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

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

**for**

**Irrigation System in Sub-Project Areas of Šehovci and Trnova in Sanski Most Municipality (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 7

3.4 Irrigation Water Demand and Drainage Demand 7

3.5 Assessment of Water Demands for Agriculture 8

3.6 Description of New Irrigation System 9

3.6.1 System of free water distribution 9

3.6.2 Drainage and protection against excess water 12

3.7 System Operation and Maintenance 12

4 DESCRIPTION OF THE ENVIRONMENT AND SOCIAL SETTINGS 13

4.1 Physical Environment 13

4.1.1 Climate and Precipitation 13

4.1.2 Air Quality 14

4.1.3 Geology and Hydrogeology 15

4.1.4 Land 20

4.1.5 Forest 21

4.1.6 Water Resources 21

4.1.7 Biological Characteristics 24

4.1.8 Protected Areas 26

4.1.9 Waste management 27

4.2 Socio-economic characteristics 28

4.2.1 Main socio-economic characteristics of Sanski Most Municipality 28

4.2.2 Agricultural parcels covered by irrigation/drainage system 28

5 ASSESSMENT OF ENVIRONMENTAL AND SOCIAL IMPACTS OF THE PROPOSED ACTIVITIES 29

5.1 Impacts in the design/planning phase 29

5.1.1 Impacts on the River Sub-Basin 29

5.1.2 Land acquisition, restriction on land use and involuntary resettlement 30

5.2 Impacts in the Construction Phase 30

5.2.1 Land 30

5.2.2 Forest and forest land 30

5.2.3 Water Resources 30

5.2.4 Air quality 31

5.2.5 Noise 31

5.2.6 Biological Characteristics 32

5.2.7 Protected areas and ecological network 32

5.2.8 Waste generation 32

5.2.9 Cultural heritage 32

5.2.10 Occupational health and safety 32

5.2.11 Community health and safety 33

5.2.12 COVID-19 related OHS, Labor and Community Health and Safety risks 33

5.2.13 SEA/SH risks 33

5.3 Impacts in the Operation Phase 33

5.3.1 Land 33

5.3.2 Water Resources 34

5.3.3 Pest and Weed Management 34

5.3.4 Air quality 35

5.3.5 Noise 35

5.3.6 Biological Characteristics 35

5.3.7 Impacts on protected areas and ecological network 36

5.3.8 Waste generation 36

5.3.9 Community health and safety 36

5.4 Positive Environmental and Social Impacts 36

6 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN 38

6.1 Environmental and Social Impacts Prevention/Mitigation Plan 38

6.2 Environmental and Social Monitoring Plan 49

7 PUBLIC CONSULTATION 57

7.1 Details of the public consultation for the original EMP 57

8 ANALYSIS OF CAPACITY BUILDING AND TRAINING NEEDS 58

8.1 Training needs 58

8.2 Equipment Procurement 59

9 ANNEXES 60

**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 agricultural areas by locations 5

Table 4 Crop water requirements for the area Šehovci 8

Table 5 Crop water requirements for the area Trnova 8

Table 6 Selected irrigation system 10

Table 7 Climate parameters and potential evapotranspiration – MS Sanski Most 13

Table 8 Precipitation and effective precipitation for the project area 14

Table 9 Characteristic flows at WS Sanski Most 22

Table 10 Water quality at river Sana at the location of water intake 24

Table 11 Target species and habitats of potential Natura 2000 area BA8200014 Dabar-Čapljansko polje 27

Table 14 Flows and water-levels in the sub-project areas for high water of return period of 1/20, 1/100 i 1/500 29

Table 13 Plan of Measures for Prevention/Mitigation of Environmental and Social Impacts for the Sub-Project areas of Šehovci and Trnova in Sanski Most Municipality 39

Table 14 Environmental and Social Monitoring Plan 49

Table 15 Required equipment 59

**LIST OF FIGURES**

Figure 1 Overview of project zones Trnova and Šehovci in Sanski Most Municipality 6

Figure 2 The layout of the planned irrigation system on location Šehovci 11

Figure 3 The layout of the planned irrigation system on location Trnova 11

Figure 4 Area of Trnova (alluvium of Sana River) 15

Figure 5 Area of Šehovci (alluvium of Sana River) 15

Figure 6 Geology of Trnova area intended for agricultural production 16

Figure 7 Geology of Šehovci area intended for agricultural production 16

Figure 8 Hydrogeology of Trnova area 19

Figure 9 Hydrogeology of Šehovci area 19

Figure 10 Average duration line of the flow with anvelopes of maximum and minimum for period 1961 – 1990 at WS Sanski Most on Sana river 23

Figure 11 View of the existing arable land near Trnova (left) and Šehovci (right) (photo: Oikon Ltd.) 25

Figure 12 View of the vegetation towards the left bank of the Sana River (photo: Oikon Ltd.) 25

**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) refers to the irrigation system in the sub-project areas Šehovci and Trnova in Sanski Most Municipality in FBiH. Preliminary design of irrigation system in sub-project areas Šehovci and Trnova in Sanski Most Municipality[[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 (IDP), 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:

* Analyse the current legal framework relevant to the irrigation and drainage systems construction and rehabilitation projects,
* Analyse 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 Sanski Most 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 an irrigation and drainage construction project to obtain relevant construction approvals, namely Location Permit, Construction Permit and Use Permit. Construction Permit and Use Permit are required for irrigation system rehabilitation projects.

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 Šehovci and Trnova** in Sanski Most Municipality. 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 Šehovci and Trnova in Sanski Municipality | Moderate | Environmental and Social Management Plan | Water acts  Concession for water abstraction | Location permit Construction permit Use permit |

# PROJECT DESCRIPTION

## Project Site Description

Sanski Most Municipality is located in the north-western part of BiH (Una-Sana Canton) and covers an area of ​​781 km² (49.1% of forest, 48.3% of agricultural land, 3.23% of roads and other). It is territorially divided into 19 local communities and 67 settlements.

The geo-traffic position is favourable and is located on the main road that connects Banja Luka and Prijedor with Ključ and Drvar, that is, it is in on the crossroad of the main corridors Western Europe - Mediterranean - Middle East. The M-17 main road (257 km) connects Sanski Most with the capital of Bosnia and Herzegovina - Sarajevo and other parts of BiH. The section M-15 (Bosanska Dubica - Prijedor - Sanski Most - Ključ) and regional roads R-404 (Blagaj - Stari Majdan), R-406 (Ljubija - Milin Birt), and R-405 (Lušci Palanka – Sanski Sanski Most – Banja Luka) pass through the municipality.

Sanski Most's relief is diverse, with mostly hilly areas and with a plain along the Sana River. High mountains are spread around the area: Grmeč (1,500 m above sea level), Mrežnica, Čelić kosa, Mulež and Behramaginica. The altitude of the urban part of the municipality is 160 m, and the average altitude for settlements is 500 m.

The basis of the hydrographic network in the municipality is the Sana River, which, with its tributaries, represents significant water resource distributed over most of the municipality (central and eastern area).

The project area is located in two local communities, namely LC Trnova and LC Šehovci. According to the available data, a total of 441 households live in the area of ​​these two local communities.

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

|  |  |  |
| --- | --- | --- |
| **Municipality** | **Local community / Project zone** | **Area (ha)** |
| Sanski Most | Trnova | 51.6 |
| Šehovci | 46.5 |
| **TOTAL** | **98.1** |

Total surface of the project area of Trnova and Šehovci (Figure 1) is 98.1 ha.

|  |
| --- |
|  |
| Figure 1 Overview of project zones Trnova and Šehovci in Sanski Most Municipality[[4]](#footnote-4) |

## Agricultural Production Background

At the cantonal level, the municipality of Sanski Most has a very favorable land-spatial structure. Fields and orchards are internally and cantonally represented by above-average participation (locality coefficients greater than 1.0), meadows and pastures in satisfactory high proportions, forests on average by cantons. Expressed in hectares, it has a land-spatial structure: arable land and gardens 23,958 ha, orchards 653 ha, meadows 7,068 ha, pasture 6,071 ha, and forest 38,361 ha.

The municipality of Sanski Most has significant potential for the development of agricultural production, which is underutilized and should therefore look for its own development opportunity. Agricultural land, which was abandoned during the war and after the war, is increasingly being put into production every year. Crop production is a function of the development of livestock production with predominance of milk and meat production. According to the indicators, this area is extremely suitable for livestock breeding (especially breeding of cattle and sheep) and for the cultivation of fodder, potato and vegetable crops, using modern agrotechnical measures and fruit cultivation. Nowadays, trends are bio and raw food production, in which the municipality of Sanski Most has a lot of chances, as well as for honey production, medicinal herbs and harvesting fruits in forests.

## Description of the Previously Used Irrigation and Drainage Systems

In the sub-project areas Šehovci and Trnova in Sanski Most Municipality there are no organized irrigation or drainage systems. The sub-project area of Šehovci and Trnova floods almost every year. In view of the unresolved problems of flooding so far, the Preliminary Design also provides recommendations for solving the problem of drainage and implementation of the planned irrigation system in the municipality of Sanski Most.

