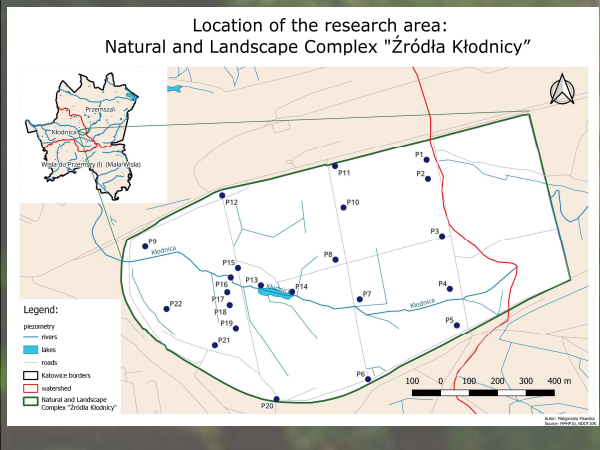


INTRODUCTION

The aim of the study is to analyse the impact of mining exploitation conducted by the Staszic-Wujek Hard Coal Mine on elements of the natural environment within the area protected as the Natural-Landscape Complex "Źródła Kłodnicy" between 2019 and 2022. The main research question is whether the current mining exploitation significantly affects the surface and underground water regime of the "Źródła Kłodnicy" Natural-Landscape Complex (NLC).

The protected area of "Źródła Kłodnicy" covers an area of 98.26 hectares within the city of Katowice. It is located in the northern part of the forest complex known as the Murcki Forests, south of the city center of Katowice and east of the Ochojec district, south of the 73rd Infantry Regiment street (fig. 1). The status of the natural-landscape complex aims to ensure the protection of the Kłodnica River catchment area along with the fauna and flora present there. This area is considered one of the most valuable in Katowice, not only due to identified natural and landscape values but also because of the need to protect water resources in the main watershed area of the Vistula and Oder rivers. The research area is located within the mining exploitation zone of the 405 seam in the L field, Staszic-Wujek Coal Mine.

Fig. 1

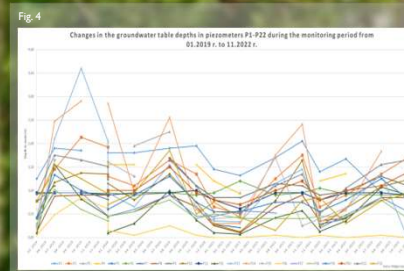
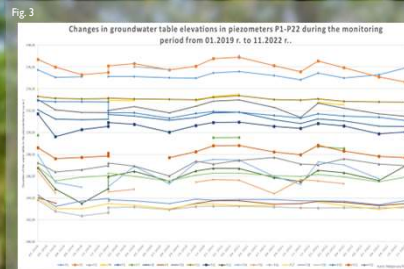
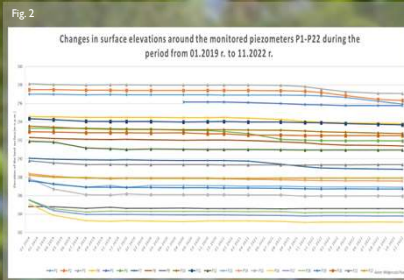


MATERIALS & METHODS

The analysis was conducted based on monitoring data from 22 piezometers and assessments of the impact of mining exploitation of the 405 seam in the L field on environmental elements in the area of the "Źródła Kłodnicy" Natural-Landscape Complex, carried out in the years 2019-2022 by the team consisting of: Tokarska-Guzik B., Absalon D., Molenda T., Fojcik B., Zarychta A. (2019-2022), Jochymczyk K. (2019). Among the data from the specified monitoring period, charts depicting changes were primarily analysed: surface elevations around the examined piezometers, groundwater table depths in the piezometers, groundwater table elevations in the piezometers, as well as the elevation of the Kłodnica riverbed. For the first three criteria, measurements were taken 4 times a year – in January, April, August, and November. Measurements of the riverbed elevation were conducted twice a year, in the first half of the year in March or April, and in the second half of the year always in November. Charts illustrating the analysed changes were created based on the compiled monitoring data from the specified years using Microsoft Excel software.

