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THE ROLE OF MUNICIPALITIES IN ENVIRONMENTAL MANAGEMENT: A CASE STUDY OF RZGÓW MUNICIPALITY

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Abstract

Managing the environment in a sustainable manner allows for economic, social, and cultural development. The task of the municipality is to meet the basic needs of residents. The article presents the method of environmental management in the Rzgów Municipality and preventive actions in the form of monitoring, which are used to constantly control individual elements of the environment. Based on the collected data, a SWOT analysis was created along with an indication of possible actions and activities aimed at improving the conditions of the natural environment.

Keywords: environmental management, SWOT analysis, environmental monitoring, Rzgów Municipality

1. INTRODUCTION

Human life is closely related to the surrounding environment, which ensures the satisfaction of not only basic needs, but also social, economic, and cultural security. We use natural resources at every step, and their quantity and quality strongly determine the standard of living of the inhabitants of a given area. Environmental issues have become increasingly important around the world in recent years because while individual problems may be more or less important in different countries, in many cases they are universal. Environmental management issues cannot be considered in isolation from the level of economic development of countries, and this applies both to international relations, the formulation of internal policy, and the management of individual enterprises. The development of civilization associated with the careless use of natural resources has unfortunately contributed to the degradation of the environment and the depletion of its natural resources. Problems such as air pollution, depletion of natural resources, environmental degradation, and an increase in the amount of waste were noticed only in the 1960s. It was then that the first publications appeared covering the economic aspects of water management, waste management and pollution control [1]. It was then pointed out that humans have a

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strong impact on the world around them. The first questions arose about how the negative impact of human activity on the natural environment could be reduced through the development of the economy and industry. People began to realize that the ongoing degradation of the environment would, sooner or later, have negative effects on the lives of current and future generations, and the degraded environment and exhausted natural resources would limit human functioning. Interest in environmental issues appeared again in the 1990s, when the concept of sustainable and sustainable development began to gain more and more importance. In line with this concept, a compromise solution is possible between further economic development and maintaining the environment in the best possible condition. Sustainable development is inextricably linked to environmental management, which, by definition, aims to maintain and improve the quality of the environment caused by anthropogenic factors. It can be implemented for the entire country, individual municipalities or, in the case of environmental management, for enterprises [2, 3, 4].

According to the Act of 8 March 1990 on municipal government [5], it is the duty of each municipality to conduct activities in accordance with the principle of sustainable development that may contribute to improving the quality of life of the entire local community. The tasks of the municipality as part of environmental management include maintaining spatial order, providing basic utilities such as water, sewage disposal, waste disposal and maintaining order. The aim of the article is to characterize the Rzgów Municipality in terms of environmental management along with an assessment of activities carried out in this direction.

2. CHARACTERISTICS OF THE RZGÓW MUNICIPALITY

The urban-rural Municipality of Rzgów is located in the central part of Poland, in the Łódź Voivodeship, in the eastern Łódź district. On 31 December 2023 the municipality was inhabited by 11 292 people, including 51.8% women and 48.2% men, the average population density is 169 people/km^2 and is higher than the average population density in the voivodeship, which is 136 people/km^2. The Rzgów Municipality is the second smallest municipality in the Łódź east county in terms of area, its area is 66.3 km^2, which is 13.3% of the area of the entire county [6]. Within the municipality, there is diversity in terms of types of buildings, which include: residential buildings; individual recreation development; homestead development; service development; industrial buildings, agricultural production facilities. Larger plants located in the agglomeration are: GEALAN Polska Sp. z o.o producer of PVC window profiles, GROT Meat Processing Plant, Aflofarm Farmacja Polska Sp. z o.o., Gameta - infertility treatment clinic, Gameta Hospital, new and used car showrooms: including Renault service, Daf Service, Toyota Service, Subaru Service, Scania Service, Automotive Service, Kia Service, Hort-Cafe, McDonald's Restaurant, KFC Restaurant, PTAK Wholesale Center, PTAK Fashion City, PTAK Gallery and PTAK Outlet. The most famous companies in the municipality include: PTAK Wholesale Center, PTAK Fashion City, PTAK Gallery and PTAK Outlet, which are constantly expanding their operations. Ptak Fashion City is the only such facility in Central Europe, which functions as the largest clothing wholesale store in Poland, but also combines retail sales and entertainment functions. PTAK Wholesale Center is visited annually by as many as 9 million customers from Poland and around the world. In addition to sales, the centres also serve as exhibition venues, where numerous fashion shows and fairs are organized. Ptak Gallery offers wholesale and retail sale of unique clothing from exclusive foreign markets. Ptak Outlet is a shopping center, the largest outlet in Poland. Here you can find a wide range of clothing, many footwear and accessories stores, and a perfumery. Services in the village of Gospodarz are also related to the textile and clothing industry, while services related to small trade are concentrated around the centre of the city of Rzgów [7].