## Irrigation Water Demand and Drainage Demand

According to the Preliminary Design, irrigation water abstraction will be carried out from the Sana River by making horizontal drainage structures connected to the watercourse. The highest average monthly water shortage, or the most critical month for drought, is July. According to the hydromodule, from the Preliminary Design, the amount of water needed for irrigation for the most critical month is q24 = 0.041 l/s/ha. Such a hydromodule implies that the system is operating non-stop (i.e. 24 h/day).

According to the calculations, the required water quantities are:

* For project zone Šehovci, the water consumption in the critical month is 19.53 l/s, i.e. 0.02 m3/s.
* For project zone Trnova, the water consumption in the critical month is 21.67 l/s, i.e. 0.02 m3/s.

The Preliminary Design does not provide data on the quantities of water that will be drained from the project area, nor technical solutions developed at this level.

Options are given for solving the problem of drainage and implementation of the planned irrigation system in the municipality of Sanski Most, which consist of the following steps:

* Construction of a protective embankment along the Sana riverbed around the project areas of Šehovci and Trnova. As the scope of these works was not foreseen in the terms of reference and is of vital importance for the project in question, in the coming period the competent authorities of the Sanski Most Municipality, in coordination with the competent Sava River Basin Agency, will find ways to initiate the procedure for solving the flooding of the project area.
* The drainage of excess inland waters resulting from increased precipitation intensities, as well as the part of external waters that gravitate from higher ground to the subproject area and the Sana River, will be addressed by a system of drainage trenches which are executed in the same trench which serves for distribution of water to the hydrants. The drainage of excess water from the drainage trenches will be carried out through drainage shafts, which will be installed at certain places in the subproject area, and will be built so that the depth of the shaft is up to the appearance of a layer of coarse gravel (about 3.5 m deep), which is hydrologically connected with watercourse. A valve will be installed in the shaft to protect the area from the spillage of shallow groundwater during floods. If necessary, suction drains will be installed in the field, in critical places. The drains will flow into the drainage collector, which will also serve as the trench of the irrigation pipeline.
* The drainage of external waters coming from higher ground will be done at the boundary of the project area, from the outside, by installing a drainage canal along the route of the road. This will protect the area and the road from the impact of excess water.

## 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, ie 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), the slope of the terrain, soil color, land cover, etc.

Agricultural water needs assessment was taken from the preliminary design (*Idejni projekat sistema za navodnjavanje Šehovci i Trnova, općina Sanski Most, ŠIFRA: 1444/19, Routing d.o.o. Banja Luka, Aquaduct d.o.o. Beograd, Jun 2019.*).

Table 4 Crop water requirements for the area Šehovci

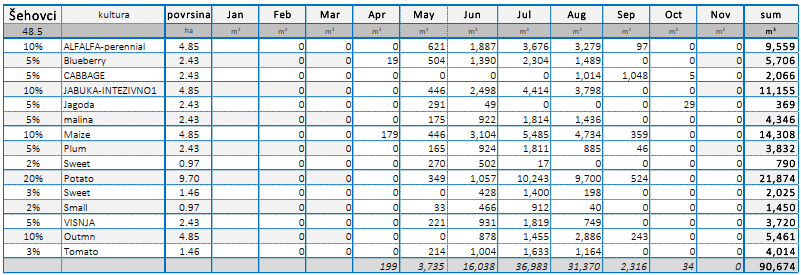
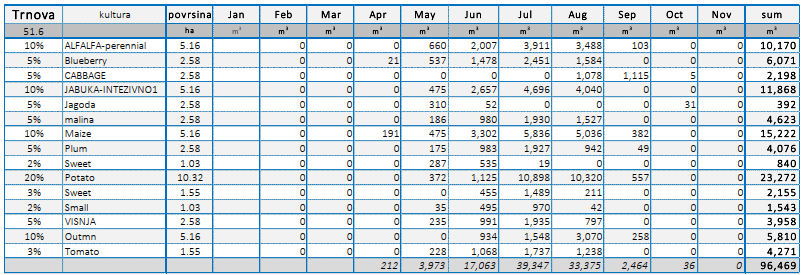


Table 5 Crop water requirements for the area Trnova



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

The Preliminary Design states that farmers prefer a system with free distribution of water, thereby achieving complete freedom in the organization of production and their daily working hours. The project envisages that the first years of production will be based on the production of fodder and that in the third year onwards, when new technologies are adopted, production will change in the direction of vegetable and fruit production, with the retention of 30% of the area under intensive production of fodder.

### System of free water distribution

In designing the free water distribution solution, the methodology for calculating the performance of the pressure system presented in FAO IDP 59 was used. The following parameters were analysed:

* Agricultural production structures,
* Meeting the water demands of cultivated plants,
* Plot irrigation method,
* Density of hydrants,
* Hydrant flow,
* Scheme and system operation time.

The calculated and adopted criteria for both locations are:

* The sowing structure is adapted to the development and gradual transition from fodder production to vegetable and fruit production, with a retention of 30% for fodder production in the future;
* The calculation is intended to satisfy the real daily evapotranspiration of Etr = 4 mm;
* It is planned to use drip systems, mini-irrigation with stationary systems, irrigation with mini mobile equipment - typhoons with ramps;
* The density of hydrants on the plot was the biggest challenge for the project. It is designed that one hydrant covers up to 10 cadastral parcels, which due to the fragmentation of plots led to an increase in the number of hydrants and a decrease in the flow rate per hydrant. In this way the possibility of real organizing of producers and their association into smaller groups is obtained.

A statistical Clement model was used to determine the hydrant flow. The parameters for the model were:

* System operating hours 12 h/day; r = 1.65
* The probability of simultaneous operation of the hydrants p = 95%
* Class 0 hydrants; Q <= 2.1 l s
* Class 1 hydrants; Q <= 4.2 l/s
* Allowed pressure loss up to the highest point within a block of 5% pressure
* Allowed pressure loss to the farthest point within a block of 5% pressure
* Hydrant operating pressure Pmin = 4bar

#### Determination of suitability of irrigation equipment

A combination of drip irrigation methods, mini sprayers and ramp typhons was selected. A combination of low and medium pressure equipment is made, leaving maximum flexibility in monitoring of both crop order and rotation.

Table 6 Selected irrigation system

| Irrigation system | Covered area | Pressure | System efficiency | Flexibility | Watering intensity | Fertigation | Operation and maintenance | Total |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Stationary set of medium sprayers | 100% | 4.5 | 70% |  | 5-30 | foliar |  |  |
| ++ | ++ | ++ | +++ | ++ | ++ | +++ | 16+ |
| Stationary set of meni sprayers | 100% | 3.5 | 70% |  | 2-10 | foliar |  |  |
| ++ | +++ | ++ | +++ | +++ | ++ | +++ | 18+ |
| Typhoon with a cannon | 100% | 5.0 | 60% |  | 30-50 | foliar |  |  |
| ++++ | + | + | ++++ | +++ | + | + | 15+ |
| Typhoon with a ramp | 100% | 3.5 | 70% |  | 5-30 | foliar |  |  |
| ++++ | +++ | ++ | ++++ | ++++ | ++ | ++ | 21+ |
| Surface dripping | 100% | 1.5 | 95% |  | 1-2 | fertigation |  |  |
| ++++ | ++++ | ++++ | ++ | ++++ | ++++ | +++ | 25+ |

During the equipment selection, care was taken to satisfy the criterion that the maximum flow variation on the emitter was <10% during operation, in order to successfully carry out the fertigation.

Based on calculations of distribution uniformity and flow variation, a length of 200 m was defined for the row, a drop system with a lateral diameter of 22 mm, and regular emitters at a distance of 0.3 m and a flow of 1.0 l/h.

The choice of typhoon is with 63 mm pipe diameter, 100 m long, ramp width of 13-18 m. Emitter operating pressure on the ramp is 1.5 bar.

As the project area is exposed to late spring frosts, the project envisages the use of mini sprayers in the function of frost protection (Anti-frost system). A modern irrigation system with intensity of up to 1.3 to 1.5 mm/h is used, thus providing complete protection for frost-exposed crops with minimal water quantities. It is a Pulse Anti Frost System (PAF).

