous experience and practice of drafting environmental documentation for irrigation and reconstruction projects, the consultant has prepared a separate Waste Management Plan for the phases of construction and operation of the system.

Pursuant to the new Law on Amendments to the Law on Waste Management[[15]](#footnote-15) (Article 19), Waste Management Plan must be updated every five years or after a change in operation. Furthermore, pursuant to Article 20, system operator, as a waste producer, must appoint a person responsible for waste management activities. The Plan development shall take into account provisions of the Regulations of Waste Categories with Lists (“Official Gazette of FB&H”, no. 9/05) and the provisions of the Article 2 of the Regulations of the Requirements for the Transfer of Waste Management Liabilities from Producers and Vendors to the Waste Collection System Provider (“Official Gazette of FB&H”, no. 9/05).

For the purpose of complete understanding of the concerned Plan, explanations of basic terms used, and compliant with the Law on Waste Management (“Official Gazette of FB&H”, no. 33/03), are given below:

* "waste" means any substance or object which the holder discards or intends or is required to discard; according to one of the categories included on the waste list constituted in the Regulations on Waste Categories with Lists (“Official Gazette of FB&H”, no. 09/05);
* "municipal waste" – is the waste from households and other waste, which by its nature or composition is similar to waste from households;
* “hazardous waste" – is any waste that is determined by a special regulation and has one or more features causing danger to human health and the environment by its origin, composition or concentration, as well as the waste include on the list as hazardous waste and regulated by an implementing regulation;
* "non-hazardous waste” – is the waste not defined as "hazardous waste";
* “inert waste” – is the waste that does not undergo any significant physical, chemical or biological transformations. It does not dissolve burn or otherwise physically or chemically react, biodegrade or adversely affect other matter it comes into contact with in a way likely to give rise to environmental pollution or harm to human health. Its total solubility, pollutant content and ecotoxicity of its leachate are insignificant and, in particular, do not endanger the quality of any surface water or groundwater;
* "holder" means waste producer, or the person in possession of it;
* "producer" means anyone whose activities produce waste ("original producer") and/or anyone who carries out preliminary processing, mixing or other operations resulting in a change in the nature or in the concerned waste composition;
* "disposer’’ – is any person who delivers or disposes waste;
* "operator" means physical or legal entities empowered to carry out waste management;
* "waste management" - means a system of activities and actions related to waste, including prevention of waste generation, reduction of waste quantity and its hazardous characteristics, waste treatment, planning and control activities and waste management processes, waste transport, establishment, operation, closure and maintenance of waste treatment devices after closure, monitoring, consulting and training related to business practices and waste management activities.

**2. WASTE MANAGEMENT IN THE CONSTRUCTION PHASE**

**2.1 Classification of Waste Occurred in the Construction Phase and Structure Removal**

Classification list of all waste types that may arise during the preparation, planning and site closure in the construction phase and in the structure closing phase is given below. Guidelines for waste treatment, or collection, transportation, processing and removal methods are given for each category below.

Classification of Waste Occurred during Construction

| **No.** | **Group** | **Waste Code** |
| --- | --- | --- |
| **NON-HAZARDOUS WASTE** | | |
| 1 | MUNICIPAL WASTE (WASTE FROM HOUSEHOLDS AND SIMILAR WASTE FROM INDUSTRIAL AND CRAFT PLANTS AND FROM INSTITUTIONS) INCLUDING SEPARATELY COLLECTED COMPONENTS | |
| 1.1 | Mixed municipal waste | 20 03 01 |
| 1.2 | Paper and cardboard | 20 01 01 |
| 1.3 | Plastic | 20 01 39 |
| 1.4 | Wood waste | 20 01 38 |
| 2. | WASTE WHICH IS NOT ELSEWHERE SPECIFIED IN THE CATALOG | |
| 2.1. | Old/warn tires | 16 01 03 |
| 3. | WASTE FROM MECHANICAL SHAPING AND PHYSICAL AND MECHANICAL SURFACE FINISHING OF METAL AND PLASTIC | |
| 3.1. | Scrapings and chippings containing iron | 12 01 01 |
| 3.2. | Scrapings and chippings of ferrous metal | 12 01 03 |
| 4. | CONSTRUCTION WASTE AND WASTE FROM DEMOLITION OF THE BUILDING (INCLUDING EXCAVATED SOIL FROM CONTAMINATED LOCATIONS) | |
| 4.1. | Concrete | 17 01 01 |
| 4.2. | Bricks | 17 02 02 |
| 4.3. | Tiles, Tiling/ceramics | 17 01 03 |
| 4.4. | Mixtures of concrete, bricks and ceramic tiles that do not contain hazardous materials | 17 01 07 |
| 4.5. | Wood, glass and plastic | 17 02 01, 02 and 03 |
| 4.6. | Iron and steel | 17 04 05 |
| 4.7. | Earth and stones, and earth excavated by means of an excavator | 17 05 04 and 06 |
| 4.8. | Insulating materials (Styrofoam) | 17 06 04 |
| 4.9. | Mixed construction waste and demolition waste not included in 17 09 01 17 09 02 and 17 09 03 | 17 09 04 |
| 5. | WASTE FROM AGRICULTURE, GARDENING, AQUACULTURE; FORESTRY, HUNTING AND FISHING, FOOD PREPARATION AND PROCESSING | |
| 5.1 | Waste plant tissue | 02 01 03 |
| **HAZARDOUS WASTE\*** | | |
| 1. | WASTE OILS, BITUMINOUS, SUBSTANCES CONTAINING OILS | |
| 1.1 | Bituminous mixtures containing tar | 17 03 01\* |
| 1.2 | Biodegradable hydraulic oil | 13 01 12\* |
| 1.3 | Machine oils | 13 02 06\* and 07\* |
| 1.4 | Packaging containing residues of hazardous substances or being contaminated with hazardous substances | 15 01 10\* |
| 1.5 | Lead batteries | 16 06 01\* |
| 1.6 | Exploited absorbents (absorbent materials in case of oil and grease spillages, rags, protective clothing) | 15 02 02\* |
| 1.7 | Inorganic media for the protection of wood | 03 02 04\* |
| 1.8 | Waste from the application and removal of paints and varnishes | 08 01 11\*, 13\*, 15\*, 17\*, 19\* and 21\* |
| 1.9 | Mixture of oil and grease from oil / water separators | 19 08 10\* |
| 1.10 | Synthetic oil for heat transfer | 13 03 09\* |

**2.2. Waste Management Plan for Construction Phase and Structure Removal Phase**

Methods of Collection, Storage and Waste Handling

The goal of selective waste collection, storage and handling is to prevent the threat to human health and the environment, especially the discharge of harmful substances into the water and soil. Collection and storage of waste will be organized within the construction site, and is based on general waste management principles:

* Separate collection
* Prevention
* Recycling

Waste generated on construction site and in areas where administration is situated, will be collected selectively, or in separate containers in accordance with the waste. Waste incineration on site or in the open is prohibited.

Basic principle to be followed is the separation of hazardous from non-hazardous waste, then the separation of construction waste from other waste categories, and particularly separation of waste that can be recycled or given to third parties for re-use.

Hazardous waste and its packaging shall be marked pursuant to the regulations defining labelling of dangerous goods. Hazardous waste should be collected separately and sorted by categories as defined in the table above.

Waste oil shall be collected and stored separately. It is forbidden to discharge waste oil in surface and underground rivers, drains or soil, which also applies for substances containing mineral or synthetic oil.

Separately collected waste shall be stored on specially designated locations in adequate waste bins as follows:

1. Container for hazardous waste – mixed hazardous waste (15 01 10\*, 16 06 01\*, 15 02 02\*, 08 01 11\*, 13\*, 15\*, 17\*, 19\* and 21\*, 03 02 04\*),
2. Container for non-hazardous waste – mixed municipal waste (20 03 01),
3. Container for non-hazardous waste – mixed packaging waste which can be recycled (20 01 01 , 38 and 39),
4. Container for non-hazardous waste – mixed metal waste which can be recycled (12 01 and 03 and 17 04 05).

Containers shall be manufactured for the purposes above, thus shall not allow leakages. Each container must be appropriately marked.

Collected waste oils (13 02 06\* and 07\*) shall be stored in barrels or other suitable containers to prevent leakages. Servicing of vehicles shall take place exclusively in the service plateau away from watercourses and sensitive areas, where waste oil barrels are positioned.

For disposal of construction waste, the Contractor shall provide temporary and permanent depositing locations along the route, within the construction zone and at a special location.

Biodegradable waste, or waste plant tissue and material that is collected during the preparation of the construction site, will be selected and offered to the citizens for re-use. The remaining part will be handled by an authorized operator for this type of waste.

Temporary landfill sites are required for deposition of humus, excavated materials, as well as for smaller amounts of buffer material and stone fractions. The Contractor shall identify permanent and temporary disposal locations, and obtain all required permits.

Waste Disposal

The producer shall deliver all selectively collected waste to the operator i.e. to companies authorized for waste collection, transport and treatment pursuant to the *Law on Waste* (“Official Gazette of FB&H”, no. 33/03).

In the procedure for the selection of the best offer for waste (hazardous) disposal, the producer will require a proof from the bidder of being registered for execution of waste management activities in accordance with applicable regulations.

The Contractor signs a Contract with the selected company.