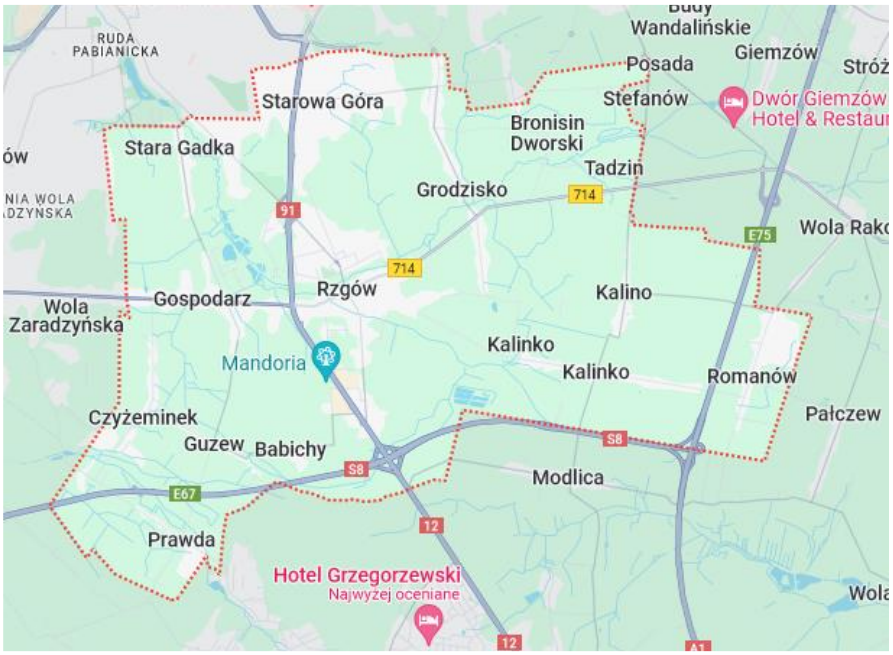

Fig. 1. Map of the Rzgów Municipality [8]

2.1. Water supply for the municipality

The length of the water supply network in the Municipality of Rzgów in 2021 was 101.9 km and in relation to 2019 this value was increasing by 2 km (Table 1). Approximately 99.2% of residents living in the municipality have access to the municipal water supply network, and the same applies to service and production facilities. The exception is Starowa Góra, which is served by a municipal water supply from the area of Łódź. The water supply network in the municipality is constantly being expanded and new customers are being connected. Water for economic and domestic purposes is collected from municipal groundwater intakes. There are six water intakes in the municipality in: Rzgów, Kalina, Romanów, Gospodarz, Grodzisk and Czyżeminek. The captured groundwater is subject to treatment processes due to exceeded concentrations of iron compounds in water. Then the treated water goes to hydrophore stations, from which it is distributed to the network. The water supply network in the municipality operates in a single-stage system, while in Rzgów a two-stage system is used. There is also a reserve and expansion tank at the station in Rzgów, providing access to water in the event of a failure. In an emergency and in the event of failure of municipal intakes, the network is connected to the water supply network in Starowa Góra, which is subordinated to the Water Supply and Sewerage Plant in Łódź. In addition, in Kalinko there is a facility of the Łódź ZWiK - Water Treatment Station, which serves the living and economic purposes of the station's employees and residents. In the future, it is planned to connect the station with the municipal water supply network. There are numerous deep wells in the municipality, which were created for the individual needs of private individuals and enterprises, such as Kerakoll, OVOVITA and the PTAK Shopping Centre. Due to the dynamic development of the municipality, work is being carried out to search for new water sources, but also activities aimed at connecting existing networks into rings to prevent emergency situations [7].

Table 1. Characteristics of the water supply network in the Municipality of Rzgów, own studies based on GUS data [9]

Indicator	Unit	2019	2020	2021	2022
Length of active distribution network.	km	99.9	100.8	101.9	ND
Connections leading to residential buildings and collective housing.	pcs	3505	3573	3680	3711
Water supplied to households.	dam^3	463.4	475.0	470.3	465.3
Population using the network water supply.	person	10375	10905	11001	11144
Water consumption per inhabitant.	m^3/year	44.6	43.5	42.6	41.7
Percentage of population using the water supply network.	%	99.2	99.2	99.2	99.2