#### Water intake for Sana River

Water abstraction from the Sana River includes the following:

* 1. Build horizontal drainage structures (canals) that are connected to the watercourse,
  2. The canal is covered with granulate of a certain diameter:
  + to provide the designed water supply;
  + pre-filtration of water from suspended material;
  + microbiological purification of water.
  1. The construction is secured by submerging the hydraulic part of the equipment into water,
  2. The electrical equipment of the pumping station is installed on an object whose lower elevation is above the height of the flooding,
  3. Medium voltage power supply is connected to the pumping station,
  4. A low voltage transformer intended for the operation of the system is installed at the pumping station itself,
  5. The hydraulic equipment of the pumping station is done by installing two pumps in parallel operation, with electrical equipment with frequency inverters,
  6. Protective hydraulic equipment and protective electrical equipment are installed in the station,
  7. A primary automatic filter plant is also installed at the pumping station,
  8. System operation management, automation and equipment for system maintenance are located in the pumping plant,
  9. The plant operates on the principle of a hydrophore station, i.e. the system starts by opening the valve in the field and by pressure drop that is detected and turns on firstly one pump and then another.

|  |
| --- |
|  |
| Figure 2 The layout of the planned irrigation system on location Šehovci |

|  |
| --- |
|  |
| Figure 3 The layout of the planned irrigation system on location Trnova |

#### Distribution network

Water is distributed from the pumping station to each block - field by a pressure system. HDPE100, PN10 is used for distribution, and the pipe profile is in accordance with the design. The connection of the pipeline is planned to be done by butt welding.

#### Field control units

The transition from the distribution system to the field is done by blocks - fields. The pipes of the control units are planned to be metal with diameter of Ø63mm. The control unit equipment will consist of: (i) DN65 valve; (ii) Semi-automatic mesh filter of 0.1 mm DN65; (iii) Air and anti-vacuum valve 2“; (iv) Valves with pressure control 2“; (v) Valves for opening individual fields 2“; (vi) Water meters with electrical equipment for sending signals about water consumption to the automatic control system. The pipeline from the control unit to the farmers’ field will be the HDPE100 pipeline. Field equipment will be defined in more detail in the next design phase.

### Drainage and protection against excess water

The project area is flooded almost every year. The preconditions that must be fulfilled for agricultural production planning include the following:

1. Building a protective embankment along the Sana riverbed around the project areas of Šehovci and Trnova. As the scope of these works was not foreseen by the terms of reference and is of vital importance, in the coming period the competent authorities of the Municipality of Sanski Most, in coordination with the competent water management company, will find ways to initiate the procedure for solving the flooding of the project area.
2. The drainage of excess inland waters resulting from increased intensity of precipitation, as well as the part of external waters that gravitate from higher ground towards the Sana River, will be addressed by a system of drainage trenches which are executed in the same trench which serves for distribution of water to the hydrants. The drainage of excess water from the drainage trenches will be carried out through drainage shafts, which will be installed at certain places in the subproject area, and will be built so that the depth of the shaft is up to the appearance of a layer of coarse gravel (about 3.5 m deep), which is hydrologically connected with watercourse. A valve will be installed in the shaft to protect the area from the spillage of shallow groundwater during floods. If necessary, suction drains will be installed in the field, in critical places. The drains will flow into the drainage collector, which will also serve as the trench of the irrigation pipeline.
3. The drainage of external waters coming from higher ground will be done at the boundary of the project area, from the outside, by installing a drainage canal along the route of the road. This will protect the area and the road from the impact of excess water.

## 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 area of ​​the municipality of Sanski Most is influenced by the temperate continental climate. Although these areas are peri-Pannonic, the impact from the north is much mitigated by the hilly and forest areas, and the frequent penetration of cyclones from the west. The mountain climate covers medium mountain ranges up to 1,700 m above sea level. The summers here are fresh and short, the winters long, cold and snowy. It is also important to emphasize the fact that temperature inversions are a relatively common occurrence in these climates. The average annual precipitation in these areas is 1,250 to 1,500 l/m². Generally, the climate of the Sanski Most municipality is of moderate humidity, moderate temperature, considerable sunshine, no stormy winds and is basically favourable for the development of settlements, economy, tourism, food production, etc. The average annual temperature is 10 - 11 °C.

In the Preliminary Design, data from the Sanski Most meteorological station (for the period 2008 - 2017, and as control data for the period 1961-1990) were used for the analysis of climatic parameters for irrigation purposes. The calculation of potential evapotranspiration, effective precipitation, plant water demand, and irrigation programs were performed according to the FAO methodology.

Based on climatic data for the period 2008 - 2017, potential evapotranspiration was obtained and is presented in the following table.

Table 7 Climate parameters and potential evapotranspiration – MS Sanski Most

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Month** | **Min** | **Max** | **Relative humidity** | **Wind** | **Insolation** | **Radiation** | **ETo** |
| **(°C)** | **(°C)** | **(%)** | **(km/day)** | **(h)** | **(MJ/m²/d)** | **(mm/day)** |
| January | 2.5 | 5.4 | 85 | 185 | 2.2 | 4.6 | 0.53 |
| February | -1.7 | 8.0 | 81 | 180 | 2.7 | 6.7 | 0.86 |
| March | 1.7 | 13.9 | 74 | 180 | 5.1 | 11.8 | 1.69 |
| April | 5.7 | 19.0 | 74 | 185 | 6.1 | 16.0 | 2.64 |
| May | 9.5 | 22.8 | 75 | 185 | 7.7 | 20.1 | 3.56 |
| June | 13.4 | 26.8 | 74 | 190 | 8.4 | 21.9 | 4.36 |
| July | 14.9 | 29.4 | 72 | 190 | 10.1 | 23.7 | 4.99 |
| August | 14.3 | 29.4 | 73 | 190 | 9.6 | 21.1 | 4.56 |
| September | 10.9 | 23.3 | 80 | 185 | 5.7 | 13.4 | 2.68 |
| October | 6.4 | 17.7 | 84 | 173 | 4.6 | 9.1 | 1.52 |
| November | 2.7 | 12.9 | 85 | 173 | 3.1 | 5.6 | 0.89 |
| December | -1.5 | 7.1 | 85 | 173 | 2.6 | 4.3 | 0.53 |
| **Average** | **6.6** | **18.0** | **79** | **182** | **5.7** | **13.2** | **2.40** |

Precipitation values have been obtained by precipitation analysis for the period 2008 - 2017 and by statistical processing of 90% probability of occurrence. The effective precipitation for the project area has been obtained by using the USDA SCS method. This is presented in the following table.

Table 8 Precipitation and effective precipitation for the project area

|  |  |  |
| --- | --- | --- |
| **Month** | **Precipitation** | **Effective precipitation** |
| **(mm)** | **(mm)** |
| January | 78.2 | 68.4 |
| February | 82.2 | 71.4 |
| March | 82.8 | 71.8 |
| April | 102.3 | 85.6 |
| May | 107.2 | 88.8 |
| June | 95.9 | 81.2 |
| July | 74.4 | 65.5 |
| August | 67.0 | 59.8 |
| September | 113.4 | 92.8 |
| October | 102.8 | 85.9 |
| November | 83.7 | 72.5 |
| December | 87.7 | 75.4 |
| **Total** | **1077.6** | **919.2** |

### Air Quality

In the area of ​​Sanski Most municipality, 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 Sanski Most are caused by households, followed by the existing industrial plants, landfills and certain processes in agriculture and forestry. Considering that in the Sanski Most 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 ​​Sanski Most municipality 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 Sanski Most municipality, 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 Bihać. 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 Sanski Most Municipality in the morphological sense is mostly flat area, with a maximum altitude not higher then 6 m in the zone of Sana river flow. The research area is defined by the indicated watercourse and in geological sense represents the Quaternary (Q), that is, alluvial sediments (al), which are a direct product of the dynamism of this river. The research area from the west is completely contoured by the Sana River, whose flow is oriented south-north, while the eastern boundary is a railway line which, passing the edge of the alluvium, has a fully aligned orientation with the Sana River in the Trnova area (Figure 4) and in the Šehovci zone (Figure 5). In this sense, the area of agricultural land belonging to the municipality of Sanski Most is defined by the toponyms Polje (Trnova), and Kamenice and Duge njive (Šehovci).

|  |  |
| --- | --- |
| D:\disk E_SR\BiH_SVE\SANSKI_MOST\SMost_Top1.jpg | D:\disk E_SR\BiH_SVE\SANSKI_MOST\SMost_Top2.jpg |
| Figure 4 Area of Trnova (alluvium of Sana River) | Figure 5 Area of Šehovci (alluvium of Sana River) |

Hydrography of research area is predominantly represented by the river Sana as the most significant watercourse in this part of the region with many smaller tributaries, most important of which are Blija and Pilješka River. In hydrogeological terms, alluvium is referred to as a well-permeable medium, which allows faster groundwater flow within the gravel-sand material (aquifer of intergranular porosity). However, notwithstanding the good characteristics of the effective porosity of this sediment, it should also be emphasized that in the substrate of hypsometrically the lowest positions of alluviums indicating close contact with the less permeable substrate (Neogene - **M, Pl** and Carbon - **C1+2**), as an important segment of hydrological stability control of this terrain, in the recent past, there have been frequent occurrences of flooding of these agricultural areas during pronounced hydrological maximums.

**Geological structure of the study area**

The defined area is in the stratigraphic sense expressed by the presence of the Paleozoic and Cenozoic formations which are presented by the following litho-stratigraphic units:

**Paleozoic (Pz)**

The Paleozoic is represented by older Carboniferous deposits (C1+2) and very sporadically by younger Permo-Triassic (P, T) sediments whose deposition occurs only in the southeast, outside the defined research area, along the right side of the Sana River alluvium, which implies stretch Trnovo - Šehovci (Figure 6 and Figure 7).

