ENVIRONMENTAL AND SOCIAL IMPACT MONITORING PROGRAM FOR THE RESTORATION OF SATESKA RIVER IN ITS NATURAL RIVERBED



Skopje

July 2025

The Environmental and Social Impact Monitoring Program for the restoration of Sateska River in its natural riverbed was prepared by the team, presented in the table.

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1. Environmental and Social Impact Monitoring Program

1.1. Introduction

The Environmental and Social Monitoring Program (ESMP) aims to assess the degree of project implementation and the effectiveness of implementing mitigation measures in the operational phase of the project in Sateska sub-basin. The purpose of monitoring is to ensure that the impacts are within the predicted limits and to provide timely information if an unacceptable impact is taking place. In some cases, the project should also monitor the status of ongoing or further threats to biodiversity and social aspects from the other projects in vicinity of the project area.

Wherever deviations with the Project's objectives and commitments are detected, adaptive / corrective actions should be put in place to ensure a positive outcome for the biodiversity features and social aspects of the Project. Such action may entail the definition of alternative monitoring indicators or methodologies. This means that the ESMP is a living document that will be subject to periodic reviews, leading to regular updates that will contribute to optimize the monitoring and the expected outcomes of the project in terms of biodiversity and social aspect based on:

• The results of the proposed monitoring;

• The results of the proposed mitigation measures; and

• The associated increase of knowledge and accumulation of data in terms of natural variation in biodiversity features and social aspects that may modify previously proposed thresholds.

1.2. Monitoring program for key environmental and social indicators

A water monitoring program is a systematic process to assess the quality of water resources, identify potential pollutants, and ensure compliance with environmental standards. It involves regular sampling and analysis of water bodies to track changes in water quality over time and identify areas needing attention.

Key aspects of a water monitoring program include: Clearly outlining the goals of the monitoring program; Establishing Monitoring Locations (selecting appropriate sites for sampling, considering factors like proximity to pollution sources, water flow patterns, and representative areas); Selecting Parameters (determining which physical, chemical, and biological characteristics of the water to analyze, based on the program's objectives); Developing a Sampling Plan (specifying the frequency of sampling, the methods for collecting samples, and the procedures for handling and preserving them); Analyzing Samples (Conducting laboratory analysis of water samples to determine the concentrations of chosen parameters); Data Management and Analysis (Storing collected data in a database, analyzing trends, and generating reports) and Reporting and Action (Sharing monitoring results with relevant stakeholders, identifying areas of concern, and implementing corrective actions to improve water quality).

The benefits of water monitoring programs are:

- ✓ Protection of Public Health, ensuring the safety of drinking, recreational and irrigation waters;
- ✓ Environmental Protection, identifying and mitigating pollution sources, protecting aquatic ecosystems, and maintaining water quality;
- ✓ Providing data for water resource management, policy development, and environmental planning in decision-making process and
- ✓ Compliance with Regulations (ensuring adherence to water quality standards and regulations).

This monitoring program is design on the base of findings during assessment of the status of the habitats and species along the river bed and artificial channel of Sateska River and includes defined set of environmental and social indicators (receptor/parameter), data collection methodologies, location and frequency of monitoring activities, reason for monitoring and responsible entities. Potential sources of financing for the monitoring program in Sateska sub-basin is not part of the ESMP. It should be specifically design on a base of the assessment of the existing institution and human capacity for developing and implementation long term monitoring system on the rivers in the Drini River basin, as well as Ohrid Lake.

For establishing a reliable monitoring on Sateska River (natural river bad and artificial chanal), the expert's team propose establishing remote sensing and GIS based mapping, monitoring and modeling system, which will offer biodiversity mapping for individual species, species assemblages and habitats; assessing and enhancing biodiversity conservation efforts with meticulously planned and executed biodiversity monitoring program and predict species distribution and risk to biodiversity to aid visualization, exploration and modeling of data on species distributions, modelling, ecological niche modeling and habitats suitability modeling has been growing at a striking rate in the recent years.

At the specific case of Sateska River, the remote sensing GIS based system can be used to monitor changes in water quality, water levels, and vegetation patterns in and around river water body for developing conservation plans that aim to protect aquatic habitats and the species that depend on them. It also can give the information of land use around the artificial and natural riverbed and serve for the socio-economic monitoring.

The following Table gives insight into the proposed monitoring program.