Record Keeping

Waste producer maintains records of the type and the quantities of the waste produced. The record includes the following information:

* data on produced waste and causes of its occurrence,
* waste storage,
* Waste removal.

The producer is the record sheet for each waste shipment, in two copies, one copy for the operator and one for his own records.

Delivered waste record sheets of delivered waste are to be kept in the Contractor’s permanent office, and copies on temporary sites for inspection purposes.

Responsibility

The Contractor shall appoint a Supervising Engineer to be responsible for supervision of waste management operations at the construction site.

**3. WASTE MANAGEMENT IN THE OPERATION PHASE**

**3.1. Classification of Waste Occurred in the Operation Phase**

Waste in the operation phase occurs during maintenance of pumping stations and possibly reservoirs, and in case of the need for replacement tubes due to malfunction, cracking, or the like. Furthermore, waste in the operation phase occurs also during agricultural activities.

Pumping stations are designed to be automatic, without crew, thus the only waste that may occur is the waste generated from maintenance of power equipment and water pumps.

All the types of waste generated at specific locations in the course of operating the planned irrigation systems are presented below.

Classification of Waste Occurred during Operation of Irrigation Systems

| **No.** | **Group** | **Waste Code** |
| --- | --- | --- |
| **NON-HAZARDOUS WASTE** | | |
| 1 | MUNICIPAL WASTE (WASTE FROM HOUSEHOLDS AND SIMILAR WASTE FROM INDUSTRIAL AND CRAFT PLANTS AND FROM INSTITUTIONS) INCLUDING SEPARATELY COLLECTED COMPONENTS | |
| 1.1 | Mixed municipal waste | 20 03 01 |
| 2 | CONSTRUCTION WASTE AND WASTE FROM DEMOLITION OF THE BUILDING (INCLUDING EXCAVATED SOIL FROM CONTAMINATED LOCATIONS) | |
| 2.1 | Plastic | 17 02 03 |
| 2.2 | Soil and stones, and excavator dredging operations | 17 05 04 and 06 |
| 3 | Waste from agriculture, horticulture, aquaculture, FORESTRY, HUNTING AND FISHING, FOOD PREPARATION AND PROCESSING | |
| 3.1. | Sludge from washing and cleaning | 02 01 01 |
| 3.2. | Vegetable tissues waste | 02 01 03 |
| 3.3. | Hazardous plastic (including packaging) | 02 01 04 |
| 3.4. | Waste from chemicals used in agriculture and waste included in 02 01 08 | 02 01 09 |
| 3.5. | Hazardous metal | 02 01 10 |
| 3.6. | Wastes not specified in any other way | 02 01 99 |
| **HAZARDOUS WASTE \*** | | |
| 1 | WATER OILS AND WASTE FROM LIQUID FUELS | |
| 1.1 | Synthetic oils for motors, devices and lubrication  Biodegradable oils for motors, devices and lubrication | 13 02 06\* and 07\* |
| 2. | WASTE PACKAGING, APSORBENS, ABSORPTION MATERIALS, FILTER MATERIALS AND PROTECTIVE CLOTHES NOT OTHERWISE SPECIFIED | |
| 2.1. | Packaging containing residues of hazardous substances or contaminated with harmful substances | 15 01 10\* |
| 2.2. | Used absorbents (absorbing substances in case of oil and grease leakage, cloth, protective clothing) | 15 02 02\* |
| 3. | WASTE FROM AGRICULTURE, HORTICULTURE, AQUACULTURE, FORESTRY, HUNTING AND FISHING, FOOD PREPARATION AND PROCESSING | |
| 3.1. | Waste from chemicals used in agriculture and containing hazardous materials | 02 01 08\* |

**3.2 Waste Management in the Operation Phase**

Collection and storage of waste in this case as well will be based on the principles of prevention and separate collection. Waste incineration on site or in the open is prohibited.

Waste management is presented as follows:

Waste Collection, Storing and Handling Methods

Waste producer, or individual users associated into the Water Users Association, is responsible to secure that waste management is compliant to the principle of good working practices pursuant to legal regulations. A restriction can impose a temporary waste management method in the respective municipality that does not favour separate waste collection.

During regular maintenance of power equipment and water pumps in pumping stations, there is waste in form of greased and oiled cloth, hazardous waste oils, etc., labelled as 15 02 02\*. This waste should be collected, selected and temporarily deposited to the planned facility sites for the maintenance duration. Barrels or other suitable containers, properly labelled to avoid environmental pollution will be procured for the storing of collected waste oils (13 02 06\* and 07\*), classified as hazardous waste. Waste collected by these means is to be placed at companies dealing with the concerned waste disposal. Water User Association is responsible to sign a contract with the referred companies. In case of and occasional appearance of a leak of oil and fats, remove them with a cloth, and temporarily store oily rags in metal barrels. Fat occasionally removed off the equipment, due to the appearance of mechanical particles or due to replacement needs, is to be removed applying the same method.

In the process of agricultural production, organic waste occurs mainly from waste plant tissues (02 01 03) and shall be collected separately and subjected to the process of composting. Composting should be implemented jointly as organized by the Water Users Association. It is necessary to find a suitable waste composting location in coordination with the municipality.

Containers of the chemicals used for plant protection are classified as hazardous waste (02 01 08\*). Such containers should be selected and collected separately in specially marked bags as organized by the Water Users Association. The collected waste must be handed over to the company dealing with hazardous waste and the Water Users Association is responsible to sign a contract with the referred company prior to the system commencement.

Municipal waste marked as 20 03 01, 17 02 03, 02 01 04, 02 01 10, 02 01 99 may occur on the irrigated location, as generated by individual producers especially during planting and harvesting operations. In case the municipality has not established a separate waste collection system, such waste must be collected and temporarily stored in plastic buckets or containers installed by the municipal utility in the region. This category includes non-hazardous waste from chemicals used in agriculture (02 01 09). If there is no waste collection service, each manufacturer must arrange collection and transport to the nearest buckets/containers for waste disposal installed by the municipal utility. Upon establishment of organized separate waste collection systems by municipal structures, recyclable waste (plastics, paper, glass and iron) will be separated and disposed of in special containers intended for the concerned purpose.

During construction works involving pipe replacements and in case of failures, pipe bursts or similar, clay layer (17 05 04 and 06) must be deposited separately and reinstated after pipe lying. Possible surplus material must be deposited at predetermined locations, until transported to the landfill.

Waste Disposal

It is necessary to enter into contracts for removal and disposal of all generated waste with companies that have obtained all required waste management permits.

Waste producer will hand over all (selectively) collected waste to the operator or authorized waste collection, transport and treatment enterprises, pursuant to the *Regulation on Selective Waste Collection, Packaging And Labelling* (“Official Gazette of FB&H” no. 38/06). The operator undertakes the obligation to transport waste to the final waste treatment process or final disposal.

Final disposal of municipal waste will be carried out regularly to the municipal/regional landfill by means of the municipal public utility trucks and pursuant to the concluded contract.

Hazardous waste will be handed over to the operators authorized to deal with hazardous waste. In the course of transportation, it must be labelled and packaged in accordance with the regulations. Transportation of hazardous waste must comply with general requirements for the carriage of dangerous goods. Transport of hazardous waste shall be accompanied by appropriate documentation as set out in accordance with the *Regulation on Selective Waste Collection, Packaging and Labelling* (“Official Gazette of FB&H” no. 38/06).

The producer or waste holder of who transports hazardous waste to the operator within the Federation of Bosnia and Herzegovina shall ensure that the wastes are accompanied by completed forms (hereinafter referred to as transport documents), available at the Cantonal Ministry of Environment. A sample of transport documents is provided in Appendix 1 of this Plan.

The waste carrier and recipient shall sign transport documents. In the event that the same carrier repeatedly carries similar types of waste, it is possible to provide one transport documents valid for certain period of time but not longer than 12 months. A copy of transport documents is kept in archives of the carrier and the recipient for the period of two years from the waste transport date.

During the period above, the carrier is obliged to provide transport documents within seven days from receipt of the written request of the Cantonal Minister for environment.

Record Keeping

Responsible person from the Water Users Association keeps the record of the occurrence of all waste types on the site. It is necessary to keep records on waste types and quantities.

Producer shall, for each waste shipment, prepare a record list in two copies, one for the operator and one for own records.

Based on the stored documents, it is easy to determine the exact amount of delivered non-hazardous and hazardous waste.

Responsibility

Waste Management responsibility is as bellow:

* Water Users Association will appoint a person who, inter alia, will be responsible to organize collection and temporary storage of hazardous waste and waste subject to composting.



**ANNEX 3. LEGAL FRAMEWORK**

1. **Environmental Impact Assessment Procedure**

Responsibility for the Environmental Impact Assessment (EIA) procedure in FBiH is shared between the Federation and Cantonal Ministries responsible for the environment. Procedure for issuing Environmental Permits in FBiH is defined by:

* Law on Environmental Protection of FBiH[[16]](#footnote-16),
* FBiH Rulebook on Plants and Facilities Subject to EIA, and Plants and Facilities which may be Constructed and Commissioned only if they have an Environmental Permit[[17]](#footnote-17) .

The FBiH Rulebook specifies the following:

* Plants and facilities or significant changes to existing plants and facilities for which the Federal Ministry of Environment and Tourism (FMET) is obliged to carry out the environmental impact assessment (EIA) procedure in the process of issuing an environmental permit;
* Plants and facilities or significant changes to existing plants and facilities for which FMET determines whether the EIA must be conducted, in the process of issuing an environmental permit;
* Plant and facilities for which EIA is not obligatory and which can be constructed and commissioned only if they have an environmental permit issued by the FMET.

