Project: Sustainable Hydro Assessments and Groundwater Recharge Projects
Project acronym: SHARP

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APPENDIX: Long version of good practices

GP 8	Systematic monitoring of groundwater and surface water (mining closure)

Project Partner:
Institute of Meteorology and Water Management (IMGW)

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1. Description

The presented Good Practice consists in integrated **monitoring of groundwater and surface water in the vicinity of lignite opencast mines (mining closure)** – monitoring network in the anthropogenically transformed area.

Monitoring (within the anthropogenically transformed area) allows for a rational management of water resources and provides information on the variability in groundwater levels as well as water chemistry in the system under strong anthropopression. The monitoring network provides a comprehensive and systematic information on the quantitative and qualitative status of water system,. Furthermore, it also allows to specify long-term trends of anthropogenic impact. Monitoring of water environment, in areas of open pit mines, should be carried out at each stage of mining operation – overburden removal, mine dewatering, growth of depression cone, dewatering impact on surface water resources.

Multi-annual monitoring of surface and groundwater carried out within the Lusatian Neisse basin allows to elaborate a diagnosis of the aquatic environment of the studied area and to develop forecasts of the direction and rate of changes in the hydrogeological conditions. Cross-border control of the interaction of the water system is also important in order to prevent conflict situations. The joint monitoring of the water system,

analysis of the monitoring results provide data on the status and quality of the water in this area, and also allows an identification of hazards from sources located in the territory of the neighboring country, and thus the alarm when the real threats to the water system.

An evaluation based on survey data derived from existing monitoring network which is located in the catchment of the transboundary Lusatian Neisse basin was carried out.. The evaluation concerned disposable resources and the rules of division of these resources It was carried out for the purpose of flooding the post-mined pit Berzdorf which is located in Germany. Multi-variant scenarios of water intakes were developed for this project. These scenarios allow to determine the Polish Government's attitude towards water intake, which is most advantageous for the reduction in water resources of the Lusatian Neisse basin.. The Polish Government's decision was to choose the optimal solution, which would not significantly reduce the water resources of the Lusatian Neisse River and would not worsen the ecological status of surface water. The report, prior to the beginning of the water intake, has been presented to public consultation concerning the assessment of environmental impact and has been agreed by the bilateral Polish-German Commission for Boundary Waters. Furthermore, a hydrodynamic and hydrogeological model of the German Jänschwalde mine area was done on the basis of monitoring data. The aim of the model was to assess the impact of dewatering the mine on the water resources within the Polish territory. Evaluation of changes in soil-water environment requires both current and archival data related to the status of waters. Therefore, long-term monitoring of the water resources within the areas of risks enables to develop diagnosis, forecast trends and rate of changes in water conditions induced by external elements.

Characteristics of the research area

The research is performed in the Lusatian Neisse River basin, which at nearly 200 km section is the border river between Poland and Germany. Water resources in the basin are under high influence of anthropopression, because of very intensive use of water resources in the basin. The main users are the opencast lignite mines, in various stages of operation.

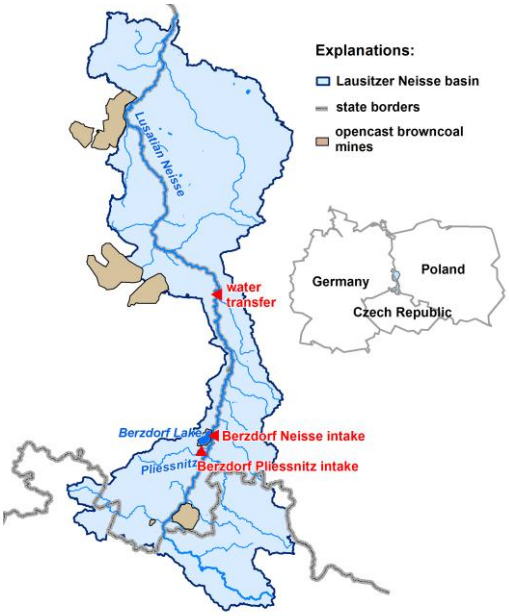

Fig. 1: Localisation of Lusatian Neisse basin.

2. Methodology

Work of experts coming from many fields has resulted in the creation of a joint Polish-German "Concept of monitoring of water intake from the Lusatian Neisse for the purpose of flooding". When it comes to the authors from the Polish party of the study, these were employees of the Institute of Meteorology and Water Management National Research Institute Wroclaw Branch (IMGW PIB). The Institute has also been appointed to carry out the planned monitoring of the given concept.