ND - no data

2.2. Wastewater disposal systems

Wastewater from the municipality is discharged through a dispersed sewerage network which transports wastewater to the municipal wastewater treatment plant located at Stawowa Street in Rzgów. Liquid wastewater generated in the agglomeration, which is not collected by the sanitary sewer network, is collected by authorised entities and disposed of mainly to the sewage treatment plant in Rzgów. The wastewater treatment plant in Rzgów is a mechanical-biological treatment plant with a capacity of 3000 m^3/day (two twin treatment lines with a capacity of 1500 m^3/day each). The technological system consists of a mechanical part, i.e. sieves, and grates, and a biological part that purifies the supplied sewage. The treated wastewater is discharged into the river Ner. The biological wastewater treatment system consists of two anaerobic chambers and two aerobic chambers, followed by a secondary settling tank. The sewage sludge is dried in a solar dryer and the resulting pellets are used in agriculture. Rainwater and snowmelt wastewater is mainly discharged through numerous drainage ditches. Rainwater drains are located along major traffic routes or periodically flooded areas. Due to the large impermeable area, the car parks of Ptak Fashion City and Makro Cash and Carry shopping centres are also equipped with rainwater sewers. In the case of the PTAK Wholesale Center, in addition to the rainwater sewerage system, rainwater pretreatment was also used to separate the oil-derived substances from the rainwater, which goes into a retention tank used for fire-fighting purposes, while the excess water is discharged into a drainage ditch [10].

Table 2. Characteristics of sewage system in the Municipality of Rzgów, own studies based on GUS data [9]

Indicator	Unit	2019	2020	2021	2022
Length of active distribution network	km	65.0	65.1	66.2	69.8
Connections leading to residential buildings and collective housing	pcs	1576	1711	1713	1797
Treated wastewater discharged total together with infiltration water and wastewater from sewers	dam^3/year	440	436	534	545
Population using the sewage network	person	6365	6835	6881	7076
Percentage of population using the sewage system	%	60.9	62.2	62.1	63.0

2.3. Gasification

A high-pressure gas pipeline runs through the Municipality of Rzgów, at which two first-stage pressure reduction and measurement stations are located, constituting the main source of gas in this area. These stations supply the municipality with medium and low-pressure gas. In villages that are not currently gasified, residents use domestic propane-butane cylinders. Low-pressure gas is supplied to areas with predominantly single-family housing. The medium-pressure network, on the other hand, is present in areas potentially designated for industrial development The length of low- and medium-pressure gas networks in the Rzgów commune is 93.641 km and supplies 1804 properties, but these values are still changing dynamically (Table 4). This is due to the intensive gasification of the commune. Further development of the gas network in the Rzgów commune will be carried out through medium-pressure gas pipelines due to their greater capacity [11].

Table 4. Characteristics of the gas network in the Municipality of Rzgów, own studies based on GUS data [9]

Indicator	Unit	2019	2020	2021	2022
Length of active distribution network	km	85.439	86.813	88.586	93.641
Connections leading to residential buildings and collective housing	pcs	1456	1556	1646	1804
Population using the gas network	person	4805	5518	5776	5970
Percentage of population using the gas network	%	45.9	50.2	52.1	53.1

2.4. Waste management

In accordance with Resolution No. LVII/596/2023 of the Municipal Council of Rzgów of February 1, 2023, on the Rules for Maintaining Cleanliness and Order in the Municipality of Rzgów, selective collection is carried out by segregating waste into paper, metals, plastics, glass, mixed waste and biodegradable waste. Residents of the municipality can also hand over selectively collected waste to Jantar 8 Sp. z o. o., a company based at 83 Literacka Street, off National Road No. 1, next to Ptak Shopping Centre. This company recycles waste, produces alternative fuel, and operates a vehicle dismantling station. The levels of recycling and preparation for reuse of municipal waste fractions: paper, metals, plastics and glass, reduction of the mass of biodegradable waste directed to landfill and the levels of landfilling are presented in Table 5.

Table 5. Levels of recycling, storage, and preparation for reuse of various fractions of municipal waste [12]

Year	Achieved level of recycling and preparation for reuse of the following municipal waste fractions: paper, metals, plastics, and glass	Achieved level of reduction in the mass of biodegradable municipal waste sent to landfill	Storage level
2020	67.11 %	32.89 %	30.68 %
2021	31.10 %	28.76 %	28.57 %
2022	36.87 %	14.48 %	19.37 %
2023	78.71 %	22.13 %	24.10 %

In the area of the municipality there are also sludge fields of the ZWiK Water Treatment Station in Łódź, located in Kalinko. There is also a Selective Municipal Waste Collection Point located in the municipality area at 115 Ogrodowa Street in Rzgów [13]. In December 2015, the landfill in Rzgów at Ogrodowa Street was closed, which is currently undergoing biological reclamation to restore the

appropriate pH, soil fertility and aesthetic value [14]. As part of the reclamation, planting will be carried out, water relations will be regulated, and slopes will be protected against landslides.