*The Lower and Middle Carboniferous (C1+2)* is located in the Permo-Triassic (P, T) substrate, although the areas of overthrust of Carboniferous over the younger sediments mentioned above are also noticeable. This fact emphasizes the pronounced presence of plicative and disjunctive tectonics, within the alevrite and greywacke sandstones and limestone of the Carboniferous, which has a thickness of approximately 400 m in the research area.

*The unbroken Permo-Triassic (P, T)* is an immediate companion to Carboniferous formations.

In addition to tectonic degradation, its considerable erosion is also pronounced, so that only relict forms can be identified in the research area as constituents of overturned anticlinal and synclinal structures. The major fault areas (as in the case of the Carboniferous) are oriented northeast (NE) - southwest (SW), and lithologically, this stratigraphic member is represented by quartz sandstones and conglomerates, with a maximum thickness of 30 - 40 m, and along with older sediments in its substrate, it occupies mostly hypsometrically higher position of the terrain.

|  |  |
| --- | --- |
|  |  |
| Figure 6 Geology of Trnova area intended for agricultural production | |

|  |  |
| --- | --- |
|  |  |
| Figure 7 Geology of Šehovci area intended for agricultural production | |

**Cenozoic (Kz)**

It is represented by Tertiary (Tc) and Quaternary (Q) deposits, where the shy presence of the Neogene, that is, the Miocene-Pliocene (M, Pl), as well as the products of Quaternary geomorphological processes (alluvial sediments-**al**), is emphasized on the surface of the terrain.

*The* *Miocene-Pliocene (M, Pl)* sediments are represented in the west of the wider research area (Figure 7 and Figure 8) and form an immediate substrate of alluvium of the Sana River along the Pobriježje - Koprivna section, which includes the research area. No tectonic damage was observed, and in lithological terms they are represented by marls, clays, sandstones, conglomerates and a gravel component.

The thickness of the Miocene-Pliocene sediments at maximum development can reach a value of 200 m.

Quaternary (Q), in the wider area, is represented by sediments of the first (t1) and second (t2) river route, as well as alluvial deposits (al), in the surroundings of the surface watercourse of the Sana. Given the characteristics of the research area, the author refers exclusively to the interpretation of alluvium.

*Alluvium (al)*, is a product of modern river activity, generated by the constant flow of the Sana River and its tributaries. In certain segments, alluvium appears as a product of deep water faults, resulting in a small thickness of deposited material (the upper course of the Sasina and Kruharuša rivers).

The powerful alluvial plateau of the Sana River (from Čapljansko field to Koprivna), which is lithologically represented by a gravelly-sand component with clay scuds, reaches a thickness of 10 m.

Due to the relatively significant flow, this area, however, cannot, to a considerable extent, accumulate sufficient water from the river, which causes the occurrence of flooding of the close, hypsometrically lowest parts of the terrain during intensification of precipitation.

**Tectonic characteristics**

Taking into account the specifics of defining the hydrogeological characteristics of lithological members of certain stratigraphic units, which imply the narrower spatial environment of agricultural areas in the municipality of Sanski Most, it was concluded that elaboration of tectonic characteristics of this area necessarily affects the quality of design of the protection of potential sources. In this regard, the tectonic characteristics of the area were elaborated, where the poor-permeable and watertight rock materials were almost completely represented. This emphasizes that the conditions for defining environmental protection remain unchanged within the entire catchment area including the agricultural land of the municipality of Sanski Most. Within the research area, the presence of a structural-facial unit was determined, on which the agricultural land with its catchment is located. In this regard, representation and further interpretation of impact on the conditions of formation and functioning of the observed agricultural areas is given, as well as the interpretation of the conditions of the total environmental impact within the dominantly established structural-facial unit, expressed as:

* Palaeozoic shale and Mesozoic limestone

*Palaeozoic shale and Mesozoic limestone* represent the base medium in the agricultural area in the Sanski Most municipality. This unit is predisposed by a stone fault that allows it to develop from the south-western edge (Kamengrad), to the northeast toward the Central ophiolites. In this environment, mostly smaller transverse faults were also found, which have cut the present litho-stratigraphic formations into blocks in several localities (the complex is considerably faulted, with mainly longitudinal faults), which emphasizes the intensive tectonization of the structures (fragmented into blocks, cataclastitized and milonitized), which express the presence of a very influential fault zone.

The Sana River alluvium is located at the hypsometrically lower positions of the indicated structural unit. It was formed by the continuous dynamic action of watercourses in a close environment, which formed a specific flattened morphology. In this sense, the unbound granular structure of these sediments is the root cause of the formation and functioning of such a structured morphological unit.

Within this area, tectonization is noticeable, reflecting the regional character of the fault zones, with a general orientation northwest-southeast, which also applies to the wider area (north-east of the Sana alluvium), where Palaeozoic shale and Mesozoic limestone are formed.

**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 local characterization of the area by hydrogeological characteristics in the research area, where the following groups of aquifer sediments can be identified (Figure 8 and Figure 9):

*a) Rocks of good water permeability* composed of gravel, sand and alevrites components (alluvial sediments of Quaternary of inter-granular porosity)

Alluvium (al) is represented by rock material of inter-granular porosity, which (in particular, gravel and sand) have characteristics of very water-permeable environment. Given the presence and potentials offered by these formations in terms of the necessity of water sources protection, their presence is evident in relation to the water-intakes for the supply of the local population. In this regard, the Quaternary deposits, given the good characteristics of water filtering, can be considered as an important factor for deciding on defining the water source protection zones (both in terms of quantity and quality), given the potentially very strong character of the impact on the water wells in a relatively close environment.

|  |
| --- |
| C:\Users\VukasinB\Documents\SMostHG_Navod-Model.jpg |
| Figure 8 Hydrogeology of Trnova area |

|  |  |
| --- | --- |
|  |  |
| Figure 9 Hydrogeology of Šehovci area | |

*b) Moderate to poor-permeable rocks*, represented by water-permeable deposits of cracking porosity which related to carbon (C1+2), alevrite and sub-greywacke formations of sandstones and limestone.

*c) Non-permeable rocks*, in geographical terms show elements of considerable alienation and is stratigraphically marked by Permo-Triassic (P, T) and Miocene-Pliocene formations (M, Pl).

*Permo-Triassic (P, T)*, appears in the southeast (outside the research area and is embedded into the carbon sedimentary structure). It is highly eroded, or covered in certain segments of older Carboniferous deposits, so that it can be viewed in many localities in the form of relict forms. With regard to lithology (quartz sandstones and conglomerates), as well as tectonic constitution, it has the characteristic of a overlaying local hydrogeological barrier. Its porosity ranges from inter-granular to cracking and only within rarely observed localities, it is found in the substrate of Quaternary water-permeable sediments (alluvial-al and river terrace sediments -**t1** and **t2**).

In general, the Permo-Triassic sandstones and conglomerates express the marginal character of appearance in the observed area, and in this regard do not have a serious impact (both positive and negative) on the area designated as the agricultural area of ​​the municipality of Sanski Most. The direct alluvium substrate (**al**) within the basin is predominantly represented by Carboniferous formations (relative hydrogeological barrier), which ultimately results in a negligible hydrogeological impact, that is, a hydrologic contribution to the alluvial aquifer horizon (only hydrologic effects due to terrain morphology are noticeable).

**Conclusions**

Considering the significant tectonic degradation of the Palaeo-relief in the substrate of alluvial depository masses emerging as a consequence of the fluvial activity of this area, in addition to the considerable presence in the area envisaged for the agricultural production, it can be concluded that the Quaternary (Q) sediments, in the hydrogeological sense, present the main aquifer recharging the alluvium of the river Sana. The appearance of alluvial groundwater is attributed to the strong influence of this powerful surface watercourse.

These data should be included in the decision-making process when defining source protection zones (both in terms of quantity and quality), which can be crucial given the need for environmental impact assessment.

According to the abovementioned statements, it is necessary to emphasize that the rock massif from the immediate surroundings of the agricultural area, is exposed to potentially strong impact of exogenous processes and technogenic factors in its substrate (pronounced lateral erosion activity, increased aggregation of fine-grain accumulation material and soil contamination) which, as a logical consequence of such impacts (natural or anthropogenic), may result in water turbidity as well as its biological-chemical pollution. In this respect, it is necessary to foresee the necessary measures to limit the potentially negative impacts on groundwater and surface water quality within the maximum permissible concentrations, or to ensure complete water protection of the subject area from the potential negative anthropogenic impacts.

In this regard, special attention should also be paid to the protection of agricultural land from the occasional (seasonal) negative impact of high waters during the more intensively exposed hydrological period (flood protection).

### Land

Hydromorphic soils have been developed within the scope of the Sanski Most subproject with respect 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 condition the 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 pollution for groundwater and watercourses.