**For plants and facilities subject to an EIA** the assessment procedure begins by submitting an Environmental Impact Assessment Study (EIA Study) to FMET in one written and electronic copy. EIA study is prepared by the legal entities authorized by FMET. The context of the EIA Study is prescribed by the Rulebook on Plants and Facilities Subject to EIA, and Plants and Facilities which may be Constructed and Commissioned only if they have an Environmental Permit[[18]](#footnote-18). As per article 12 of this Rulebook the EIA study must contain the minimally following:

* Description of the proposed project,
* Description of the environment that might be endangered by the project,
* Description of the significant environmental impacts,
* Description of the mitigation measure of negative impacts,
* Draft of basic alternatives,
* Non-technical resume,
* Indication of the difficulties.

EIA study also contains a special part related to possible impact of the project to the environment of the other entity or Brčko District BiH.

FMET publicly disclosed the electronic version of the EIA Study through its website, informs and invites all the interested parties and the general public to public consultation, and appoints an expert committee to evaluate the EIA Study. Within the 30 days after completion of the public consultation process, the evaluation by the expert committee must be completed. Once the process of evaluation of the EIA study is completed, the FMET issues a Decision on Approval or Rejection of the EIA Study within the 60 days. In case of approval, FMET issues a Decision on Granting of the Environmental Permit. In case of rejection, the procedure is terminated. The new procedure with the new EIA study can be started within the 6 months after Decision on Rejection of the EIA Study.

**For plants and facilities for which FMET determines whether they need an EIA** the procedure begins by development and submission of a Request for Prior Impact Assessment.

The request for a Prior impact assessment contains:

* description of the project, including information on its purpose and size,
* excerpt from the spatial planning act,
* information on the type and quantity of materials to be used, and the type and level of emissions,
* description of the possible effects of the project on the environment during its construction, during its operation or exploitation and during the decommissioning phase,
* description of basic and auxiliary raw materials and other sources of energy,
* description of the environment in the area affected by the project,
* brief overview of alternative solutions with regard to environmental impacts,
* information on possible difficulties encountered by the applicant in data collecting process, and
* non-technical summary.

In the process of considering and deciding on the request for a Prior impact assessment, the FFMET is obliged to submit a copy of the request and provide free access to the competent administrative body in the canton and the unit of local self-government in whose territory the project is carried out, administrative bodies and organizations responsible for the protection of environmental components, responsible for the protection of cultural, historical and natural heritage, responsible for health protection as well as to other interested parties in order to obtain their opinion.

If it is a project with a significant impact on the environment of another entity or Brčko District, or another state, the request is also forwarded to the body responsible for environmental protection of the other entity and Brčko District.

In case the project site is within a zone under any type of protection regime as regulated by the Law on Waters (water protection zone) or Law on Nature Protection, then the assessment is mandatory in order to check compliance of the proposed activities with protection regimes and potential impacts.

Within above-described process the FMET determines on the basis of the Prior environmental impact assessment that further impact assessment is required, or that an environmental impact assessment is mandatory, and determines the obligation to prepare an environmental impact assessment study, the scope and the content of the Study.

If FMET decides, that there is no need for an EIA Study, FMET issues a Decision on Granting the Environmental Permit. Otherwise, it issues a Conclusion on the Need to Develop an EIA Study.

**For plants and facilities which do not need an EIA, and for which FMET issues an Environmental Permit**, the environmental permitting procedure begins by submitting to FMET an Application for Obtaining an Environmental Permit, and FMET is obliged to issue the Permit or reject the application for an environmental permit within 60 days.

Application for Obtaining an Environmental Permit, besides the general data on the applicant, location of the plant or facility and decision from the relevant Tad Administration Office, must contain the following:

* description of plant and facility (plan, description of plant and facility, technical description of operation, plant capacity, etc.),
* description of basic and auxiliary raw materials, other substances and energy used or produced by the plant and plant,
* description of the condition of the location of the plant and facility,
* description of emission sources, nature and quantities of emissions from plants and facilities into the environment (air, water, soil), ie. zero status report, as well as identification of significant environmental impacts,
* description of the proposed measures, technologies and other techniques to prevent or, if that is not possible, to reduce the emissions from the installation,
* description of measures to prevent the production of waste as well as to recover useful material from the waste produced by the facility,
* description of other measures to comply with the basic obligations of the operator,
* description of the planned emission reduction measures and a description of the planned monitoring,
* excerpt from the planning act,
* final water act,
* non-technical summary,
* conceptual design,
* waste management plan,
* safety report and/or plan for the prevention of large-scale accidents, if it is a plant or installation that can cause a large-scale accident.

FMET will reject the application for the issuance of the Environmental Permit if the application is not completed in a timely manner or contains inaccurate data that are of importance for the issuance of an Environmental Permit.

For projects, plants and facilities which can be constructed and commissioned only if they have an Environmental Permit, and which fall under Cantonal level responsibility based on their capacity and size, it is necessary to prepare an Application for Obtaining an Environmental Permit. The Application is submitted to the responsible Cantonal Ministry of Environment, which is obliged to disclose the Application on its website, and to forward copies of the Application to interested stakeholders for suggestions and comments in order to ensure public participation. The Environmental Permit is issued based on the Application.

1. **Agriculture Regulations**

The tables below present regulations related to agriculture in BiH and FBiH.

*Regulations in agriculture, BiH*

| Regulation | Brief Description |
| --- | --- |
| Law on Agriculture, Food and Rural Development of Bosnia and Herzegovina („Official Gazette of BiH”, No. 50/08) | This Law:  a) establishes a framework for institutional structures, competencies, responsibilities, etc., at all levels of government in BiH involved in the development of the agriculture, food sector and rural development;  b) establishes a framework and mechanisms for strengthening competitiveness, the quality of agricultural and food products and the application of standards necessary for achieving more dynamic development in the agricultural, food and rural development sectors;  c) establishes the framework and mechanisms necessary for the preparation of accession and accession to the EU and fulfil all obligations set out in international agreements related to the sector of agriculture, food and rural development in BiH. |
| Law on Protection of New Plants Varieties in Bosnia and Herzegovina („Official Gazette of BiH”, No. 14/10, 32/13) | This Law regulates the procedure for protection of new varieties of plants, conditions, distribution, methods and procedures for the protection and the duration of the breeding rights. |
| Law on Plant Health Protection („Official Gazette of BiH”, No. 23/03) | This Law regulates the health of plants, determines the measures and commitments to prevent occurrences, entrance and spread of harmful organisms on plants, plant products and other regulated objects and their eradication, regulates biological plant protection, sets out the collection and exchange of data and systems of information, regulates the public services concerning plant health, determine the authorities responsible for implementing the Law and prescribing penalties for violations of this Law. |
| Law on Mineral Fertilizers („Official Gazette of BiH”, No. 46/04, 76/11) | This Law deals with issues of distribution of mineral fertilizers and issuing permits for such activities, testing the quality of fertilizer, keeping records and carrying out inspections. To enforce the provisions of this Law, it is necessary to adopt detailed sub-regulations. |
| Law on Phytopharmaceutical Products in Bosnia and Herzegovina („Official Gazette of BiH”, No. 49/04) | This Law regulates the transport and control of active substances that represent phytopharmaceutical products (hereinafter referred to as PPP), PPP registration, licensing under this Law, transport, use and supervision of PPP, the remains of PPP, keeping a register of PPP and the register of legal entities and natural persons dealing with traffic of PPP, providing information on and maintaining records in relation to PPP, the technical requirements for devices for application PPP and their components, competencies of the authorities responsible for the execution of the Law and supervision over its implementation, and regulations adopted pursuant to this Law. |
| Law on Seeds and Seedlings in Bosnia and Herzegovina („Official Gazette of BiH”, No. 03/05) | The purpose of this Law is to provide quality seeds and planting material of agricultural plants to encourage cost-effective agricultural production, with environment and consumer protection. |
| Law on Genetically Modified Organisms („Official Gazette of BiH”, No. 23/09) | This Law prescribes the procedure and conditions for restricted use, transboundary transfer, deliberate release into the environment and placing on the market of genetically modified organisms and products consisting of, containing or derived from genetically modified organisms (GMO).  The aim of this Law is to ensure a high level of protection of human life and health, animal health and welfare, environment and consumer interests, with regard to GMOs and GMO products, as well as living modified organisms, while effectively functioning market of BiH. |
| Law on veterinary medicine („Official Gazette of BiH”, No. 34/02) | This Law regulates which state and entity services must plan, implement, monitor, control, update through this law and bylaws, infectious animal diseases, veterinary prevention, minimum volume of animal health care, fees and costs for animal health care, veterinary activities and their performance, databases and information system, inspection control, as well as the rights and duties of legal and natural persons under this law. |
| Law on animal protection and welfare („Official Gazette of BiH”, No. 25/09) | This Law regulates the responsibility of humans for the protection and welfare of animals in terms of keeping, housing and nutrition, protection from torture, protection of animals at the time of killing or slaughter, stress during transport, protection of wild animals, and treatment of abandoned animals, pets and laboratory animals. , the formation of an ethics commission and an expert council, as well as supervision over the implementation of this law and criminal sanctions for violators of the law. |
| Regulations of the list of harmful organisms, lists of plants, plant products and regulated objects („Official Gazette of BiH”, No. 48/13) | These Regulations prescribe the contents of the list of harmful organisms, the contents of the list of plants, plant products and regulated objects. |
| The list of active substances permitted for use in phytopharmaceutical products in Bosnia and Herzegovina („Official Gazette of BiH”, No. 21/20, 33/20, 49/20) | The list of active substances permitted in phytopharmaceutical products aligned with the official list of active substances permitted in the European Union. |
| Decision to ban registration, import and transport of active substances and phytopharmaceutical resources containing active substances, whose transportation and use is banned in the European Union („Official Gazette of BiH”, No. 02/11) | Decision with a list of banned substances and phytopharmaceutical products whose use is banned in the European Union. |