The scope of monitoring (Fig. 2):

Climatic data

On the basis of climatic data, components of water balance are determined. What is more, surface flow and groundwater flow which are specific for a given region are established.

Water flow intensity in rivers

Keeping record of daily flows at different water gauges is required in order to control water intake from the Neisse river and necessary to assess the hydrological conditions in the basin compared to average, multi-year flows.

Groundwater's level

Observation of groundwater level is crucial in order to identify the possible influence of water intake on groundwater and for the purposes of assessment of trends in groundwater level formation.

Direct water intakes and discharges

Direct water intakes and discharges are necessary to assess water balance of the Lusatian Neisse river.

Water quality

Controlling the selected parameters of water quality from the Lusatian Neisse river and groundwater enables to assess any long-term changes and their impact on supplying the society with water.

Biomonitoring

Monitoring plant and animal communities on the Lusatian Neisse itself, the riparian zones of the river and valuable biotopes on both sides of the Neisse is carried out in order to protect the river against the effects of the planned projects.

Technical monitoring

Technical monitoring is performed in accordance with the developed planning documentation. What is more, it should guarantee the fulfillment of the decision concerning the volume of water intake and ecological flow.

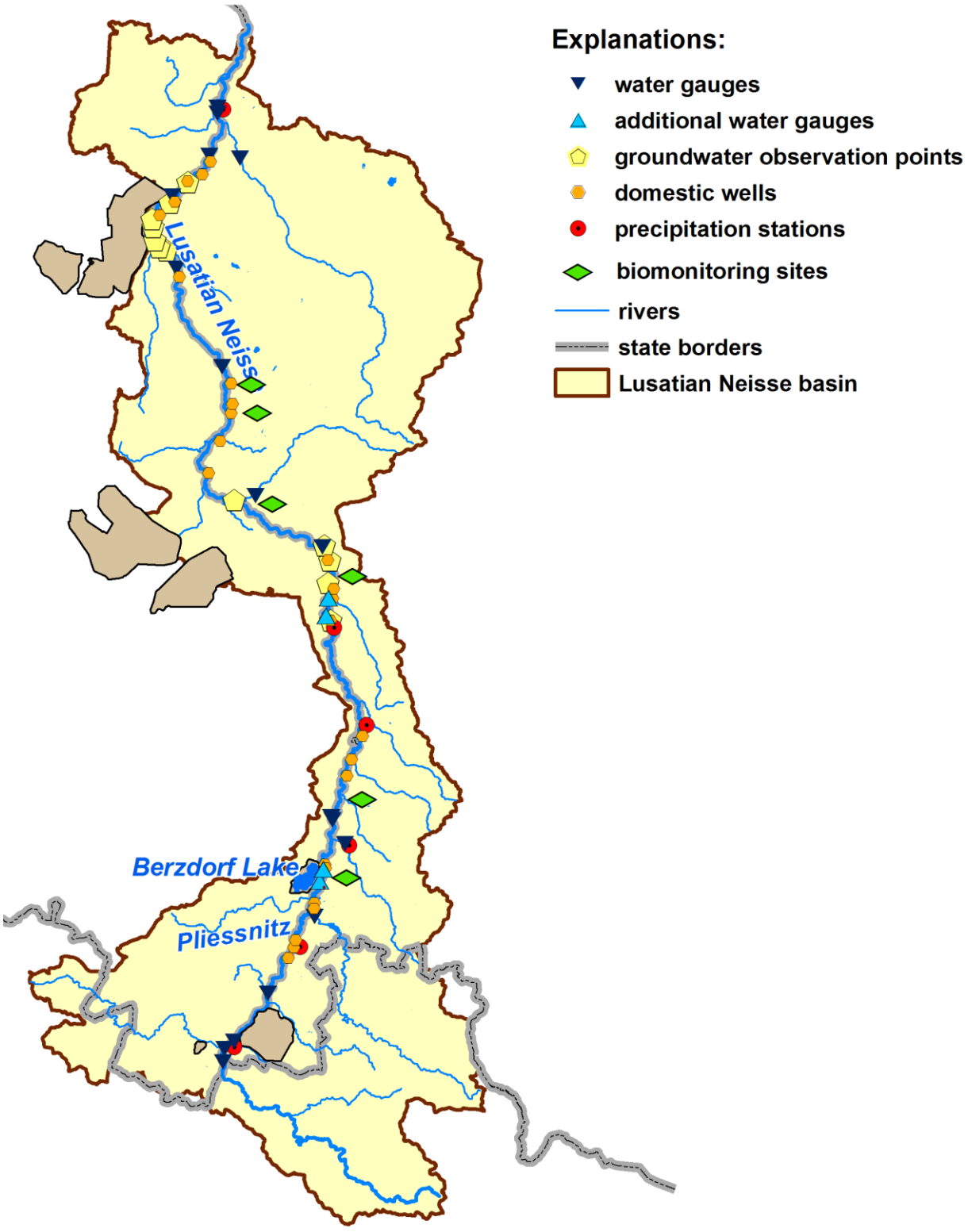

Fig. 2: Localization of monitoring points.

In addition, geodetic measurements are made in the area of water transfer whose aim is to measure the possible impact of the water reservoir which is being built on an uplift or settlement of the ground in the vicinity.