In the area of planned interventions, fluvisols developed on the right bank of the Sana River.

Fluvisols are soils of river valleys, whose main morphological feature is the layered structure of the profile. An initial humus-accumulative (A) horizon develops on the surface. It is a highly permeable, translucent soil with variable textures in profile with a sandy layer at the bottom. What is important is that the soils that are well cultivated are not plastic or compacted, they are light and not sticky. The reaction of this soil is neutral to alkaline and low in humus, phosphorus and potassium. The basic measure of bringing soils to intensive crop production is flood protection and humidification to increase adsorption capacity and improve soil structure.

Insight into the digital orthophoto shows that fluvisols are mostly used for arable or crop production.

According to the "Rulebook on Uniform Methodology for the Classification of Agricultural Land in Convenience Categories" ("Official Gazette of the Federation of BiH", No. 43/11), land/soil may be suitable (P) or unsitable (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 unsiutable, while the N-2 classes are permanently unsuitable for cultivation and/or multi-use in agriculture. Fluvisols, according to their production ability, belong to suitable soils. These are high-quality land suitable for intensive production.

### Forest

The area of the subproject is located in the northwestern part of Bosnia and Herzegovina, in the Sana river valley. From the geographical point of view, this valley belongs to the Peri-Pannonian or Pre-Dinaric region, so the terrain has mountainous characteristics. Biogeographically, forests of the wider area belong to the Eurosiberian-North-American vegetation region. The most common are sessile oak and hornbeam forests (300-800 m above sea level), followed by mesophilic beech or beech-fir forests and beech-fir-spruce forests in the highest areas.

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 Sanski Most. Forests of this area belong to the Forest Management Area (FMA) „Sansko“ which includes seven Forest Management Units: Grmeč-Mijačica, Ćelić-Kosa, Grmeč-Palanka, Japra, Majdanske planine, Behremaginica and Kozica-Mulež. Planned operation is located in the „Behremaginica“ FMU. Total area of FMA is 35,966 ha, of which „Behremaginica“ FMU occupies 2,129 ha.

According to the Forest Management Plan for FMA „Sansko“ (validity period 01/01/2013 – 31/12/2022), the most common are high forests (beech, beech-fir or beech-fir-spruce forests) and coppice beech and hornbeam forests.

In the entire forest management area high forests cover 58 % of the territory and coppice forests 26 %. In the area of „Behremaginica“ FMU there are total of 102 ha of high forests and 1,857 ha of coppice forests (of which more than half is mined).

The average wood stock for the whole forest management area for high coniferous forests is 139.51 m3/ha and for broadleaved forests 227.09 m3/ha. Average wood stock for coppice coniferous forests is 0.63 m3/ha and for broadleaved forests 173.08 m3/ha. Total annual increment for high coniferous forests is 2.93 m3/ha and for broadleaved forests 4.99 m3/ha. Total increment for coppice coniferous forests is not measured and for broadleaved forests is 5.24 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 Sana River is a right tributary of the Una River and belongs to the Sava River Basin. The Sana springs at the foot of Mount Lisna. It is made up of three karst springs that merge into a stream. It flows further towards the north, taking in the waters of the tributaries, to the mouth of the Gomjenica River, then turns west and flows into the Una near Novi Grad.

In the study area there is an extremely unfavourable distribution of water during the year. During the summer months, when the water needs are highest, the Sana flows only about 10% of the average annual flows. On the other hand, large waters occasionally occur with maximum flows greater than ten times the average.[[6]](#footnote-6)

According to the Preliminary Design, the amount of water required for irrigation is 41 l/s (0.041 m3/s). The Municipality of Sanski Most has requested prior water approval for the abstraction of this amount of water from the competent authority.

The following table shows the characteristic flows of the Sana River at the Sanski Most water metering station, which is closest to the project area.

Table 9 Characteristic flows at WS Sanski Most

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Water metering station/ Location** | **Mean water** | **Low water** | | | **EF dry part of the year** | **EF wet part of the year** | **High water** | | |
| Qmean annual | Qsr.min. | Qm.sr.mjes | Qmin95% | Qmax 1/20 | Qmax 1/50 | Qmax 1/100 |
| WS Sanski Most | (m3/s) | | | | | | | | |
| 66.7 | 10.9 | 9.26 | 7.72 | 10.9 | 16.35 | 608 | 659 | 695 |

The above table shows that the minimum mean multi-annual flow of the Sana River, which is considered as ecological flow (EF) in accordance with the valid regulations, is 10.9 m3/s. According to the distribution of the minimum flows of this watercourse, the flow rate of 10.9 m3/s represents the minimum water of the occurrence range of 2-3 years. In other words, this means a designed volume of 0.041 m3/s can collide with the EF once in 2-3 years in the dry season. The impact of the designed quantity on the EF would be only 0.38%.

The following figure, for illustration purposes, shows the average flow duration line with maximum and minimum anvelopes for the period 1961 - 1990 at WS Sanski Most.

|  |
| --- |
|  |
| Figure 10 Average duration line of the flow with anvelopes of maximum and minimum for period 1961 – 1990 at WS Sanski Most on Sana river |

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

In the annual report on the status of the waters of the Sava River Basin in the FBiH in 2018, the overall ecological status of the water body of the Sana River, for the period 2018 based on monitoring results, was defined as good and overall status also defined as good.[[7]](#footnote-7)

The results of microbiological analysis[[8]](#footnote-8) of the quality of surface waters of the Sana River, at settlement Podluga, show that the parameters are in the reference values of class II watercourses, while the physical and chemical analysis[[9]](#footnote-9) show that the tested parameters correspond to the class I of watercourses according to the Decree on Water Classification and Categorization ("Official Gazette of RS", No. 42/01), respectively, pursuant to the Decree on Hazardous and Harmful Substances in Water ("Official Gazette of FBiH", No. 43/07), and Decree on Classification of Water ("Official Gazette of SRBiH", No. 19/80).

Class I watercourses are waters that, in their natural state, with possible disinfection, can be used for drinking and in the food industry.

Class II is water that, in their natural state, can be used for bathing and recreation of citizens, for water sports, for the cultivation of other types of fish, or which, with the usual methods of processing - conditioning (coagulation, filtration, disinfection, etc.) can be used for drinking and in the food industry.

In the Elaborate on the performed hydrogeological surveys at the locations Trnova and Šehovci, the results of testing the physic-chemical and microbiological parameters of the water quality of the drilled wells show that the physic-chemical characteristics are satisfactory and within the limits of the reference values ​​according to the Regulation on the health safety of water intended for human consumption ("Official Gazette of RS ”, No. 88/17), as well as according to the Rulebook on the health safety of drinking water (“Official Gazette of BiH”, No. 40/10). However, the samples show the presence of bacteria, and water as such cannot be considered safe for end-user's health. Treatment must be performed to satisfy the microbiological parameters of water.

Table 10 Water quality at river Sana at the location of water intake

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Value  mg/l (ppm) |  | Parameter | Value  mg/l (ppm) |
| Cations | Na+ | 1,3 | Salts | pH | 7,5 |
| Ca2+ | 72,0 | Ecw dS/m | 0,341 |
| Mg2+ | 8,0 | TDS mg/ll | 218 |
| K+ | 0,36 | Calculated values | SAR | 0,04 |
| NH4+ | 4,69 | HCO3- : Ca2+ | 1,08 |
| Fe3+ | 0,22 | adj SAR | 0,06 |
| Mn2+ | 0,02 | Na : Ca | 0,02 |
| Cu2+ | 0,08 | RSC | -0,37 |
| Zn2+ | 0,01 | LDP 1 HCO3+CO3 | 3,9 |
| Anions | HCO3 | 237,9 | LDP Ca+Mg | 4,27 |
| Cl- | 1,9 | Microbiological analysis | Total coliform bacteria | 5100 |
| SO42- | 16,0 |
| NO3- | 0,56 | Escherihia coli | 100 |
| B3- | 0,01 | Number of colonies on 37oC | 930 |
| H2PO4- | 0,08 | Number of colonies on 22oC | 1220 |
| F- | 0,013 | Enterococci | 500 |

### Biological Characteristics

According to the ecological and vegetation division of BiH, the area of Sanski Most municipality belongs to the northwestern 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 hilly area of eurosiberien-northamerican region where predominate mesophilic forests with oak forests (*Alegro, A. (2000). Vegetation of Croatia. Internal script, Division of Botany, Faculty of Science, Zagreb*).

The area is dominated by active farmland with seed corn (Figure 11) and abandoned agricultural areas where is dominant shrubby terrestrial flora or along the edges of plowed shrubs, hornbeam, hazel and ruderal species such as girdle, blackberry, nettle. There are occasional foresters, dominated by beech, oak and alder.