*Regulations in agriculture, FBiH*

| Regulation | Brief Description |
| --- | --- |
| Law on Agriculture ("Official Gazette of FBiH", No. 88/07, 04/10, 27/12, 07/13) | This Law opens the processes for strengthening competitiveness and raising the quality of agri-food products, as well as the application of standards necessary for achieving more dynamic development in the sector of agriculture, processing and rural development. The law clearly indicates the path of European integration, in a way that support measures for agriculture and rural development will be gradually adjusted at all levels of government, in order to harmonize with the types of measures in the EU. |
| Law on Agricultural Land ("Official Gazette of FBiH", No. 52/09) | This Law defines the term, management, protection and establishment of agricultural land (Article 1), as well as allocation of responsibility for activities related to the cantons and municipalities. It also contains provisions concerning the construction and use of irrigation systems (Articles 85-91). According to Article 26 of this law, discharge of hazardous materials on agricultural land in such quantities that may adversely affect the fertility of agricultural land and the quality of the product is prohibited, as well as the inappropriate use of mineral and organic fertilizers, and pesticides. |
| Law on the Recognition and Protection of Agricultural and Forest Plants ("Official Gazette of FBiH", No. 31/00) | This Law regulates recognition and protection of new varieties and foreign varieties (cultivars) of agricultural and forest plants. |
| Law on Seeds and Seedlings of Agricultural Plants ("Official Gazette of FBiH", No. 55/01, 31/14) | This Law regulates manufacture, transport and import of agricultural seeds and planting materials, and other issues of importance to implementation of a unified system and approach to these issues in the territory of the Federation of Bosnia and Herzegovina. |
| Rulebook on the content, manner and conditions of entry in the registers of agricultural seeds and agricultural seedlings ("Official Gazette of FBiH", No. 05/03) | This Rulebook prescribes the content, form and manner of keeping the Register of producers of agricultural seeds, seedlings and mycelium of edible and medicinal mushrooms, the Register of agricultural seed processors, the Register of laboratories for quality control of agricultural seeds, the Register of importers of agricultural seeds, planting material, seedlings and mycelium of edible and medicinal mushrooms, the Register of Producers of agricultural **s**eedlings and the conditions that must be met by legal entities for entry in the Register and the content of the application for entry. |
| Rulebook on basic requirements, on the quality of agricultural seedlings, method of packaging, sealing, declaration and storage conditions of seedlings of agricultural plants ("Official Gazette of FBiH", No. 51/03, 58/03) | This Rulebook prescribes the basic requirements for the quality of agricultural **s**eedlings, the method of packaging, sealing and declaring, the form and color of the declaration according to the subcategory of **s**eedlings, the manner of keeping records on issued declarations, and conditions for maintaining the quality of **s**eedlings. |
| Ordinance on basic requirements for the quality, packaging and declaration of agricultural plant seeds ("Official Gazette of FBiH", No. 49/03, 12/04) | This Rulebook prescribes obligations, procedures and methods for seed sampling in order to determine the quality of seeds, conditions and manner of packing and declaring seeds, obligations to keep and form records kept by processors and importers of seeds, and conditions for keeping and storing seeds in the store. |
| Instructions on determining the admissible amounts of hazardous substances in soil and methods of testing ("Official Gazette of FBiH", No. 72/09) | These Regulations define harmful and hazardous materials, including sludge from wastewater treatment, maximum admissible content in different types of land. In addition, these Regulations prescribe sampling and monitoring the presence of organic and mineral wastes, and pesticides in soil. |

1. **Waste Management Regulations**

In FBiH, the waste management is regulated by the Law on Waste Management FBiH[[19]](#footnote-19). According to the Environmental protection law of FBiH the Environmental Permit Application must be accompanied by a Waste Management Plan. Article 19. of the Waste Management Law of FBiH prescribes that the Waste Management Plan contains the following:

* Documentation on the waste generated by the company (origin, type of waste pursuant to waste classification list, composition, volume),
* Measures to be taken to limit waste generation, particularly in case of hazardous waste,
* Separation of waste, particularly separation of hazardous waste from other types of waste and from recyclables,
* Waste disposal at the landfill sites,
* Waste treatment and/or disposal methods.

The Regulation on Waste Categories with Lists[[20]](#footnote-20) defines waste categories by activities. Some waste categories which may be generated as a result of activities potentially included in this Project are provided below.

*Waste Generated by the Activities Potentially Included by the Project*

|  |  |
| --- | --- |
| Activity from which the Waste Originates | Regulation Code |
| Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing | 02 01 |
| Soil (including excavated soil from polluted/contaminated sites), rocks and excavated soil from excavator operation | 17 05 |
| Insulating materials and construction materials containing asbestos | 17 06 |

1. **Water Management Regulations**

In FBiH, the Water Law of FBiH[[21]](#footnote-21) prescribes that water management acts must be obtained, regardless of their impact on water abstraction in all industries and activities, especially for industry and energy, as well as for any other activity which may affect volume and quality of water, the water management acts must be obtained.

According to the Water Law of FBiH, water-permitting process consists of three stages:

1. issuing of Preliminary Water Approval;
2. issuing of Water Approval;
3. issuing of Water Permit.

Preliminary Water Approval sets the conditions, which have to be meet by project documentation, such as project design. Request for issuing of Preliminary Water Approval should be submitted parallel with request for issuing of Environmental Permit, as they both are the subject of issuing of Location Permit and Urban Permit. Request for Preliminary Water Approval has to be accompanied with Study for issuing of Preliminary Water Permit. This Study must be prepared by the company licensed by Federal Ministry of Agriculture, Water and Forestry. Preliminary Water Approval validity is expiring after three years, if Request for Water Approval was not submitted in that period.

Water Approval confirms that project documentation submitted with Request for issuing of Water Approval is in accordance with Preliminary Water Approval, other water acts and planning documentation. Request for issuing of Construction Permit has to be accompanied with Water Approval. Water Approval validity is expiring after two years, if Construction Permit was not issued and construction works were not started in that period.

Water Permit confirms that all the requirements set in the Water Approval are met and is issued before the Use Permit. The Water Permit defines purpose, terms and conditions of water use, facility and plant operating regime, terms and conditions of wastewater discharge, terms and condition of solid waste and liquid waste disposal and other terms and conditions. It also defines the applicant’s obligations related to wastewater measurement, measurement frequency, quality control and records keeping on used water, as well as obligations related to water fees accounting and payment. Water Permit is being issued for limited time period, but not longer than for 15 years.

In FBiH, water documentation is issued pursuant to the Regulation on Content, Form, Terms and Conditions and Manner of Issuance and Keeping of Water Documentation[[22]](#footnote-22).

Article 111 of the Water law of FBiH foresee that Preliminary Water Approval is obtained within the Environmental Permit obtaining procedure. It is thus ensured that the environmental ministry can integrate in the Environmental Permit any water protection-related recommendations and measures.

In FBiH, the Sava River Water Agency, the Adriatic Sea Water Agency and Cantonal Ministries are responsible for issuing water management acts.

1. **Construction Regulations**

The purpose of spatial planning is the optimal deployment of people, material goods and activities in space through organization, arrangement, use and protection of land resources. Spatial planning adopts an integrated approach that combines natural, anthropogenic and created spaces to solve spatial conflicts. In legal terms, spatial planning in BiH is the exclusive constitutional competence of entities and cantons. Such division of competencies requires the adoption of laws and bylaws at entity and cantonal level. The coverage of the country with spatial plans is incomplete.

In FBiH, construction is governed by the following legislation:

* The Law on Physical Planning and Land Use of FBiH[[23]](#footnote-23)
* Cantonal Laws on Physical Planning and Construction.

The Law on Physical Planning and Land Use of FBiH regulates: planning of land use through the development and adoption of planning documents and their implementation; the type and content of planning documents; land use at the entity level; control of the implementation of planning documents relevant for the entity; control over the enforcement of this legislation and penalties for legal entities and individuals.

Planning at all federal levels must be harmonized with specific regulations from the sectors of environment, water, land, forestry, health etc. as per article 9 of the Law.

Article 25. stipulates that institution responsible for enacting of Physical plan must provide to the entity that is responsible for elaboration of the Plan all relevant documentation including: water management plans, forestry plans, environmental strategy, development plan of agriculture, economy, transport etc. Institution responsible for enacting of Physical plan must enable cooperation and harmonization of the opinions with all stakeholders and space users and particularly with institutions responsible for water, forestry, agriculture, transport, energy, tourism health etc., and provide opinions and approvals from responsible institutions.