Both the scope of measurements and analysis carried out for each party - Polish and German one have been determined. Every year, each party prepares a report on the conducted monitoring which covers data from its territory from the previous calendar year. An exchange of reports takes place during joint annual meetings at which authors present the obtained results. Then, the reports are analyzed and, if necessary, a new scope of monitoring is established. After approving the report, an abbreviated version of the reports is prepared, which is transferred to the Polish-German Transboundary Water Commission.

Three zones and four phases have been distinguished in the executed monitoring :

The zoning refers to an extent of impact of the planned project. Along with the course of the river, a division into three zones is established.

Zone 1 - river itself together with direct riparian areas on both sides.

Zone 2 - area directly and indirectly influenced by the water intake in width from 100 m to 250 m, at both sides of the Neisse.

Zone 3 - area directly influenced by water intake in width to 1000 m, at both sides of the Lusatian Neisse river. (Fig. 3).

The zones differ in the number of examined components and frequency of studies.

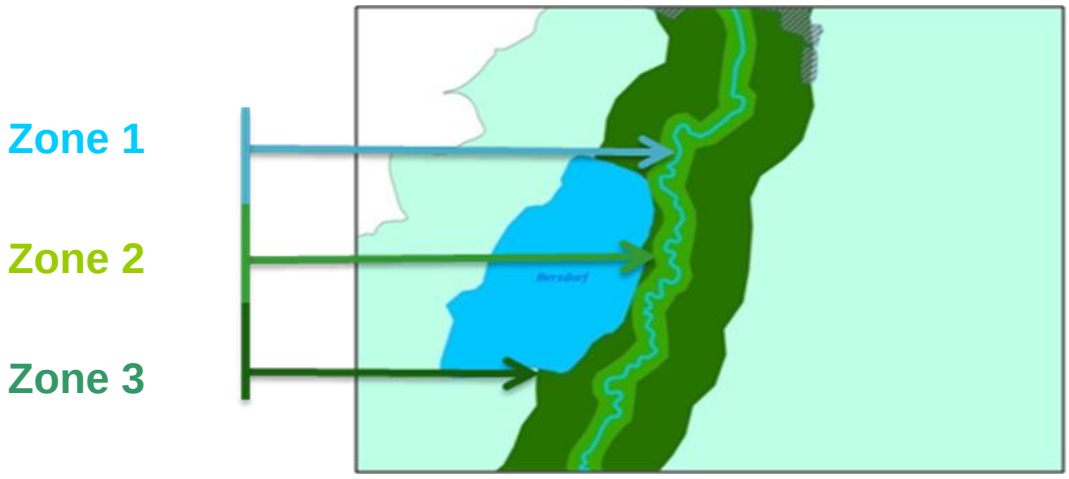

Fig. 3: Diagram of the monitoring zones.

The division into phases refers to the project's stages

Phase I of the monitoring refers to the state of the environment near the river before the start of the project. This phase, combined with historical data and a comprehensive research on the impact on the environment is to establish the initial situation. The start of the project is planned for approximately one year prior to the flooding.

Phase II includes the active period of the project. The number of measurement points remains unchanged.

Phase III includes the active period of flooding, but the scope of the monitoring is reviewed and reduced or clarified if necessary every two years.

Phase IV covers a period of two years after finishing the water intake intended for filling the post-mining pit Berzdorf or water transfer from the Neisse. Its aim is to determine the possible negative long-term effects.