Table 1 Environmental and Social Monitoring Program for Operational phase

ENVIRONMENTAL ASPECTS						
Biodiversity	**What?** (Receptor / Parameter to be monitored)	**Where?** (Monitoring location)	**How ?** (Monitoring method/type of monitoring equipment)	**When?** (Define the frequency of monitoring)	**Why?** (Reason for monitoring)	**Who?** (Responsibility for monitoring)
Algae	Diatom composition	1). Littoral zone of Lake Ohrid, specifically at the confluence with the Sateska channel 2). Five selected sampling sites along the natural riverbed (4 downstream of v. Volino to confluence of Sateska River into river Crn Drim and 1 upstream of v. Volino)	Collection of algal biofilm from at least five stone with toothbrush	Twice a year (late spring and autumn season) during the first three years of the operational phase. After this period, monitoring should continue once every three years.	To check the development and stability of diatom composition after diversification	Diatom taxonomy and ecology expert
Habitats	1. species composition of communities 2. abundance of significant species 3. presence of non-native species 4. occurrence of other habitat disturbances	For selected sampling sites along the natural riverbed (3 downstream of v. Volino and 1 upstream of v. Volino). There are no natural habitats in the canal.	By determining a specific area for monitoring at each of the measurement sites and by monitoring the status of indicators (number of natural and allochthonous species) and by determining their abundance.	Forest habitats in may or june. Macrofite vegetation in july.	To check the development and stability of plant communities after diversification	Phytocoenologist
Flora species	No species of conservation importance were observed. The condition of the other plant species will be determined by monitoring the condition of the plant communities	No significant conservation species were observed either in the old river bed or in the channel	/	/	/	/

Aquatic meiofauna	Meiofaunal community structure: composition, abundance, diversity indices, saprobic values	Key sites along the natural Sateska Riverbed (e.g., upstream, midstream, downstream)	Benthic dredge, 55 µm mesh microsieve, taxonomic identification via microscopy and keys	Twice a year (spring and autumn)	To assess biodiversity status and detect responses to environmental stressors (e.g., pollution, hydromorphological changes)	Meiofauna experts
Aquatic macroinvertebrates	1). Presence and relative abundance of conservationally important species (aquatic gastropods *Chilopyrgula sturanyi, Valvata (Cincinna) stenotrema, Ampullaceana relicta* and *Ochridopyrgula macedonica m*acedonica, and the mussel *Dreissena carinata*) 2.1). Species composition and relative abundance of aquatic invertebrates 2.2). Ecological status assessment 2.3). Presence and relative abundance of invasive aquatic invertebrate species	1). Littoral zone of Lake Ohrid, specifically at the confluence with the Sateska channel 2). Five selected sampling sites along the natural riverbed (4 downstream of v. Volino to confluence of Sateska River into river Crn Drim and 1 upstream of v. Volino)	1). Ekman birge sampling 2). Kick-net sampling and hand picking	Twice a year (late spring and autumn season) during the first three years of the operational phase. After this period, monitoring should continue once every three years.	To ensure whether the mitigation measures are undertaken properly and if they mitigate the negative impact of the operational phase	Aquatic invertebrate experts
Insects	Riparian Coleoptera species	Along river Sateska with focus on sandy banks and wetland habitats	Qualitative assessment of beetles by standardized hand-collection method, at five predefined sites	Once a year during June	To document the recolonization of the habitats along river Sateska by beetles	Entomologist
Fish	Fish species presence, distribution, and relative abundance of fish species	Minimum 4 sampling sites along the old riverbed and one sampling site upstream of Volino	Monitoring will be conducted with electrofishing - Number of caught species on a certain	No less than 2 times per year during operative phase (late spring	To follow does implementation of mitigation measures amortize	Fish biology experts

	To determine the spawning sites of the fish species Presence of allochthonous fish species		transect of each of the investigated localities and comparison with the results from the investigation from two seasons per year - Determine the presence or absence of juveniles and/or adults - Presence of sedimentary deposits at the bottom of the riverbed at every investigated transect	and autumn season) This type of monitoring should be conducted regularly during the first three years of the operational phase. After this period, monitoring should continue once every three years.	negative effect of operative phase	
Amphibians and reptiles	1. European pond turtle (Emys orbicularis) 2. Macedonian crested newt (Triturus macedonicus) 3. Balkan whip snake (Hierophis gemonensis)	1. Map flooded areas of no to slo-flowing water where animals are spotted basking 2. Identify very-slow-to-no flow areas of the river basin where monitoring can take place 3. Open areas along the new channel, especially rocky outcrops	1. Binoculars to establish presence by spotting basking animals; after mapping out the inhabited areas, if an expert assesses that the population merits more detailed monitoring, a capture-recapture scheme can be initiated. Aquatic funnel traps can be used in designated areas annually, animals captured, marked using a notch code (Stubbs 1984), and identified at points of recapture. 2. Monitor for reproductive activity during April and early May. Look for aqatic vegetation or flooded terrestrial vegetation	1. Both checking for presence or eventual capture-recapture studies should be undertaken in annually in May. 2. Annually in April and/or May 3. Annually in late spring	1. Nationally Endangered species	Managing body of an eventual protected area established in the region with consultation and training from experts