Pursuant to this law and cantonal regulations on physical planning and construction, in order to construct facilities, it is necessary to obtain an Urban Permit, Construction Permit and Use Permit. Depending on the type of construction, these permits are issued by the Federal Ministry of Spatial Planning, the Cantonal Ministries relevant for spatial planning, or by the local self-government units (Cities or Municipalities).

The Decree on Construction Site Organization, Mandatory Documentation on Construction Site and Construction Participants[[24]](#footnote-24) specifies the documents that must be kept at construction sites, including a Construction Site Organization Plan (CSOP). The CSOP contains the following:

* Description of preparatory works and site arrangements works during and after construction works,
* Description of technological scheme,
* Elaborate on Safety (composed of Elaborate on Protection at Work and Fire Fighting and Explosion Protection Elaborate),
* Environmental Protection Elaborate during construction works.

The CSOP must be developed by the Contractor for construction works prior to the commencement of construction works. It has to be controlled and signed by the Supervisory Authority which is the legal entity responsible for the overall supervision of construction works, as stipulated by the above-mentioned Decree. The Plan should correspond to the requirements, safety measures and obligations contained in the Environmental Permit or environmental protection requirements laid down in the construction approval process.

Water Approval and Environmental Permit are both the subject of issuing of Urban Permit. Investor is responsible for submission of Request for issuing of Urban Permit. Request has to be accompanied with Preliminary design. Ministry is obliged to respond on the request 30 days upon submission of Request. If the Request is not complete (e.g., document is missing), the authority will request this document, and 30 days period will start after all missing documents are submitted. Location permit is valid one year, and within that period Request for issuing of Construction Permit have to be submitted.

Article 54 defines the issuing of Construction Permit. Party to which the Location Permit is assigned is responsible for submission of Request for issuing of Construction Permit. Request for issuing of Construction Permit has to be accompanied with Detail design.Ministry is obliged to respond on the request 30 days upon summation of Request. If the Request is not complete (e.g., document is missing), the authority will request this document, and 30 days period will start after all missing documents are submitted.

1. **Land Acquisition**

The proposed Project activities might have smaller involuntary resettlement and/or land acquisition that might be necessary to implement territorial development component or some parts of infrastructure works. Prior to the submission of subprojects for funding consideration, the PIU shall carefully screen the proposed subprojects to assess whether or not land acquisition may be required and to what extent.

The land acquisition in FBiH is regulated by the Law on Expropriation of FBiH (“Official Gazette of FBiH”, no. 70/07, 36/10, 25/12, 8/15 and Decision of Constitutional Court 34/16).

This Act regulates the conditions, manner and procedure of expropriation of the property for the construction of facilities of public interest. Property can be expropriated for construction of roads, business and industrial zones, economic, communal, medical, educational and cultural structures, civil defense structures and other structures of public interest as per article 3. The expropriation target includes real property owned by individuals and legal entities.

Property can only be expropriated upon the declaration of public interest for the projects. Expropriation may be carried out for the needs of the Federation of Bosnia and Herzegovina, cantons, cities, municipalities, public companies, their 100% owned subsidiaries and public institutions. Exceptionally, expropriation may establish easement in favor of citizens for the purpose of installing water and sewage pipes, electric and telephone cables, gas pipelines and in other cases determined by law as defined by the Article 6.

Public interest is declared by a special decree or a law (Art. 14 and 15). The public interest in the construction of a facility or the performance of other works in the area for which a regulatory plan or urban plan has been adopted shall be considered determined by that plan, i.e., project.

Expropriation may be complete or incomplete.

Complete expropriation allows the beneficiary of expropriation to obtain legal title over the expropriated property, i.e., it becomes the property of the expropriation beneficiary, while the rights of the previous owner over the property as well as other rights over that property cease to exist (Art. 7).

Incomplete expropriation does not entail change of ownership of land. Incomplete expropriation can establish easement on land and buildings as well as lease on land for a certain period of time (Art. 8)

By expropriating the property, the beneficiary of the expropriation acquires the right to use that real estate for the purpose for which the expropriation was performed. Landowners affected by a partial loss of their property are entitled to request complete expropriation and the corresponding compensation, in case partial expropriation would deteriorate the economic situation of the actual property owner or make the remaining part of the property useless or difficult to use. Owners must be informed of such right by the municipal/city authority. Such request may be submitted until the Decision on Expropriation is issued in the first instance, as well as during the appeal procedure if the affected owner was not informed of such right. (Art. 11).

Prior to submitting the proposal for expropriation, the expropriation user is obliged to invite the property owners through a public announcement for the purpose of acquiring the property by mutual agreement as per Art 23. Expropriation can be started only after the required funds have been secured and deposited with the bank in the assessed total sum for payment, or proof of existence of replacement properties provided (Art. 24) and compensation must be provided prior to formal transfer of ownership (Art. 31).

For reasons of urgency and in order to avoid major damage, the beneficiary of expropriation may take possession of land even before the Decision on Expropriation becomes final and before compensation is paid, but solely on the basis of a decision by the FBiH Government. Generally, compensation is provided by replacement with another appropriate property corresponding to the market value of the real estate expropriated in the same municipality or city but if the owner refuses such replacement property, or replacement property cannot be provided by the beneficiary of the expropriation, compensation is paid in cash at market value of the property.

The Law on Proprietary Rights (“Official Gazette of FBiH”, No. 66/13, 100/13 and Decision of Constitutional Court 32/19) stipulates acquisition, use, disposal, protection and termination of ownership rights and other proprietary rights as well as possession rights, including issues of restricting such rights, the right of servitude, co-ownership and joint ownership rights, the procedure for acquiring property rights over land and/or structures build on someone else’s land. Protection of ownership rights and other proprietary rights is guaranteed by this Law. According to the Article 2, ownership rights and other proprietary rights can only be limited or taken away only in public interest but only under specific conditions defined by the Law in accordance with principles of international law. For the purpose of protection of natural resources, the environment, human health, cultural and historical heritage, etc., the manner of use and disposal of certain items may be limited or specifically regulated. A significant provision of the Law is that occupants of property acquire ownership rights upon 10 years of conscientious and legal occupancy, or upon 20 years of conscientious occupancy. In addition, the Law provides that the conscientious builder of a structure on land owned by another person is entitled to acquire such land, if the land owner did not oppose to the construction. The land owner is in this case entitled to request to be compensated for the market value of the land.

1. **Labor Regulations**

The key legislation that regulates the terms and conditions of employment in FBiH are:

* Labor Law of FBiH (“Official Gazette of FBiH”, No. 29/16, 89/18 and 23/20 - Decision of Constitutional Court)
* Law on Health Insurance (“Official Gazette of FBiH”, No. 30/97, 7/02, 70/08, 48/11, 100/14 and Decision of Constitutional Court 36/18)

Labor Law of FBiH[[25]](#footnote-25) regulates the rights, obligations and responsibilities of employers and workers in relation to the implementation and improvement of safety and health protection of workers at work, as well as general principles of prevention and the system of rules of safety and health at work whose application helps in preventing injuries at work, occupational and other diseases related to work, as well as the protection of the working environment, and other issues related to safety and health at work. Law defines the conclusion of employment contract, working hours, salary, work contract termination, right and obligations under employment contracts and collective bargaining. The Law, inter alia, treats rights of worker and employer to enter employment contract, rights of minor and female workers, safety and health at work. Provisions of this Law are harmonized with International Labor Organization (ILO) Conventions on forced work, discrimination, child work, equal pay, freedom of association, freedom of organization and collective bargaining.

The laws prescribe in Article 20 the minimum employment ageof 18 for concluding an employment contract, with exception of allowing persons between 15 and 18, with the consent of their legal custodians and based on a medical certificate issued by health facility, and provided that the given job does not endanger the minor’s health, moral and education. Employment contracts can be concluded as open ended or fix-term or part-time (Art. 22).

The terms and conditions provided by this Law include prohibition of discrimination in terms of employment requirements and selection of candidates, education, training and professional development, promotion and employment contract termination (Art. 10). Discrimination of workers and job seekers is prohibited with regard to sex, sexual orientation, marital status, family obligations, age, disability, pregnancy, language, religion, political and other opinions, ethnic origin, social origin, financial status, birth, race, skin color, membership or lack of in political parties and trade unions, health status, or any other personal characteristic. Harassment and sexual harassment are also prohibited (Art. 8).

Women in course of pregnancy and childbirth are given special protection. Women are entitled to 52 weeks of maternity leave. Employer cannot refuse to hire a woman because of her pregnancy or maternity leave. Furthermore, it is not allowed to terminate a labor contract to a woman after the expiry of the maternity leave.

Full working hours amount to 40 hours per week and they can be allocated to max. six working days (Art. 36). The Law prescribes breaks during working hours, as well as daily (at least 12 hours) and weekly rest (at least 24 hours). For working longer than 6 hours a day, a worker shall be entitled to rest in the duration of at least 30 minutes (Art. 44).

Employer’s obligation is to register workers for pension and disability insurance, health insurance and insurance in case of unemployment.

The worker is entitled to an increased salary for difficult working conditions, overtime and night work, and for work on a weekend, holidays or any other day for which it is determined by law not to work in accordance with the collective agreement, work regulations and employment contract (Art, 76). The Law guarantees the worker’s right to a fair salary and full compensation of salary for the period of annual holidays, official holidays and temporary inability to work due to injury at work or occupational disease (Art. 81).