Reasoning in what way the selected methodology/implementation is superior while compared to other (more standard, less tailored or optimized) procedures

The presented example of good practice illustrates an excellent approach of cooperation at transboundary level. The monitoring had been preceded by bilateral expert meetings at which a common methodology was developed. Thus, the same studies and measurements are performed on both sides of the border which gives the possibility of a direct comparison of the gained results.

Another advantage of the applied methodology is that the study is complex namely it takes into account climatic conditions, surface water (measurements of level, discharges and intakes), groundwater (measurements of groundwater levels), the surface and groundwater quality, biomonitoring (ichthyofauna, macrophytes, macrozoobenthos, diatoms), geodetic measurements of uplift and settlement of ground in the surrounded area.

Another pro of the presented monitoring concept is its implementation at both sides of the state border, not only at the side where the project is being carried out but at the side, which may be affected by the project as well. An additional advantage concerns joint, annual meetings at which the analysis of gained results are made. Furthermore, verification of the monitoring scope which is performed every two years seems to be also beneficial. Consequently, it makes the monitoring activities flexible and tailored to the current situation in the basin.

Discussion of the benefits obtained by PP through application of the good practices (and maybe also limitations).

Rational water management in the Lusatian Neisse basin is possible thanks to the preparation of the monitoring concept, its conduct, the obtained results as well as the analysis which were carried out. Furthermore, all of the activities allows to estimate the impact of such a project on the environment. The results of monitoring were also used for other, more complicated analysis on hydrogeological modeling whose aim was to recognize the water conditions within the Lusatian Neisse basin, for instance. The analysis of data and verification of the scope of monitoring enabled us to gain experience which will be useful while developing further concepts of monitoring of the areas affected by anthropogenic transformations. Currently, four brown coal mines are being exploited in the Lusatian Neisse basin or in its surrounding. The water reclamation of the mines are planned. Two new brown coal mines are intended to be constructed. Activities concerning planning the water management in the Lusatian Neisse basin are being done. The activities take into account the future water intakes for flooding the post-mining open cast mines and future users of surface water and groundwater namely the planned lignite mines. The developments concerning these issues are based on the data obtained during the conducted monitoring.

Furthermore, the development and implementation of methodology for systematic monitoring, surface water and groundwater:

- is helpful in terms of Polish-German bilateral activities, it especially supports the decision-making process related to the issue of water management within transboundary river basin, Results of the monitoring are presented during the meeting of the Heads of the working groups with the Government of Plenipotentiaries for cooperation on boundary waters. In this way, we contribute to the creation of a government policy on boundary waters, and further arrangements associated with water management executed in the transboundary area.
- provides information which may be helpful in achieving environmental objectives within the meaning of the Water Framework Directive - good quality and quantity of water resources;
- provide information on extreme events and risks for crisis management staff, water management boards and for international commissions;
- provide the basis for a strategic assessments of the impact of new projects/investments on the border area,
- provide information about the control of water users and plans for compensating existing water users for losses, in case of planning new investment;
- is crucial for the decision-making process related to the problem of water management within transboundary river basin;
- allows to carry on a bilateral agreement on rational use of water resources by users from both countries;
- allows to control water resources' users not to deteriorate the water's state;
- provides information for the development of plans and strategies of municipalities and counties,
- provides information for the public about the state of the environment within the anthropogenically transformed areas.

Did the PP develop additional know-how by applying the selected methodology/implementation in a continuous manner?

The Institute of Meteorology and Water Management National Research Institute did not change the type of research and analysis while carrying out the monitoring. Only the number of measurement points was changed. More precisely, it was reduced. For individual needs, on the basis of the experience gained during carrying out the monitoring, the hydrogeological modeling platform was additionally used (Visual ModFlow modeling platform). The platform was applied in order to recognize the water conditions within the Lusatian Neisse basin. Furthermore, the modeling of the surface water balance is planned using the Mike Basin software. The gained water balances are crucial in terms of sustainable water management for authorities which are concerned with water management, both at the local and regional level. In addition, modeling enables to determine the surface and groundwater resources including e.g. climate change.

Anything else the PP wants to add from their perspective (specifically related to the SHARP goals)?

The developed concept of monitoring, with slight modifications, taking into account the environmental area conditions (hydrogeological conditions, land use, hydrography, etc.) and water users, can be used in order to create a monitoring system in areas affected by anthropogenic transformations including various degree of impact on the environment.