On the sides of river Sana, the most common species are *Corylus avellana, Cornus sanguinea, Ailanthus sp*., *Rubus sp.* and *Urtica sp.* (Figure 12).

|  |  |
| --- | --- |
|  |  |
| Figure 11 View of the existing arable land near Trnova (left) and Šehovci (right) (photo: Oikon Ltd.) | |
|  | |
| Figure 12 View of the vegetation towards the left bank of the Sana River (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: wood mouse (*Apodemus silvaticus*), fat dormouse (*Glis glis*), black rat (*Rattus rattus*), European rabbit (*Lepus europaeus*) and European mole (*Talpa europaea*). From large mammals we can expect: wild boar (*Sus scrofa*), European roe deer (*Capreolus capreolus*), fox (*Vulpes vulpes*), European badger (*Meles meles*), golden jackal (*Canis aureus*) and wolf (*Canis lupus*), which according to the Red List of Fauna of Federation of Bosnia and Herzegovina belongs to the category endangered taxa (EN). On the bank the river Bosna, the presence of an aquatic mammal, Eurasian otter (*Lutra lutra*) was also expected, which was also proclaimed endangered to the Red List of of Fauna of Federation of Bosnia and Hercegovina, while European beaver (*Castor fiber*) was pronounced regionally extinct species (EW).

Because of the proximity of the river Sana and 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*), common buzzard (*Buteo buteo*), euroasion jay (*Garulus glandarius).*

In the wider area along the river Sana there can be expected some amphibians species like frogs and newts, while form 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).

River Sana belongs to the Salmonid region, where the dominant fish population is composed of Salmonidae fish, such as brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*) and huchen (Hucho hucho), which has been declared an endangered species (EN) according to the Red List of fauna of the Federation of Bosnia and Hercegovina. In addition to the dominant salmonid species, cyprinidine species such as pyor (*Fhoxinus phoxinus*), pike (*Gobio obtusirostris*), chub (*Squalius cephalus*), common nase (*Chondrostoma nasus*), spirlin (*Alburnodeis bipunctatus*), tench (*Tinca tinca* and *Tinca cyanca*), prussian carp (*Carassius gibelio*), barbel (*Barbus barbus*), and *Barbus peloponesius*) and sunbleak (*Leucaspius delineatus),* which according to the Red List of Fauna of Federation of Bosnia and Hercegovina has a sensitive taxa status. There are also permanent habitats in the Sana River for european bullhead (*Cottus gobio*), grayling (*Thymallus thymallus*) and northern pike (*Esox lucius*) (Una-Sana Canton Environmental Plan 2014-2019, Ministry of Construction, Physical Planning and Environment of Una-Sana Canton).

### 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).

#### 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, but the area of the planned project is within the proposed Natura 2000 sites. However, at a distance of 3 km upstream of the planned area of operation, the proposed area is **BA8200014 Dabar-Čapljansko polje**.

Given that the planned irrigation system is located on the Sana river flowing through the planned Natura 2000 area, the presence of target species in the area of the planned operation is possible because it is located downstream of the Natura 2000 area BA8200014 Dabar-Čapljansko polje. The target species of the area are listed in the table (Table 11).

The target species of the BA8200014 Dabar-Čapljansko polje area, which has the status of endangered (EN) and vulnerable (VU), are fish and bats. Of the fish species: huchen (*Hucho hucho*), European mudminnow (*Umbra krameri*) and Danube streber (*Zingel streber*), while the endangered and susceptible bat fauna of the Red List of Fauna of Federation Bosnia and Hercegovina are: the greater horseshoe bat (*Rhinolophus ferrumequinum*) and the European horseshoe bat species (*Rhinolophus hippos*).

Table 11 Target species and habitats of potential Natura 2000 area BA8200014 Dabar-Čapljansko polje

|  |
| --- |
| Target species |
| *Hucho hucho* |
| *Aspius aspius* |
| *Rhodeus amarus* |
| *Umbra krameri* |
| *Cottus godio* |
| *Gymnocephalus schraetzer* |
| *Zingel streber* |
| *Rhinolophus ferrumequinum* |
| *Rhinolophus hipposideros* |
| Target habitats |
| 6450 Northern boreal meadows of river valleys |
| 6510 Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis) |
| 8310 Caves not open to the public |
| 91K0 Illyrian Fagus sylvatica forests (Aremonio-Fagion) |
| 8210 Calcareous rocky slopes with chasmophytic vegetation |

### Waste management[[10]](#footnote-10)

The collection, removal and disposal of municipal, solid, harmless and non-hazardous waste in the municipality of Sanski Most is performed by Public Utility Company "SANA".

The service of waste collection, removal and disposal covers approximately 90% of the entire area of ​​the municipality of Sanski Most according to the established daily and weekly dynamics. Waste disposal is performed without the procedure of selection and separation of solid waste.

Waste is disposed of at the landfill "Sanska brda" which stretches along the road in an area of ​​approximately 26,800 m2. The landfill "Sanska brda" is located on the very border of the catchment area of ​​the Mađarica spring on a geological basis which is very unfavorable on permeable land. As waste is mostly disposed of incorrectly and uncontrollably, it poses a great threat to the pollution of watercourses and springs (Mađarica - Sanski Most).

There are more then 100 registered illegal dumps in the municipality.

## Socio-economic characteristics

### Main socio-economic characteristics of Sanski Most Municipality

According to the official census data for BiH from 2013, there were a total of 41,475 inhabitants living in Sanski Most Municipality. However, in 2018, there were 40,166 inhabitants in Sanski Most Municipality[[11]](#footnote-11), which represents a decrease of 3.16%.

With a population density of 51.4 inhabitants/km2, Sanski Most Municipality 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 of the municipality, i.e. 53.5% of the total population, namely in the 16 of total 19 local communities (the remaining 3 local communities – Left bank, Right bank and Zdena are urban areas).[[12]](#footnote-12)

According to the 2013 census data, the number of inhabitants in the settlements that belong to the project area was as follows: Trnova 783 inhabitants, and Šehovci 880 inhabitants.

In economic terms, Sanski Most Municipality falls in the group of undeveloped municipalities in Bosnia and Herzegovina. According to the statistics for 2018, there were 641 legal entities registered in Sanski Most Municipality, 375 branches of legal entities, while the number of independent businesses or trades was 688. The largest number of registered legal entities was in the wholesale and retail, followed by other service sectors, the manufacturing industry and construction sectors.

Out of the total area, the agricultural land occupies an area of 39,303 ha. In the structure of agricultural land the largest share is arable land 61% (23,959 ha), followed by meadows with 18% (7,068 ha), pastures 15,5% (6,071 ha), and orchards with 1,6% (653 ha). Out of the total area of arable land, only 8,950 ha or 37% is cultivated.[[13]](#footnote-13)

According to the ownership structure and size of plots, 147,739 parcels are privately owned and 24,438 are publicly owned, with the majority of plots up to 1 ha in size.[[14]](#footnote-14)

### Agricultural parcels covered by irrigation/drainage system

According to data from the Preliminary design, the project area i.e. the planned irrigation/drainage infrastructure in the municipality of Sanski Most is located in the following Cadastral Municipalities (CM): CM Šehovci and CM Trnova.

According to preliminary data, the planned infrastructure for irrigation/drainage in Sanski Most Municipality will include 244 parcels in CM Šehovci and 271 parcels in CM Trnova. These plots are either located in the pipeline/canals route or in the location of system facilities, but only some of them may will be subject to some kind of expropriation. Ownership of plots is private.

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

Below is an analysis of the impact of the planned water abstraction quantities and the calculated ecological flow (EF).

For both project areas, the total amount of water planned to be abstracted is Q= 41 l/s or 0.041 m3/s.

The ecological flow for the dry part of the year is QEPP = 10,9 m3/s. As already mentioned in Chapter 5.1.5, endangering the EF in extremely dry periods by abstraction of irrigation water is only 0.38%.

Since it is a case of water catchment with horizontal drainage structures, it is expected that part of the hinterland groundwater will be captured, which would ultimately further minimize the negative impact on the EF.

The water quantities that will be drained from the project area is unknown. However, it is known that both project areas are exposed to floods, implying that there is a possibility that the water that will be drained from the project area will have some impact on increasing the water level downstream of the project sites.

In the Preliminary Design for the protection of the project area from flooding, it is proposed to build a protective embankment along the Sana riverbed around the project areas. This may also have the effect of increasing the water level downstream from project sites. Characteristic flows and water levels for high waters are given in the table below.

Table 14 Flows and water-levels in the sub-project areas for high water of return period of 1/20, 1/100 i 1/500

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Name** | **Flow (m3/s)** | | | **Water-level (m.m.m.)** | | |
| Q1/20 | Q1/100 | Q1/500 | Q1/20 | Q1/100 | Q1/500 |
| **Šehovci** | 636,19 | 754,72 | 826,50 | 159,52 | 159,72 | 159,83 |
| **Trnova** | 661,52 | 784,90 | 859,55 | 156,18 | 156,37 | 156,49 |

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

It is unknown whether the Sana River is used for drinking water supply downstream of the project areas. However, it is considered that abstraction of 41 l/s of water from the Sana River will not significantly jeopardize the ecological flow and other downstream users of waters 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 and pumping station on the Sana riverbank and acquisition of easement rights for the placement of irrigation pipeline and drainage canals.