Workers are entitled to remuneration of salary during temporary inability to work caused by sickness or injury or other reasons provided for by the Law on Health Insurance[[26]](#footnote-26). Salary compensation is entitled to the worker only for the days for which he would be entitled to salary or salary compensation in terms of employment regulations. Salary compensation is determined in the amount of at least 80% of the base for compensation, provided that it cannot be lower than the amount of the minimum salary valid for the month for which the compensation is determined. Salary compensation during sick leave amounts to at least 80% of the salary, whereas salary compensation during sick leave for injuries at work, for diseases related to pregnancy and birth, and for organ transplantation amounts to 100% of the salary.

The salary of workers and the elements for basic salary on the basis of working performance are determined by the collective agreement, the rulebook and the employment contract.

1. **Safety at Work Regulation**

The legislation that regulates the occupational health and safety in FBiH is Law on Protection at work of FBiH (“Official Gazette of FBiH”, No. 79/20)

Law on Protection at work of FBiH[[27]](#footnote-27) has been harmonized with the ILO Convention on Occupational Safety and Health, No. 155[[28]](#footnote-28) and Occupational Safety and Health Recommendation No. 164[[29]](#footnote-29) of the ILO, as well as the provisions of the revised European Social Charter relating to the right of workers to safe and healthy working conditions[[30]](#footnote-30), which Bosnia and Herzegovina has accepted and ratified. The provisions of Council Directive 89/391/EEC of 12 June 1989[[31]](#footnote-31) on the introduction of measures to encourage improved security and Occupational health, which contains general principles regarding the prevention of occupational risks, safety and health at work and the elimination of risks that may cause accidents, on which all modern European laws governing this area are based, have been used during the preparation of this Law and the said directive has been transposed into legislation of Federation of Bosnia and Herzegovina.

Safety and protection of health at work, in terms of this law, is the provision of such working conditions which prevent the occurrence of occupational injuries, occupational and work-related diseases as much as possible and which create a precondition for full physical, mental and social safety of employees.

As per article 10 the employer who prepares technical documentation for facilities and technical-technological processes is obliged to apply the prescribed measures of safety and health protection at work when designing facilities and technical-technological processes, with an indication of all risks and measures for their elimination.

An employer who performs works on construction, installation, replacement of equipment, overhaul or reconstruction of facilities is obliged to prepare a Study on the arrangement of the work site and ensure the performance of works according to that study Art. 12). Work equipment must correspond to the work process being performed and must be appropriately adapted to that purpose so as not to endanger the safety and health of workers.

The employer is obliged to determine the organization of the implementation of occupational safety, the rules of prevention and protection by its internal act on occupational safety (Art. 23).

The employer is obliged to organize safety and health at work, perform risk assessment for each job, enable the employee to get acquainted with safety and health measures before starting work, adopt an internal act on occupational safety, informs workers about the introduction of new technologies and means for work, and dangers and harms to the health of workers, prepares workers for safe work and provides workers with means and equipment of personal protection, provides periodic medical examinations, provides periodic examinations means of work and equipment for protection at work, implement fire protection measures, implement measures to ensure first aid, and to inform the competent labor inspection of any death, accident that struck one or more workers, serious injury, occupational disease, any occurrence or diseases affecting more than one worker and any occurrence which could endanger the life or health of workers at work (Art. 22).

Workers are obliged to use personal protection equipment and comply with other instructions related to safety at work.

Vulnerable groups, such as pregnant women, mothers or nursing mothers, minors, persons with disabilities, as well as workers with changed working capacity in terms of pension and disability insurance regulations, are not allowed to work in jobs where there is a risk to their physical and mental health and life and in a difficult working condition (Art. 70).

**ANNEX 4. MINUTES OF THE PUBLIC CONSULTATION**

**Minutes of the public consultation on the document**

**„Environmental Management Plan (EMP) for the Sub-Project areas Klokot – Papari and Bakšaiš in the City of Bihać (Draft)“**

**Location:** Kamenica Elementary School, Kamenica Local Community (City of Bihać)

**Date and time:** 20/08/2019 at 10:00 a.m.

**Topic:** Introducing the key stakeholders with the document content and discussion; Agenda is given in Annex 1

**Participants:** The consultations were attended by 21 participants: the representative of the Federal Ministry of Agriculture, Water Management and Forestry (FMPVŠ) / PIU Forestry and Agriculture, representatives of the City of Bihać, two representatives of irrigation system designer IPSA Institute, Sarajevo, three representatives of the consultants - the developers of the Environmental Management Plan (hereinafter: the Plan) – Hydro-Engineering Institute (HEIS) and Oikon Ltd. Zagreb and the interested public, agricultural producers interested in using the irrigation system. The list of participants is given in Appendix 2 and photos in Appendix 3.

In the introductory part, the representative of the City of Bihać **Nijaz Lipovača** welcomed all the attendees and emphasized the importance of this project for the City of Bihać and asked everyone to participate in the public discussion on this project and invited the representative of the consultants, Božica Šorgić (Oikon) to present a draft Plan, followed by discussion and answering the questions asked to the consultant.

**Discussion, questions and answers to questions:**

**Amela Ibrahimović (Ministry of Agriculture, Water Management and Forestry of the Federation of Bosnia and Herzegovina, Representative of PIU Forestry and Agriculture)**: Before formal discussion, I would like to ask the representatives of the City of Bihać about the status of permitting since this is very important now, since resolving property and legal relations is a condition for issuing a building permit.

**Nijaz Lipovača (City of Bihać):** We are in the phase of collecting requests from the institutions, electro power consent; we have obtained the prior water approval and this will be forwarded to the relevant ministry. In order not to waste time, we have already started the procedure. We have a promise from the relevant minister that he will endeavour to issue an urban approval as soon as possible and then we have to resolve the property relations issue.

Amela Ibrahimović (MAWMF, Representative of PIU Forestry and Agriculture): Can the process of resolving property relations go in parallel instead of waiting for permits, because we have a route, we have defined plots, owners, co-owners. I'm afraid it will take a long time. The World Bank procedure is clear and requires the signing of a contract with each owner or co-owner of a plot to agree that a pipeline or shaft goes through his land. So far, we have had the practice that all this was dealt with by temporary expropriation, so the canal is dug, the pipe is laid, the earth returns to its original state and it is still in identical function, with no consequences for the next sowing season. But the paper with each owner must be signed, that is, he must be familiar with the conditions and the construction process. That is why the idea was to organize this public hearing at location so that everyone would be familiar with the project, because resolving those 236 plots, 220 of which are privately owned, would take a lot of time and there would be no construction until it is resolved.

**Nijaz Lipovača (City of Bihać):** We did not know that we could resolve property and property relations in parallel before obtaining a planning permit. If this is the case, we have called the relevant department for property relations, which is not present now, and we will convey it to a colleague to begin the process.

Amela Ibrahimović: We sent a letter to the City of Bihać with clear instructions on the terms of signing the contract with the owners that contains three - four articles, which clearly show that the contractor's obligation is to restore the land to its original state, so that there is no consequence for the land owner. Certainly the works would be done after the crop was raised. In most cases it is not about expropriation of the whole plots, but only of the part where the shaft or the pipeline is laid so that it will not affect the agricultural work. I would be available all time, so you can contact me on mail or telephone asking any question because the Bank has clear instructions on this issue.

**Sijana Hošić (Urban Planning Service, City of Bihać):** The project manager is the Local Development Service. In a name of our urban planning service, I am not sure that there is a legal basis for an incomplete expropriation without any decision or document. Someone has to confirm those cadastral parcels on which certain parts of projects will go through. We'll check it out. As far as this project is concerned, our service, by law, was not competent for issuing urban approval, we had to forward this request to the cantonal ministry, since it covers more than 5 ha of uncultivated area. According to the Regulation on issuing urban approvals, it fell under the jurisdiction of the cantons. We talked about how we could facilitate some phases because the project develop through stages (first, second ...) and that according to the Law on spatial planning it could be treated as a complex building where expropriation would be solved in stages while the urban approval must be completely issued. This is what the canton is doing, we are rushing them and we do not know at what stage they are now. As for the construction permit, it is a complex process and it may be better to go through the stages in order to forward immediately to realization. It is easier to deal with construction permit when you, in the first phase, have 50 cadastral parcels instead of 220.

**Amela Ibrahimović:** A possible reason why it is divided into phases is the short implementation period. I'm not going into the legal procedure, but the World Bank procedures are clear and we must follow them and we are here to help.

**Jasmin Stambolija (Assistant of the Mayor for Utilities, Water and Environmental Protection):** Regardless of the fact that we have a minister who is really a worker and who works, that deadline is so tight that the question is whether it is possible. When a urban permit is obtained, there are still legal procedures in place. So far, according to my experience in this area, just considering the process of resolving the property issue, I am afraid that the deadline is so tight. The mayor employed new lawyers that will work only on the property issues for this project.

**Sijana Hošić (Urban Planning Service, City of Bihać):** This is a very large project.

**Amela Ibrahimović**: I understand what you are talking about, but this project was nominated among the last and therefore entered in the third phase of the subprojects. The Bank made it clear, this project will not be extended. Unofficially, a new WB project is in course that might include all those issues that have failed to realize within this project, but that is, if and when it could be. What is known for certain is that November 30th is the end of the project. What we have done by then is done, and whether the continuation of the works will be part of another project is unknown for now, and we cannot talk about it.