3. ANALYSIS OF THE IMPACT OF THE MUNICIPALITY OF RZGÓW ON ENVIRONMENT

3.1. Environmental Management in the Municipality

The main task of the local government is to meet the basic needs of the local community leading to an improved quality of life through a broadly defined idea of sustainable development. Environmental management in the municipality is carried out through local acts of law in the form of planning tools. which include local spatial development plans, study of the conditions and directions of spatial development of the municipality, municipal development strategy, environmental protection programme. A local spatial development plan is a legal act adopted in the form of a resolution by the municipal council. It specifies the purpose of the land, the conditions for its development or construction. It consists of a descriptive part and graphic annexes. The overarching aim is to ensure a balance between the settlement system and the territorial cohesion of the entire region. The Rzgów Municipality belongs to the Łódź agglomeration and is recognised as a local centre with a high level of development in the socio-economic sphere. Information on local spatial development plans can be found in the Public Information Bulletin [15] and in the Spatial Information System of Rzgów Municipality [16]. Spatial development plans for further areas are under development. The study of spatial development conditions and directions serves to define the municipality's spatial policy based on local spatial development principles. At present, the Municipality of Rzgów applies a Study of Spatial Development Conditions and Directions for the Municipality of Rzgów, attached as Annex No. 1 to Resolution No. XXIII/218/2020 of the Municipal Council of Rzgów dated 22 April 2020. This document was drawn up based on the Act of 27 March 2003 on spatial planning and development [17]. Resolution No. XLIX/394/2018 of the Municipal Council in Rzgów of 28 March 2018, on accession to the preparation of an amendment to the “Study of conditions and directions for spatial development in the Municipality of Rzgów" covering the area of the City of Rzgów and the Municipality of Rzgów, and Resolution No. V/55/2019 of the Municipal Council in Rzgów of 27 February 2019 on accession to the preparation of an amendment to the “Study of conditions and directions for spatial development in the Municipality of Rzgów" covering part of the City of Rzgów and the area of Grodzisko - Konstantyna. The basis for the study is the identification of development opportunities in the Municipality of Rzgów in the social, environmental, economic, and land-use context in order to identify problem areas and create a municipal policy in line with regional and national policy. The need to amend the study results from the dynamic development of the city and Municipality of Rzgów. The Municipal Development Strategy sets the municipal development objectives, both strategic and operational, and assesses the investments currently being made. It is based on defined problems and prepares ways to solve them. The current Development Strategy for the Municipality of Rzgów for 2022-2030 was adopted by Resolution No. XLVII/484/2022 of the Municipal Council of Rzgów on 27 April 2022. The problems to be solved in the coming years concern the living conditions of the municipality's inhabitants, demographic, and economic aspects, but also natural and ecological assets. The municipal development strategy is the basis for the municipality's long-term policy. It contains a set of solutions to the problems faced by the municipality and measures aimed at economic, environmental-spatial, and political-social development. The Environmental Protection Program aims to define the goals and tasks of environmental protection in municipalities. It can be applied based on development with environmental diversity and functions, but also, not inhibit economic and community development. Currently, the Environmental Protection Program for the

communes of Rzgów for the years 2021-2025 with a perspective until 2030 along with a forecast of the impact on the environment. The program concerns the state of the environment in the communes, with a description presented in the environment, which causes effects on the development of rural communes and the scope of environmental protection policy in the short and long term. The economic profiles of companies in the Rzgów commune are characterized by great diversity. It is difficult to clearly indicate which industry branch dominates in the commune. It might seem that the Ptak Shopping Center is the main monopoly, but from year to year many enterprises increase their position in the commune.

Environmental management systems are becoming more and more popular among many entrepreneurs. A systemic approach allows for long-term benefits both for business owners and the environment. Within the Municipality of Rzgów, many companies have chosen to implement an environmental policy, but only a few have environmental management systems. These include: GEALAN Polska Sp. z o.o. (ISO 14001), Kerakoll Polska Sp. z o.o. (B Corp), ACS Air Conditioning Service (ISO 14001), Transfer Multisort Elektronik Sp. z o. o. (ISO 14001), McDonald's Restaurant (ISO 14001) and KFC Restaurant (ISO 14001), Aflofarm Farmacja Polska Sp. z o.o. (ISO 14001).

3.2. The State Environmental Monitoring

The State Environmental Monitoring. according to Art. 23 section 1 of the Act on the Inspection of Environmental Protection [18] is a system of measurements. assessments and forecasts of the state of the environment, as well as the collection, processing and dissemination of information about the environment. Its task is to systematically inform the authorities and the public about the quality of natural elements, maintain quality standards required by law and indicate areas of exceedance of these standards. The data obtained is used by relevant government and local government units for the purposes of operational environmental management using legal acts. The information received as part of the State Environmental Monitoring provides the basis for the creation of strategies for environmental protection and sustainable development at all levels of management.