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

Since there are no forests or forest land in the project area, there will be no impact on forests and forestry.

### 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 Sana 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 Sana River (downstream of the water-intake).

Since the Sana River is known for its abundance of tufa barriers, it is necessary to take all necessary measures to protect the tufa in the riverbed during the construction of water intake for irrigation system. Namely, tufa deposits are a habitat for many organisms and contribute to the overall biodiversity of karst terrains, which are otherwise very sensitive to anthropogenic impacts. The ecological significance of tufa deposited in the form of tufted sills is that they provide favorable living conditions for organisms and at times of extremely low flows, which are particularly characteristic for the Sana River. Downstream from tufted sills, free-flowing lakes are formed during low river flows that are quite acceptable depths for the survival of river fauna. The tufa, that is rapids and waterfalls that are in the riverbed are also significant in terms of increasing the turbulence of the water, which is important for natural purification of water.

### Air quality

During construction works such as construction of water capture, pipes and pumping stations for irrigation purposes, drainage channels and manhole for the drainage of excess water, 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

During the construction works, noise emissions will arise as a result of using mechanization 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, measures for mitigating the impact will prescribe daily working hours in areas that can be mostly affected. This impact is assessed as temporary and less significant.

### Biological Characteristics

#### Flora and fauna

During the construction of the irrigation system, there will be changes and occupation of the habitat due to the work of clearing part of the Sana river bank, construction of hydrants, drainage trenches and absorbent manholes. Given that the area of intervention is under anthropogenic influence dominated by arable and neglected agricultural areas with low biodiversity, the impact on biodiversity is considered acceptable. Existing canals are overgrown with ruderal or invasive vegetation (*Ailanthus altissima*) and its removal does not have a negative impact. The construction of drainage canals will result in permanent removal of coastal vegetation and occupation of agricultural habitat, but given the small occupied area, this impact is not considered significant. The work on the coast will also lead to a small occupation of the coastal habitat of riparian forest vegetation and riverine habitat potentially relevant to the endangered species of fish, such as huchen (*Hucho hucho*). However, due to the developed riparian vegetation around the area of intervention, this impact is considered acceptable.

The movement of machinery and workers increases the risk of introducing new invasive alien species of flora and fauna. Measures should be taken to prevent their spread: to clean up machinery and vehicles before use in the project area, and to allow restoration to its original natural state after construction works. In case of invasion of an invasive species, try to prevent it from spreading and remove it.

Noise, dust, particulates and gases, which can disturb the local fauna, will be reported due to the works. These impacts are limited to the narrower construction area and are temporary, therefore considered acceptable. Impacts can be mitigated by appropriate good construction practices: site organization, regular equipment maintenance, sound attenuators, etc.

### Protected areas and ecological network

The planned irrigation system is not within the protected area and will not be adversely affected.

Also, the planned irrigation system is not within the area of the planned ecological network but is located three kilometers downstream of the area of the planned ecological network Natura 2000 BA8200014 Dabar-Čapljansko polje and there will be no negative impacts on this area.

### 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).

One part of the distribution pipeline route is planned alongside of a 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.

Therefore, the potential negative impacts on the land that may occur during use are the pollution of land and groundwater due to the excessive use of chemical agents, and causally a consequence of a disturbance in the ecological balance of the land of the irrigated 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 Sana 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 Sana 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.

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 Sana river and no impact on endangering the ecological flow of the Sana 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 Sana 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. Acid and chlorine evaporation in the catchment area that will be used to treat water could be expected, however, these are negligible quantities that will not affect the air quality in the area concerned. 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 Sulfur Content in Fuels (“Official Gazette FBiH”, No. 06/08), these emissions can be further reduced.

### Noise

No increase in noise emissions is expected during operation of irrigation system. Increased noise levels can occur during the maintenance of irrigation systems, during the cleaning of drainage channels using machines, then, through the use of agricultural machinery and the operation of pumps. Works on the maintenance of the irrigation systems and drainage channels are performed occasionally and do not represent a constant source of noise and have very little effect on the increase of noise level. The use of agricultural machinery is also occasional and the intensity and duration of the noise are time-limited. As the project envisages the selection of pumps with appropriate operating characteristics and maintenance in an optimal mode, it is not expected that the noise levels in the observed area will be affected. 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.

### 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 the 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 Sana 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, part of the water will be returned to the Sana River by drainage channels, and water purification filters need to be installed at these sites to reduce the potential for contamination of the Sana River with fertilizers and pesticides.

### Impacts on protected areas and ecological network

The planned irrigation system is not within the protected area and will not be adversely affected.

The planned irrigation system is not within the area of the planned ecological network but is located three kilometers downstream of the area of the planned ecological network Natura 2000 BA8200014 Dabar-Čapljansko polje and there will be no negative impacts on this area.

### 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[[15]](#footnote-15);;
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 13 Plan of Measures for Prevention/Mitigation of Environmental and Social Impacts for the Sub-Project areas of Šehovci and Trnova in Sanski Most Municipality

| **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 | Noise from the operation of irrigation pumps | Plan to use appropriate pumps in the optimum mode of operation and noise emissions. | Included into system design costs. | - | Designer | Designer | Regulate through construction works contract. | |
| 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 Sana river | Define acceptable activities for the exploitation of water of the river Sana.  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 Sana | |
| 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 | Morphological changes in the flow of the Sana river caused by the excavation of tufa barriers in the riverbed | Investigate the presence of tufa barriers at the location of the planned water intake.  It is prohibited to remove or destroy tufa deposits in the riverbed during construction works. | - | - | 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 14 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 Sana and at the point where the canal flows into the Sana River (if there will be a canal drainage system) | 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 Sana:   * pH * flow * turbidity * conductivity * suspended particles | On river Sana downstream from water-intake at the point where the canal flows into the Sana River (if there will be a canal drainage system) | 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 Sana 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 Sana | 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 Sana | 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 Sana 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 Sana downstream from water-intake at the point where the canal flows into the Sana River (if there will be a canal drainage system) | 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 Municipality Sanski Most 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 consultation, the draft "Environmental Management Plan for the sub-project Šehovci and Trnova in Sanski Most Municipality" was published on the website of the PIU Forestry and Agriculture (http://portal.piusum.ba). The public was informed about the date and venue of the public consultation on the website of Sanski Most Municipality.

Public consultation of the Environmental Management Plan for the sub-project Šehovci and Trnova in Sanski Most Municipality was held on 06/08/2019 in the premises of Sanski Most Municipality, starting at 12:00.

The consultation was attended by 17 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 municipality 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 15 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[[16]](#footnote-16) (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[[17]](#footnote-17),
* 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[[18]](#footnote-18) .

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[[19]](#footnote-19). 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[[20]](#footnote-20). 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[[21]](#footnote-21) 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[[22]](#footnote-22) 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[[23]](#footnote-23).

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[[24]](#footnote-24)
* 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[[25]](#footnote-25) 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[[26]](#footnote-26) 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[[27]](#footnote-27). 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[[28]](#footnote-28) has been harmonized with the ILO Convention on Occupational Safety and Health, No. 155[[29]](#footnote-29) and Occupational Safety and Health Recommendation No. 164[[30]](#footnote-30) 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[[31]](#footnote-31), which Bosnia and Herzegovina has accepted and ratified. The provisions of Council Directive 89/391/EEC of 12 June 1989[[32]](#footnote-32) 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 Šehovci and Trnova in Sanski Most Municipality (Draft)“**

**Location:** Municipal Hall of Sanski Most Municipality

**Date and time:** 06/08/2019; 12:00

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

**Participants:** The consultation was attended by 17 participants. The list of participants is given in Annex 2.

In the introductory part, Mayor of Sanski Most Municipality Mr. Faris Hasanbegović welcomed all the participants.

Representative of PIU Forestry and Agriculture, Ms Amela Ibrahimović welcomed the participants and introduced them with basic information on the project, dynamics and current activities, and what has been done so far with special emphasis on the short deadlines of the project, which closes in November 2019.

The presentation of draft EMP was held by Ms Dragana Selmanagić, on behalf of the consortium of the Hydro-Engineering Institute Sarajevo (HEIS) and Oikon Ltd. Zagreb who are responsible for preparation of this document. The presentation was followed by discussion and answering questions asked by the participants.

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

**Mr. Emir Talić, president of the Council of Local Community Šehovci**, and as a farmer, welcomed all participants, noting that he supported the project. He stated they were satisfied with the technical equipment of the project, and the only complaint is the lack of extension of the irrigation system project to the right side of the planned area. He emphasized that this area remained uninvolved in the project and that the right side is not being flooded and is economically more profitable than the left side. That area includes approximately 22 ha of non-flooded arable land that is a priority for irrigation. At the previous public consultation, it was stressed that it would be a more economically viable project if the irrigation was shifted to the right side. This will give the opportunity to grow more profitable crops and to set up greenhouses. Nothing can be done now because there is no irrigation, and it is absolutely necessary. On this side where irrigation is now planned, drainage is necessary, so they are in a dilemma and he thinks that the project will not be profitable if irrigation is not on the right side.