**Sijana Hošić:** Is this deadline November 30th deadline for start construction work or ...

**Amela Ibrahimović**: Completion of works. When a project closes, the line is drawn, what is done, what is paid. This is it.

**Jasmin Stambolija:** To be realistic, this cannot be done neither in our country nor in Switzerland due to public procurement reasons.

**Amela Ibrahimović**: Procurement procedures are not by local rules but by World Bank procedures, so there is no appeal process.

**Jasmin Stambolija:** This is clear, but again, given the financial amount, you have one period of 40 days.

**Amela Ibrahimović**: Clearly, this is a period that must be.

**Jasmin Stambolija:** Then you have an evaluation process. We have 50 days to select a contractor, but given the financial amount, there is legal time that must passed. For the amount of about a million and a half it's about 40 days. About 40 days only to procure.

**Amela Ibrahimović**: Let's not talk about it now. Let's go do the job. There is a possibility that this can be continued, done… we are going with the aim of realizing it faster, we should take the opportunity and eventually when we draw the line we will see where we are.

**Jasmin Stambolija:** I agree. This does not mean that we will not work. We will work today. It's just that we're aware of the real problems. This public debate is an opportunity to talk about everything, not to say tomorrow, we did not know.

**Sijana Hošić:** We did not even have completed conceptual design, which we received at the end of May. Without a project, nothing can be done.

**Amela Ibrahimović**: These were the deadlines, you saw how the project development was going.

**Jasmin Stambolija:** You know the deadline was broken, but that's how it is. As my colleague Sijana also said, we will start this today, and we have the promise of the Minister.

**Ekrem Okić (President of the Kamenica Local Community):** I would welcome you all and as I said at the last public hearing on the conceptual design, the biggest problem is property relations. It is not a problem for residents which are eagerly anticipating this project. We know your good intention to do what was needed and now it's up to us. Most of the people did not respond, it's the time of vacations, it's the season ... and it might be better if they didn't hear what the problems were.

It probably takes a little more effort to complete this project. I would not like to open new discussions. I know we need to end this discussion on issues that are not going to be, and with a little positive view to see what is to be done for each of us.

**Kasim Nadarević (President of the Klokot Association):** A consultant was talking about irrigation, which is the amount that will be affected because here is an information that the Klokot River rises and flows up to 18 times, flooding both the right and left banks. Part of a neighbourhood where I live, for example, sometimes is so flooded that it can't be reached. Is there a link between your project and the flood ? I would like to know about the information on the flora and fauna that has been provided - since this is actually an area which is extremely rich in flora and fauna, I have been following it for years. And what about the water concession?

**Božica Šorgić (representative of consultants)**: We have also designers hear with us, so maybe they can answer better on the flood questions.

**Munir Trako (designer):** The values abstracted from the Klokot River are really small, much less than the ecologically acceptable flow. They have no effect on the floods.

**Božica Šorgić:** Regarding flora and fauna, colleagues were at the field, visiting these areas intended to be irrigated, and these are areas on the left bank that are now under agricultural production or have been neglected. Which area were you referring to?

**Kasim Nadarević:** Yes, this is the left bank area towards the source of the Klokot River, which is extremely rich in flora and fauna.

**Božica Šorgić:** And you probably meant on the area that is rich in flora and fauna toward river source that is not covered by this project, which will not be irrigated. The irrigation area is some 1.8 km away downstream from the river spring. On one of the slide from the presentation, you can better see what areas are the part of the project.

**Kasim Nadarević:** Is this the area along the Klokot road? Area that is phase IV - is it along the road to LC Klokot ?

**Munir Trako (designer):** Yes, that's the area.

**Sijana Hošić:** There is the Kamenica Bridge, there is the main road and this is where the reservoir is planned to be elevated because it needs to be at a higher attitude due to the need of the fall - there are forests around, but there is one plot - a plowed land. Designers know that there have been three to four variants of location of the reservoir because it needs to be elevated due to the fall. It turns out that this is, even the pipelines are a bit longer, the best design solution.

**Kasim Nadarević (President of the Klokot Association):** In relation to the concession for the water capture is it a contract for exploitation e.g. 10 L in 3 seconds, this is for pumping only?

**Erna Zildžović** **(representative of consultants)**: Yes, it is a concession only to water capture of planned quantity at that location only, and you need to issue it only for that capture.

**Amela Ibrahimović**: The project itself was discussed at a public hearing a month ago and the city has decided that this option is the most acceptable and the Main project is being done accordingly.

**Sijana Hošić:** It's been a long time since we've done this procedure to identify the cadastre particles, prepared material for the ministry to get it started as soon as possible.

**Jasmin Stambolija:** We will present this to the Mayor today, because this project means a lot to him, it is important to him.

**Amela Ibrahimović**: What can slow down the process are displaced people, unsolved hereditary issues, but there is also a clear instruction on how to resolve this.

**Sijana Hošić:** Question for the designer, I didn't find it in the preliminary design, but does the designers envisioned flood protection measures ?

**Munir Trako:** Such measures are intended only for a pumping station that is located at a height of 50 cm above the level of 100 annual river water, and for the rest it is not provided.

**Zerina Kurić (Local Community Klokot-Papari):** I just wanted to say that there are 230 plots here, and for those 230 plots, there are nine inhabitants of Klokot area. Other owners should be sought. I personally informed all nine either by message or "at the door." They are not problem. The rest are not locals of my LC. There are those from the city departments who are in charge of these issues, so they need to be addressed, I can't do it.

**Amela Ibrahimović**: There is a procedure for how this is handled, so we will be in touch and handle it when it comes to that stage.

**Božica Šorgić:** All owners are listed in the preliminary design - the owners of the cadastral parcels.

**Ekrem Okić (President of the Kamenica Local Community):** There are owners present now among us.

**Amela Ibrahimović**: It is very important to us at this point that everyone is informed about what will be done, how it will be done… I am just afraid of the lack of interest on the part of the farmers.

**Ekrem Okić (President of the Kamenica Local Community):** Here, everyone is waiting to see that it works and then so will they.

**Amela Ibrahimović**: It is important that they know that it costs them nothing.

**Ismet Kurić:** Objectively, the value of the land increases on all plots that are within this irrigation route. We have those who will. I have no doubt that farmers are for it. We have no time to waste. I do not think that urban approval will be a problem for the government and they will solve it quickly.

**Nijaz Lipovača:** The issue for designers is that the secondary network does not go along the plot itself, but along the edge of the plot, so that it greatly facilitates the project implementation for us as the City and for the owner as a mitigating circumstance. There is also a last soultion, I do not believe it will happen, if it happens that someone does not agree there is a last technical solution to get around this plot so that the owner will be at a loss.

**Sijana Hošić:** The one who be on the field should be eloquent to convince these owners that they have the benefit of this project.

**Amela Ibrahimović**: That is why we have tried to bring this discussion to the location. The next who will come to the site is a representative of the City, and then the Contractor, and before that, they must have approval.

**Nijaz Lipovača**: We will be free to contact you to facilitate us.

**Amela Ibrahimović**: As it suits you, there is an option to invite people on the location, or to gather people in one place or to go in groups.

**Ismet Kurić:** Individually, there will always be some who are always against, but we do not expect some bigger problems, people expect something to happen and build and the city government will play a major role in the realization of the project. I do not believe that by the end of the 11th month it will be realized 100%, but at all stages part of the job, decision making, happening on the ground can happen - to harmonize the dynamics to happen in parallel.

**Amela Ibrahimović:** In order not to waste time, as soon as the Main Project is completed, we can already agree and announce the tender. This period of some 40 days can be used to finally resolve property law and obtain the necessary documentation from the City, but the contract with the selected contractor cannot be signed until a building permit has been issued.

**Jasmin Stambolija:** Now we had a contract for plumbing ...

**Ismet Kurić:** And I promise on behalf of my father that he will certainly not cause problems as an owner.

**Amir Dedić (one of two owners, co-owners of individual plots):** The owners of these plots live in areas other than Klokot Municipality, Kamenica. We, as owners, are not aware of the benefits we get with this project. Anything that can be accelerated, let it be accelerated to try to realize that project or continue through another phase. As an owner, I am not even aware of the benefits. People are sceptical, when the works begin we will be happier and think about what to sow - corn has traditionally been sown, and it is no longer a crop to sow, it needs something more profitable. This is a modern project where tomorrow, we can switch to modern, cost-effective agriculture. These are small parcels, but interest will be found and these parcels can be purchased to exploit the potential of the Klokot River. I will tell you, when my grandfather came here and saw what the land was like along the Klokot River, he was grateful to have come to such fertile land. With this irrigation it can be an agricultural oasis of the City of Bihać. Let the project go in stages if necessary. The most of the owners does not have information about the project.

**Amela Ibrahimović:** At the public discussion of the conceptual design, the designer presented even other crops that could be grown there, so that not only corn but other, more profitable crops could be used.

**Sijana Hošić:** What is important to us is that this has always been planned through the spatial planning documentation as agricultural land, so this could be regard as "brought to its purpose" and it is easier for the owners themselves to know that it could never have been possible to build there. We will all do what we can and when we reach some stage we will deal with it.

**Jasmin Stambolija:** What are the stages that you can do to after the urban permit, obtaining a building permit and tender - tendering?

**Amela Ibrahimović:** We can post the tender and then the period runs, while you handle your paperwork.

The representative of the consultant thanked all those present.