3.3 Monitoring of surface waters

Based on Article 26 of the Environmental Protection Law of 27 April 2001 [19], the purpose of surface water monitoring is to obtain information and data on water quality. On the other hand, the obligation of systematic examination and assessment results from Article 349 of the Water Law [20]. Surface waters are examined for their physical, chemical, and biological properties. One of the tasks of monitoring is to obtain data to assess hydrogeochemical changes occurring in catchments. Surface water monitoring is divided into control, operational and research. Control monitoring is used for the general assessment of surface water status in a catchment area. It assesses anthropogenic changes that occur over the years in the catchment. The frequency of surveys depends on the purpose of the catchment. For surface waters that are a source of drinking water, surveys are carried out 12 times per year, for others a minimum of 4 times per year is recommended. Operational monitoring targets waters that are at risk of failing to meet the ecological objectives set for them and to evaluate programmes that have been implemented to implement remedial programmes. Waters at risk of contamination should be measured to assess the magnitude and impact of pollution sources. Investigative monitoring targets waters for which the source of pollution is unknown and waters for which the problem has not been identified by previous monitoring. Its purpose is to identify the causes of pollution and reduce its negative impact on surface water status. There are no surface water control and measurement points in the municipality, but rivers flowing through the municipality area are covered by operational monitoring. These are three water bodies: Wolbórka from its sources to the tributary from under Będzin, Ner to Dobrzynka and Jasień.

The ecological potential of the Ner River to the Dobrzynka River and the Wolbórka River from its sources to the inflow from Będzin was assessed as moderate in recent studies, while that of the Jasień River as bad [21]. In the case of water status assessment. the resultant of ecological potential, physico-chemical composition, and additional requirements for waters in protected areas should be taken into account, on this basis it was assessed that all water bodies have bad water status. From the data obtained, it can be seen that municipal, production and agricultural pressures predominate in the Rzgów municipality. River pollution may be caused by illegal discharges of domestic sewage into receiving bodies. Water run-off from agricultural areas, which has a high concentration of biogenic compounds that cause eutrophication, resulting in a reduction in the oxygen content of the water. Due to increased vehicle traffic on the main transport routes running through the municipality, there are high concentrations of oil-derived substances in surface waters. In addition, the River Ner is the recipient of wastewater from the municipal wastewater treatment plant, the quantity and quality of which is limited by water rights decisions that prevent negative impacts on the River Ner. The existing landfill in the Municipality of Rzgów, which is in the reclamation phase, is subject to post-operation monitoring. Among other things, this includes groundwater monitoring around the landfill. This is due to the possibility of leachate seeping into the ground and further into groundwater.

3.4 Groundwater monitoring

Groundwater monitoring is carried out to eliminate and reduce the negative impact of anthropogenic factors on groundwater. It includes national, regional, and local networks. It serves to maintain groundwater of good quality and to track changes in its composition. The main source of groundwater pollution is anthropogenic activity, which can be divided into point, area and linear, point sources include wastewater flowing from leaking non-drainage basins and leaking sewers. Runoff from industrial, agricultural, or urbanised areas are types of area pollution. Linear pollution is mainly surface runoff from transport routes. There is no groundwater monitoring in the municipality and none of the groundwater bodies belong to Areas of Special Exposure (according to Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources) [22].

3.5 Monitoring of waste

Waste monitoring is used to assess waste management throughout the province and provides information on the type and quantity of waste entering the environment. Analysis and evaluation of the data make it possible to create reports on the state of the environment in the selected area. Information on waste generation and management is the basis for the State Environmental Monitoring in the pressure block. The concepts of waste and waste management are defined by the Waste Act of 14 December 2012 [23]. It is the responsibility of the executive bodies within the municipality to send reports on the implementation of municipal waste management tasks [24]. There is no waste processing facility in the municipality, with the exception of the landfill, which is currently undergoing reclamation, and the Municipal Selective Waste Collection Point. Collected municipal waste from the area of the municipality, is transferred to the Regional Municipal Waste Processing Facility according to the zoning. Selected municipal waste can be disposed of free of charge at the Selective Municipal Waste Collection Point. Waste monitoring is also being carried out to control the amount of asbestos products in our country. On 19 June 1997, the Act on the Prohibition of Asbestos Products [25] came into force, which categorically prohibited the production and introduction of asbestos-containing materials into Poland, as well as their sale except for special purposes. It is estimated that there were 13.5 million asbestos-containing products in Poland in 2008. It is therefore crucial to implement repair programmes