**Representative of the Designer Mr. Milos Marmat (Routing, Ltd. Banja Luka and Aqueduct Belgrade)** addressed the attendees. He noted that this was discussed at the previous public consultation, and that it was then proposed that this request should take into account in the project, that is, to take into account that parcel of about 20 ha. He noted that they did not receive input from PIU Forestry and Agriculture to extend the project to this area, i.e. they did not receive any contract annex or authorization to so this. However, as designers they have promised that they would provide the capacity of the irrigation system to supply water to the boundary of these areas, so that the farmers could connect to the system through some other projects.

**Ms. Amela Ibrahimovic, representative of PIU Forestry and Agriculture**, emphasized that no changes are possible at this stage because the Main Design is in the process of preparation, but since the Designer said that they took into account in the design that the area can be irrigated in the long run, then there is a possibility to “push” this expansion through some other projects or other funding.

**Ms. Dragana Selmanagic, a representative of the HEIS consultant**, asked the representatives of the Municipality if they had ever initiated a flood protection procedure towards the competent Sava River Water Agency, at the stretch where the Sana River floods, independently of this project?

**Mr. Milos Marmat, representative of the Designer**, emphasized that they, as designers, had proposed to build a flood protection embankment along the project area and that further cost-benefit analysis have taken into account this proposal.

**Mr. Tehvid Harjić, a representative of Sanski Most Municipality**, noted that requests were submitted with the Study for obtaining prior water approval for the irrigation project.

**Ms. Aida Karic, a representative of Sanski Most Municipality**, said that they did not initiate an initiative towards the Agency. For some time, some activities have been carried out to address flood protection on the Sana River, and all of this has been slow. The project is being disputed, and in general, everything is going slow with the competent Cantonal Ministry and the Sava River Basin Agency.

**Mr. Irfan Hadzic, a representative of Sanski Most Municipality**, asked the Designer about the technical solution. Can Designers, at this stage of the project, provide a technical solution and dimension the system with the assumption that the disputed areas of approximately 20 ha will be connected in the long run, that is, to create infrastructure assumptions and conditions for future expansion of the irrigation system?

**The representative of the Designer, Milos Marmat**, said that the projected quantities of irrigation water and the necessary infrastructures were taken into account during the design, i.e. it was increased to enable the subject area to be connected in the long term.

**Ms. Aida Karić, representative of Sanski Most Municipality**, asked if the Designer has proposed a technical solution on floods protection in the best way?

**The representative of the Designer, Milos Marmat**, replied that this requires a special design, given the complexity of the analysis and that this should not have been addressed through this design. He noted that the Study on Prior Water Approval was done and submitted to the Municipality in order to further initiate the procedure for obtaining Prior Water Approval.

**Ms. Amela Ibrahimovic, a representative of PIU Forestry and Agriculture**, addressed the representatives of the Municipality regarding the expropriation of land for the purposes of this project, as the system goes mainly through private land. She noted that according to the experience in other municipalities, temporary expropriation of land was almost always done for pipe laying, i.e. during the works, provided the Contractor restores the land to its original state. Only locations of facilities such as pumping stations or reservoirs must be permanently expropriated. She emphasized this solely for the sake of note and to keep this in mind due to the short timelines.

**Ms. Dragana Selmanagic, a representative of the HEIS consultant**, emphasized once again that there is very little time left and that urgent action is needed, otherwise everything will remain on paper only. It's a shame not to take advantage if someone is already donating funds for projects like this.

**Mr. Emir Talić, president of the Council of Local Community Šehovci**, said that they will do their best and do everything in their power with regard to property and legal relations.

**Ms. Aida Karic, representative of Sanski Most Municipality**, expressed her concern for the period until the signing of the Contract with the Contractor, that is, the obligations of the Municipality that need to be resolved by that time.

At the end of the public consultation, **Ms. Dragana Selmanagic (HEIS)** thanked the attendees, noting that if anyone had any questions, comments, to report them, because the aim is to make the document as good as possible, and to serve the Municipality and Designers for further continuation work on this project.

Minutes prepared by: Dragana Selmanagić, 08/08/2019

**Annexes:**

Annex 1. Agenda

Annex 2. List of participants

**ANNEX 1**

**AGENDA**

|  |  |
| --- | --- |
| **Time** | **Activity** |
| **12:00 – 12:15** | **Welcome**  *Mayor/representative of Sanski Most Municipality*  *Director/representative of PIU Forestry and Agriculture* |
| **12:15 - 13:00** | **Presentation of Environmental Management Plan (EMP) for the Sub-Project areas Šehovci and Trnova in Sanski Most Municipality (Draft),** *Consultants* |
| **13:00 – 13:15** | **Coffee break** |
| **13:15 – 14:45** | **Discussion and comments**  *Participants* |
| **14.45 - 15.00** | **Conclusions** |

**ANNEX 2**

****



1. Preliminary design of irrigation system in sub-project areas Šehovci and Trnova, Sanski Most Municipality, June 2019, Routing, Ltd. Banja Luka; Aquaduct, Ltd. Belgrade [↑](#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 areas Šehovci and Trnova, Sanski Most Municipality, June 2019, Routing, Ltd. Banja Luka; Aquaduct, Ltd. Belgrade [↑](#footnote-ref-3)
4. Preliminary design of irrigation system in sub-project areas Šehovci and Trnova, Sanski Most Municipality, June 2019, Routing, Ltd. Banja Luka; Aquaduct, Ltd. Belgrade [↑](#footnote-ref-4)
5. Preliminary design of irrigation system in sub-project areas Šehovci and Trnova, Sanski Most Municipality, June 2019, Routing, Ltd. Banja Luka; Aquaduct, Ltd. Belgrade [↑](#footnote-ref-5)
6. http://www.voda.ba/pp-sana-sanski-most [↑](#footnote-ref-6)
7. Annual report on the status of waters of the Sava River Basin in the Federation of Bosnia and Herzegovina in 2018 [↑](#footnote-ref-7)
8. Analyzes made within the Preliminary Design of Irrigation System of Šehovci and Trnova, Sanski Most Municipality, June 2019, Routing, Ltd. Banja Luka; Aquaduct, Ltd. Belgrade [↑](#footnote-ref-8)
9. Ibid [↑](#footnote-ref-9)
10. Local Development Strategy of Sanski Most Municipality 2014-2023 [↑](#footnote-ref-10)
11. Federal Institute for Development Programming, "Socioeconomic Indicators by Municipalities FBiH in 2018.“, Sarajevo, June 2019 [↑](#footnote-ref-11)
12. „Local Development Strategy of Sanski Most Municipality 2014-2023“, January 2014 [↑](#footnote-ref-12)
13. Federal Institute for Development Programming, "Socioeconomic Indicators by Municipalities FBiH in 2018.“, Sarajevo, June 2019 [↑](#footnote-ref-13)
14. „Local Development Strategy of Sanski Most Municipality 2014-2023“, January 2014 [↑](#footnote-ref-14)
15. 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-15)
16. Law on Changes and Amendments to the Law on Waste Management („Official Gazette of FB&H“, No. 72/09) [↑](#footnote-ref-16)
17. Official Gazette of FBiH, No. 15/21 [↑](#footnote-ref-17)
18. Official Gazette of FBiH, No. 19/04, 1/21 [↑](#footnote-ref-18)
19. Official Gazette of FBiH, No. 19/04, 1/21 [↑](#footnote-ref-19)
20. Official Gazette of FBiH, No. 33/03, 72/09, 92/17 [↑](#footnote-ref-20)
21. Official Gazette of FBiH, No. 9/05 [↑](#footnote-ref-21)
22. Official Gazette of FBiH, No 70/06 [↑](#footnote-ref-22)
23. Official Gazette of FBiH, No. 06/08, 57/09, 72/09 [↑](#footnote-ref-23)
24. Official Gazette of FBiH, No. 2/06, 72/07, 32/08, 4/10, 13/10, 45/10 [↑](#footnote-ref-24)
25. Official Gazette of FBiH, No. 48/09, 75/09, 93/12, 74/13, 89/14, 99/14, 53/15, 101/15 [↑](#footnote-ref-25)
26. Official Gazette of FBiH, No. 29/16, 89/18, 23/20 - Decision of Constitutional Court [↑](#footnote-ref-26)
27. Official Gazette of FBiH, No. 30/97, 7/02, 70/08, 48/11, 100/14, 36/18 [↑](#footnote-ref-27)
28. Official Gazette of FBiH, No. 79/20 [↑](#footnote-ref-28)
29. 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-29)
30. 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-30)
31. European Social Charter 1961, Available at: <https://www.coe.int/en/web/european-social-charter> [↑](#footnote-ref-31)
32. 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-32)