Minutes prepared by Božica Šorgić, 22/08/2019

**Annexes:**

Annex 1. Agenda

Annex 2. List of participants

Annex 3. Photos

**ANNEX 1.**

**Public consultation on the document**

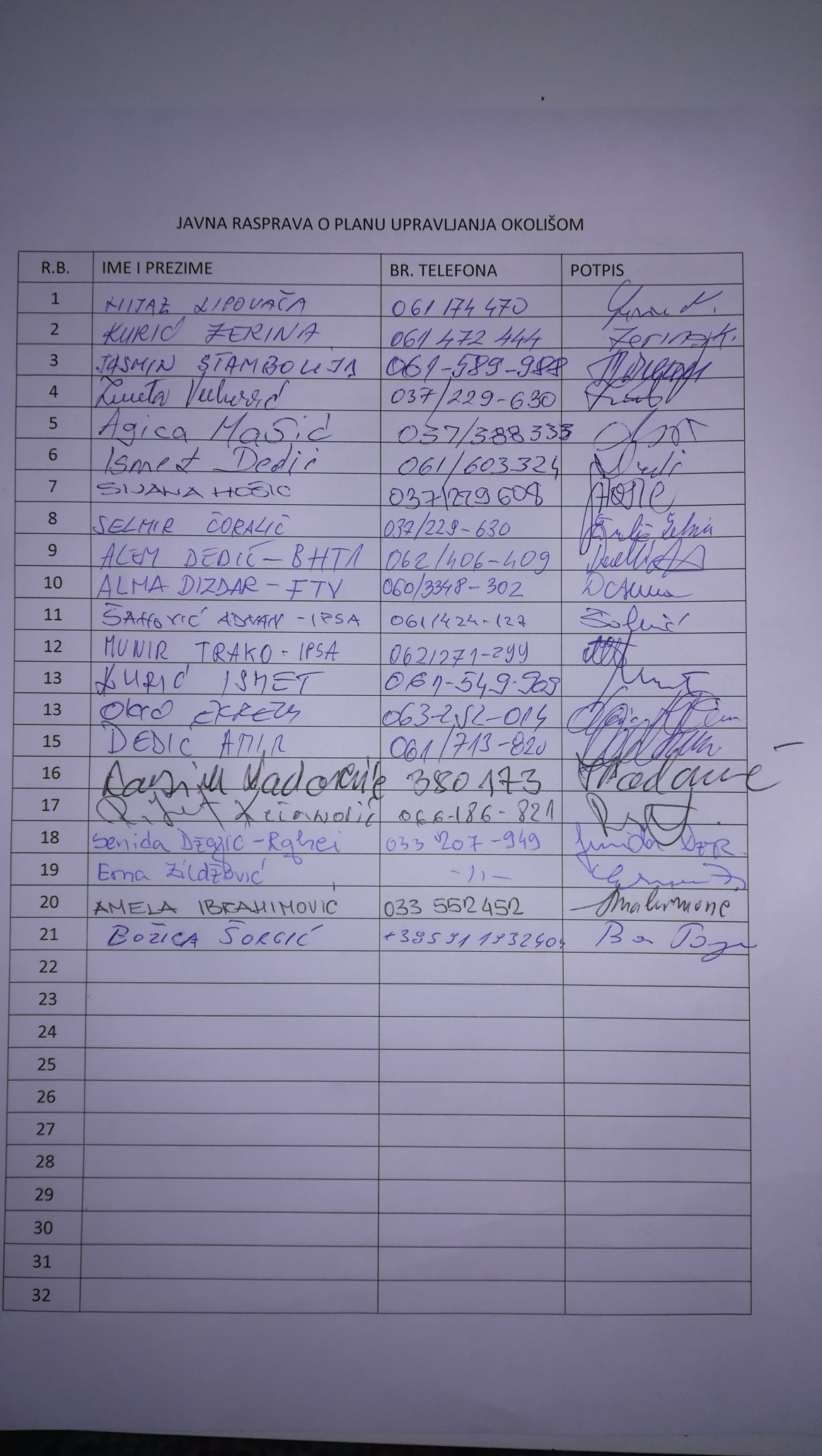
**„Environmental Management Plan (EMP) for the Sub-Project areas Klokot – Papari and Bakšaiš in the City of Bihać (Draft)“**

**Bihać, 20/08/2019**

**AGENDA**

|  |  |
| --- | --- |
| **Time** | **Activity** |
| **10:00 – 10:15** | **Welcome**  *Mayor of the City of Bihać*  *Representative of PIU Forestry and Agriculture* |
| **10:15 - 11:15** | **Presentation of Environmental Management Plan (EMP) for the Sub-Project areas of Klokot – Papari and Bakšaiš (subsidiaries Kralje – Vrkašić) in the City of Bihać (Draft),** *Consultants* |
| **11:15 – 11:30** | **Coffee break** |
| **11:30 – 12:15** | **Discussion and comments**  *Participants* |
| **12:15 – 12:30** | **Conclusions** |

**ANNEX 2.**

****

**ANNEX 3.**









1. Preliminary design of irrigation system in sub-project areas in City of Bihać, December 2019, IPSA Institut, Sarajevo; Eptisa [↑](#footnote-ref-1)
2. Accessible at - https://www.worldbank.org/en/projects-operations/environmental-and-social-framework [↑](#footnote-ref-2)
3. Preliminary design of irrigation system in sub-project area in City of Bihać, December 2019, IPSA Institut, Sarajevo; Eptisa [↑](#footnote-ref-3)
4. Ibid [↑](#footnote-ref-4)
5. Preliminary design of irrigation system in sub-project area in City of Bihać, December 2019, IPSA Institut, Sarajevo; Eptisa [↑](#footnote-ref-5)
6. Ibid [↑](#footnote-ref-6)
7. Preliminary design of irrigation system in sub-project area in City of Bihać, December 2019, IPSA Institut, Sarajevo; Eptisa [↑](#footnote-ref-7)
8. Water Management Plan for the Sava River Basin in the Federation of Bosnia and Herzegovina (2016 – 2021), Accompanying document no. 10 - status assessment and risk assessment for surface water bodies, November 2016 [↑](#footnote-ref-8)
9. Development Stratgy of Bihać Municipality 2014-2023 [↑](#footnote-ref-9)
10. Federal Institute for Statistics, „ Una-Sana Canton in numbers.“, Sarajevo, 2019 [↑](#footnote-ref-10)
11. [www.statistika.ba](http://www.statistika.ba) [↑](#footnote-ref-11)
12. Federal Institute for Development Programming, "Socioeconomic Indicators by Municipalities FBiH in 2018.“, Sarajevo, June 2019 [↑](#footnote-ref-12)
13. „ Development Strategy of Bihać 2014-2023“, January 2014 [↑](#footnote-ref-13)
14. Federal Ministry of Agriculture, Water Management and Forestry, „Irrigation Development Project in Bosnia and Herzegovina (IDP)“, „Environmental and Social Management Framework“, January 2012 [↑](#footnote-ref-14)
15. Law on Changes and Amendments to the Law on Waste Management („Official Gazette of FB&H“, No. 72/09) [↑](#footnote-ref-15)
16. Official Gazette of FBiH, No. 15/21 [↑](#footnote-ref-16)
17. Official Gazette of FBiH, No. 19/04, 1/21 [↑](#footnote-ref-17)
18. Official Gazette of FBiH, No. 19/04, 1/21 [↑](#footnote-ref-18)
19. Official Gazette of FBiH, No. 33/03, 72/09, 92/17 [↑](#footnote-ref-19)
20. Official Gazette of FBiH, No. 9/05 [↑](#footnote-ref-20)
21. Official Gazette of FBiH, No 70/06 [↑](#footnote-ref-21)
22. Official Gazette of FBiH, No. 06/08, 57/09, 72/09 [↑](#footnote-ref-22)
23. Official Gazette of FBiH, No. 2/06, 72/07, 32/08, 4/10, 13/10, 45/10 [↑](#footnote-ref-23)
24. Official Gazette of FBiH, No. 48/09, 75/09, 93/12, 74/13, 89/14, 99/14, 53/15, 101/15 [↑](#footnote-ref-24)
25. Official Gazette of FBiH, No. 29/16, 89/18, 23/20 - Decision of Constitutional Court [↑](#footnote-ref-25)
26. Official Gazette of FBiH, No. 30/97, 7/02, 70/08, 48/11, 100/14, 36/18 [↑](#footnote-ref-26)
27. Official Gazette of FBiH, No. 79/20 [↑](#footnote-ref-27)
28. Convention on Occupational Safety and Health No. 155, 1981, ILO, Available at: <http://www.ilo.org/dyn/normlex/en/f?p=normlexpub:12100:0::no::p12100_instrument_id:312300> [↑](#footnote-ref-28)
29. Occupational Safety and Health Recommendation (No. 164), 1981, ILO, Available at: <http://www.ilo.org/dyn/normlex/en/f?p=normlexpub:12100:0::no:12100:p12100_instrument_id:312502:no> [↑](#footnote-ref-29)
30. European Social Charter 1961, Available at: <https://www.coe.int/en/web/european-social-charter> [↑](#footnote-ref-30)
31. Council Directive 89/391/EEC Of 12 June 1989 on the Introduction of Measures to Encourage Improvements in the Safety and Health of Workers at Work [↑](#footnote-ref-31)