that seek to remove and manage eternit. In accordance with Resolution No. 122/2009 of the Council of Ministers of 14 July 2009 [26] on the establishment of the " Programme for Asbestos Abatement in Poland 2009-2032", which assumes the removal and disposal of asbestos waste, minimising the negative impact on human life and the environment. In addition, the Programme for Asbestos Removal assumes that an inventory of asbestos products is carried out, together with their distribution across the country. In recent years, an Electronic Spatial Information System (ESIP) has been developed to process data from the Asbestos Database with spatial data, as well as to create descriptions of the locations of asbestos waste storage or use. Implementation of the programme is carried out at central, provincial, and local levels. On the territory of the District of East Łódź 16994,886 Mg of asbestos products were inventoried as at 16.11.2022 of which 1968,258 Mg (11%) were removed. On the other hand, in Rzgów Municipality alone 2604,603 Mg of asbestos products were inventoried, and 549,356 Mg (21%) were disposed of [27]. An important aspect of the programme's implementation is the analysis of the technical condition of the products which determines their further possibility of use. It is the responsibility of the owner or manager of the property to prepare an "Assessment of the condition and possibility of safe use of asbestos-containing products". In accordance with the current Regulation of the Minister of Economy, Labour, and Social Policy of 2 April 2004 on ways and conditions for the safe use and removal of asbestos-containing products [28] there are three degrees of urgency for the removal of the product. Level III of urgency (up to 90 points) implies a reassessment of the condition within 5 years, and Level II (95 - 115 points) within a year. Asbestos products above 120 points must be removed urgently. Based on the inventory drawn up in the Municipality of Rzgów, most products (68%) are assessed as being in good condition. However, this does not exempt them from constant inspection, 29% of the objects are classified as Grade II and 3% are suitable for removal. As of 2018, in the Municipality of Rzgów it is possible to apply for funding for the removal of harmful products from one's property.

3.6 Air quality monitoring

Air quality monitoring is carried out to obtain data on air components, including pollutants. Air quality is currently one of the most important parameters affecting people's lives. When increased concentrations of gases, liquids or solids occur, pollution occurs. Monitoring is carried out in three blocks – pressure, status, response. The pressure block collects information on point, line and surface emissions. The results are analysed with the help of mathematical models and meteorological forecasts to assess air quality. A distinction is made between automatic and manual measurement networks, which differ in the lead time and the method of obtaining results. The response includes measures to counteract negative factors that affect air quality. The Regulation of the Minister of the Environment of 24 August 2012 on the levels of certain substances in the air [29] defines the permissible levels of substances in the air with respect to the safety of human life and protection of plants. Air quality assessment is carried out in relation to zones, the division of which depends on the number of inhabitants. We distinguish between agglomeration areas with more than 250,000 inhabitants, cities with more than 100,000 inhabitants and county areas which are not part of agglomerations. In addition to the division into zones, pollutants are classified according to their place of occurrence and their concentration (Tables 6-8).

Table 6. Zone classifications and required actions depending on the levels of concentrations of a pollutant obtained in the annual air quality assessment, for cases where a pollutant is assigned a limit value is set for the pollutant[1] [30]

Zone class	Concentration level pollution	Expected action
A	not exceeding the limit value[2]	maintaining concentrations of pollutants below the limit value and strive to maintain the best air quality compatible with sustainable development
C	above the limit value[2]	- identify areas of exceedance of limit values - to draw up or update an air quality programme with the aim of achieve appropriate levels of limit values for substances in the air - to control concentrations of the pollutant in areas of exceedance and taking action to reduce concentrations at least to limit values

[1]Concerns the pollutants: sulphur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), benzene (C_6H_6), particulate matter PM10 and lead (Pb) content of PM10 - protection of human health and: sulphur dioxide (SO_2) and nitrogen oxides (NO_X) - plant protection. In the case of particulate matter PM2.5, in 2023 there is a level of phase II limit value, for the assessment of which the existing class designations A1 and C1 apply
[2]Taking into account the permissible frequencies of exceedances set out in the Regulation of the Minister of the Environment on the levels of certain substances in the air [29]

Table 7. Zone classes and expected actions depending on the levels of pollutant concentrations obtained in the annual air quality assessment for cases where a target level is defined for a pollutant[1] [30]

Zone class	Concentration level pollution	Expected action
A	not exceeding the target level	maintaining concentrations of the pollutant in the air below target level
C	above the target level	- striving to achieve the target level of the substance within a specified period of time through economically justified actions technical and technological - developing or updating an air protection program, in order to: achieving appropriate airborne target levels

[1]Applicable to ozone (O_3) - human health and plant protection and arsenic (As), cadmium (Cd), nickel (Ni), benzo(a)pyrene (B(a)P) in particulate matter PM10 - human health protection

Table 8. Zone classifications and required actions depending on ozone concentration levels, taking into account the long-term objective level [30]

Zone class	Concentration level pollution	Expected action
D1	not exceeding the long-term objective level	keeping concentrations of a pollutant in the air below the long-term objective level
D2	above the long-term objective level	aiming to achieve the long-term target level