			along the coastline. Female crested newts use their hind legs to pack each egg separately, usually per leaf. Folded leaves may seem broken or cut, so should be checked for white eggs or embryos (Fig. 2). The smooth newt reproduces in similar habitats and times of the year, but their eggs are smaller and grey. 3. Visual searches should be performed. Monitoring of roadkill along closeby frequented roads can also be an efficient method of ascertaining its presence, as such instances are not uncommon close by on the roads trailing the base of Jablanica Mt. Photographing individuals (roadkill or alive) is imperative as this species is often misidentified as the much more common Caspian whip snake, particularly the immature or subadult individuals.			
Birds	Water bird species	Mouth of the channel into lake Ohrid	Bird counts with binoculars	Twice a year, in January and April	To document the population of water bird species, both	Ornithologist

					during migration and breeding season	
	Breeding bird species in the riparian habitats of river Sateska	Along river Sateska, from v. Volino to the confluence with river Crn Drim	Transect method (at least two transects along the natural riverbed)	Twice a year, in April and June	To provide insight on the positive effects of restoration of river bed of Sateska on breeding bird species	Ornithologist, in coordination with winter censuses of Lake Ohrid
Mammals	Otter, bats	Along river Sateska, from v. Volino to the confluence with river Crn Drim	Observation for Otter (5 predefined sites) Bat-detector for bats with transect method (two transects)	Once a year, in June	Monitoring of recolonization of riparian and aquatic habitats of river Sateska by mammals	Mammologist
SOCIAL ASPECTS						
Social Impacts / Mitigation measure	What? (Receptor/Parameter to be monitored)	Where? (Monitoring location)	How? (Monitoring method/type of monitoring equipment)	When? (Define the frequency of monitoring)	Why? (Reason for monitoring)	Who? (Responsibility for monitoring)
Develop and implement a Livelihood Restauration Plan (LRP)	Implementation of the LRP provisions	On site	Visual inspection. Interviews Documentation review	LRP will define	Fulfillment of SES 5	External LRP consultant
Livelihood Restauration Plan (LRP)	Monitor Agricultural Cessation in the following 5 years	On site	Visual inspection. Interviews Documentation review	LRP will define	Fulfillment of SES 5. Avoiding economic deprivation of farmers	External LRP consultant
Implementation of Promotional campaign on Improvement	Create and promote the Brochure on improved agricultural practices	Villages part of the Sateska watershed, 15km upstream from the confluence with Crn Drim River	Physical distribution of the brochure to the homes of the residents of these villages	Annually, five years	Successful completion of the Promotional campaign	Municipality of Struga and/or Debarca

of Agricultural practices						
Educational program on sustainable Agricultural practices	Implementation of educational activities on sustainable agricultural practices	Villages part of the Sateska watershed, 15km upstream from the confluence with Crn Drim River	Number of realized educational activities in the villages and primary schools	Annually, five years	Successful completion of the educational activities	Municipality of Struga and/or Debarca
Infrastructure Improvements	Established bridge crossings over Sateska's old riverbed	On site	Visual inspection	Once, after completion	Establishing road access to the fields	Municipality of Struga and/or Debarca
Stakeholder Engagement Plan	Creation and implementation of SEP's provisions	On site / desk office	Document check	Saemi- Annually	Maintaining trust and accountability	Municipality of Struga and/or Debarca
Establish a telephone hotline for monitoring of illegal waste disposal practices	Telephone number and its visibility on site	On site	Direct contact	Annually	Minimizing the pollution of the riverbed	Municipality of Struga and/or Debarca
Form a working group that will monitor improvement of the situation of the river	Formalization of the group	On site, Documents	Document/meeting reports check	Annually	Involving important stakeholders	Municipality of Struga and/or Debarca

1.3. Reporting

First three years of the operational phase, seasonal monitoring reports will be prepared to include all data sets, analyses, conclusions and recommendations for management interventions, while the annual reports will include a more detailed trend analysis and will be prepared at the end of construction phase. After this period, seasonal and annual final reports will be prepared once every three years.