REFERENCES

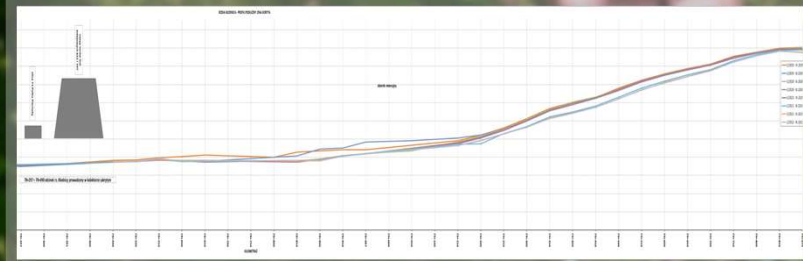
- Tokarska-Guzik B., Absalon D., Molenda T., Jochymczyk K., Fojcik B., Zarychta A. 2019. Ocena oddziaływania prowadzonej eksploatacji górniczej pokładu 405 w polu L na elementy środowiska w rejonie Zespołu Przyrodniczo-Krajobrazowego „Źródła Kłodnicy” w roku 2019. Część przyrodnicza (maszynopis)
- Tokarska-Guzik B., Absalon D., Molenda T., Fojcik B., Zarychta A. 2020. Ocena oddziaływania prowadzonej eksploatacji górniczej pokładu 405 w polu L na elementy środowiska w rejonie Zespołu Przyrodniczo-Krajobrazowego „Źródła Kłodnicy” w roku 2019. Część przyrodnicza (maszynopis)
- Tokarska-Guzik B., Absalon D., Molenda T., Fojcik B., Zarychta A. 2021. Ocena oddziaływania prowadzonej eksploatacji górniczej pokładu 405 w polu L na elementy środowiska w rejonie Zespołu Przyrodniczo-Krajobrazowego „Źródła Kłodnicy” w roku 2020. Część przyrodnicza (maszynopis)
- Tokarska-Guzik B., Absalon D., Molenda T., Fojcik B., Zarychta A. 2022. Ocena oddziaływania prowadzonej eksploatacji górniczej pokładu 405 w polu L na elementy środowiska w rejonie Zespołu Przyrodniczo-Krajobrazowego „Źródła Kłodnicy” w roku 2021. Część przyrodnicza (maszynopis)



RESULTS

- The results of elevation measurements of piezometer positions from 2019 to 2022 indicate that in all cases, there has been a decrease in the surface elevation around the piezometers (fig. 2). The largest decreases over the four analyzed years amounted to 1.98 meters in the vicinity of piezometer P-16. The average decrease in surface elevation around the installed piezometers during this period was 0.25 meters. The year with the highest average difference between the maximum and minimum measurements was 2019.
- During the analyzed period, the highest groundwater levels in most piezometers were observed mainly in March and April, while the lowest were in August and November (fig. 3). The largest fluctuations in the water table (3.43 meters) were recorded in piezometer P-13. The average change from 2019 to 2022 was 0.73 meters. The year with the highest average change was 2019.
- The fluctuations of the water table in the first level of groundwater in the analyzed area are generally characterized by seasonal variability. In most piezometers, the highest levels of groundwater were observed in January, while the lowest were in August or November (fig. 4). The largest fluctuations in the groundwater table were recorded in piezometer P-13 – 3.63 meters. Based on the fluctuations in groundwater, it can be concluded that during the years 2019-2022, the groundwater resources in the spring area of the Kłodnica watershed decreased.
- During the analyzed 4 years, the riverbed in the section from kilometer 78+490 to 79+870 increased its slope by an average of 3.7‰. The riverbed in this section lowered by an average of 0.7 meters (fig. 5). The profile of the Kłodnica river underwent changes due to the formation of a depression basin caused by mining exploitation, as indicated by a comparison of measurements from the analyzed period with a baseline measurement conducted in May 2012.

Fig. 5. A section of the graph depicting changes in the riverbed elevations of the Kłodnica River from kilometer 78+297 to 79+870.



DISCUSSION

The analysis of changes in surface elevations, groundwater levels, groundwater table elevations, and riverbed depths in the Kłodnica River channel, during the years 2019-2022, shows that this area is subject to continuous terrain deformation associated with ongoing coal mining operations at the Staszic-Wujek coal mine. A lowering of surface elevations within the piezometer area was observed (fig. 2), as well as a lowering of the riverbed in the river channel section (fig. 5). Attention was drawn to the seasonal nature of fluctuations in groundwater levels in the piezometers (fig. 4). However, a reduction in groundwater resources in the spring area of the Kłodnica watershed was also noted. Considering the pristine nature of the examined section of the Kłodnica River, which is a second-order river directly flowing into the Oder, a significant impact of current mining exploitation on the water regime of the "Źródła Kłodnicy" Natural-Landscape Complex (NLC) area was observed.