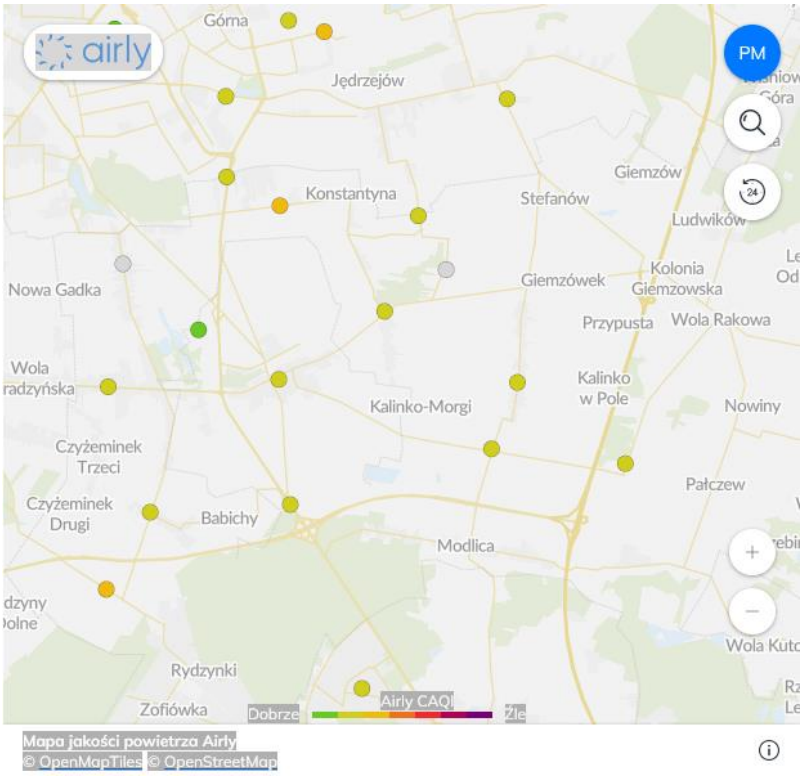

Fig. 2. Air quality meters in the Municipality of Rzgów [31]

Within the municipality there are meters (Figure 2) that are used to measure air quality. The parameters to be monitored are particulate matter PM 2.5, particulate matter PM 10, as well as air temperature and humidity and atmospheric pressure. The state of air quality can be checked on the website [31] and using the Airly mobile application. The results obtained are sent to the Voivodeship Inspectorate of Environmental Protection in Łódź and form the basis for the development of quality assessment results for the Łódź zone, to which the Municipality of Rzgów belongs. Classes of the Łódź zone for individual substances are presented in Tables 9 and 10.

Table 9. Zone classifications for individual pollutants obtained in the 2023 assessment carried out taking into account criteria established for the protection of human health - basic classification (Classes: A, C and A1, C1 for particulate matter PM2.5) [30]

Parameter	As	BaP	C_6H_6	CO	Cd	NO_2	Ni	O_3[1]	PM10	PM2.5[2]	Pb	SO_2
Class	A	C	A	A	A	A	A	A	A	A1	A	A

[1] For ozone - long term objective level, the zone has attained class D2,
[2] For particulate matter PM2.5 - phase I limit level, the zone has attained class A

Table 10. Zone classifications for individual pollutants obtained in the 2023 assessment carried out taking into account criteria established for the protection of plant- basic classification (Classes: A, C) [30]

Parameter	NO_x	O_3[1]	SO_2
Class	A	A	A

[1] For ozone - long term objective level, the zone has attained class D2

The main reason for exceeding these parameters is the large share of surface pollutants resulting from the combustion of solid fuels for heating purposes. In the Rzgów commune, 66% of buildings are heated with coal, 19% of buildings are heated with gas, the remaining 15% are heated by other sources, e.g. electricity, fuel oil [32]. However, compared to previous years, a decrease in the concentrations of individual pollutants can be observed. This is mainly due to the short heating season and favourable meteorological conditions. There are no industrial plants (sources of point emissions) with a negative impact on the environment in the commune. However, pollution from the areas of the Łódź agglomeration is of an inflow nature and has a negative impact on the air quality in the commune. Linear emissions caused by increased car traffic are concentrated on national roads No. 91 and 71, provincial road 714 and along the S8 expressway and the A1 motorway [33].

3.7. Soil monitoring

Soil monitoring is carried out as part of the State Environmental Monitoring based on the following legal acts: Act of April 27, 2001, Environmental Protection Law [19]; Act of April 13, 2007, on the prevention and repair of environmental damage [34], Regulation of the Minister of the Environment of September 1, 2016, on the method of assessing earth surface pollution [35]. Soil monitoring is used to identify degraded areas and take actions to improve soil quality by developing remedial programs and implementing them. The following indicators are used to assess soil quality: pH, humus content, calcium carbonate content, granulometric composition, hydrolytic and exchange acidity, content of easily digestible compounds of phosphorus, magnesium, potassium, and sulfur. Soil monitoring tests are carried out once every five years at 216 permanent measurement points throughout the country. There is a measuring point in the Rzgów Commune in village Gospodarz. Table 11 presents the research results in the years 1995 - 2020.

Table 11. Soil quality indicators in the years 1995 - 2020 [36]

Indicator	Unit	Year					
		1995	2000	2005	2010	2015	2020
pH	-	6.0	7.5	7.0	7.0	4.8	7.5
humus	%	1.42	1.66	4.0	3.79	1.3	3.87
carbonates ($CaCO_3$)	%	n.a.	n.a.	n.a.	0.21	n.a.	0.09
hydrolytic acidity (Hh)	cmol ($^+$) kg^{-1}	2.85	1.13	1.55	1.88	4.21	1.2
exchangeable acidity (Hw)	cmol ($^+$) kg^{-1}	0.25	0.07	n.a.	n.a.	1.47	0.09
available phosphorus	mg P_2O_5 $100g^{-1}$	10.1	13.4	105	90.8	6.6	49.2
available potassium	mg K_2O $100g^{-1}$	7.6	7.4	28.8	31.5	13.2	28.3
available magnesium	mg $100g^{-1}$	5.2	6.3	8.3	9.3	3.1	6.0

n.a.- not analyzed

It is difficult to assess the condition of the soils in the entire area of the municipality, as measurements have only been carried out at one measuring point. To assess the quality of soils in the Municipality of Rzgów, surveys should be carried out at more measurement points.

3.8. Noise monitoring

The Act of 27 April 2001 Environmental Protection Law [19] imposes an obligation to assess the acoustic climate in the areas of cities with a population below 100 000 and in the areas located on roads with a traffic volume below 3 million vehicles per year, i.e. 8200 vehicles per day. Noise is an unpleasant sound to the perceiver. This is a phenomenon that is subjectively assessed by each of us. Acoustic conditions are determined by the average level for 24 hours during the day and 8 hours at night, on the basis of which acoustic maps are drawn up (Table 12). In the area of Łódź Voivodeship, road noise measurement points have been located in Piotrków Trybunalski, Wieruszów and Sulejów.

Table 12. Acceptable levels of long-term medium level of noise expressed in L_{DWN} (day-evening-night level) and L_N (long-term-night level) indicators [37]

No.	Type of land	Acceptable Long-Term Medium Level of Noise [dB]			
		Roads or railways		Other facilities and activities that cause noise	
		L_{DWN}	L_N	L_{DWN}	L_N
1	a) protection zone "A" of health resorts b) Hospital areas outside the city	50	45	45	40
2	a) Development areas housing single-family b) Development areas related to constant or temporary stay of children and youth c) House areas social welfare d) Hospital areas in cities	64	59	50	40
3	a) Development areas housing multifamily and residence collective b) Development areas homestead c) Recreational areas - leisure d) Areas residential - services	68	59	55	45
4	Areas in the zone city center over 100 thousand inhabitants	70	65	55	45

L_{DWN} - means the A-weighted long-term average sound level in decibels (dB), determined over all the days of the year, taking into account the daytime (defined as the interval from 6 a.m. to 6 p.m.), the evening period (defined as the interval from 6 p.m. to 10 p.m.) and the night period (defined as the interval from 10 p.m. to 6 a.m.), L_N - means the A-weighted long-term average sound level expressed in decibels (dB), determined over all nights of the year (defined as the time interval from 22:00 to 6:00). The L_N indicator is also used as a stand-alone indicator to determine night-time exceedances

In 2023, as part of the State Environmental Monitoring, a local noise map was made for selected road sections within the city of Rzgów. The road sections analysed, within the framework of the local noise map of the city of Rzgów, are Rudzka Street - Łódzka Street - 500th anniversary Square - Tuszyńska Street with a length of 4.3 km, whose manager is the Mayor of Rzgów. The second analysed road section is a fragment of provincial road DW 714 from the junction with Łódzka Street to the city limits of Rzgów with a length of 1.4 km, which is managed by the Provincial Road Authority in Łódź. Based on the analyses carried out, it was estimated that 395 dwellings and 601 residents (approx. 17.5 % of the city's population) are exposed to road noise assessed by the L_{DWN} index between 55 dB and 70 dB. The estimated area of land exposed to road noise assessed by the L_{DWN} indicator is 0.73 km^2, which

is approximately 4.3% of the city's area. 298 residential buildings and 464 residents (approximately 13.5 % of the city's population) are exposed to road noise assessed by the L_N indicator in the range of 50 dB to 60 dB. The estimated area of land exposed to L_N-rated road noise is 0.46 km^2, which is approximately 2.7% of the city's area, 8 residential premises and 44 people living in these premises are exposed to exceeding the permissible values of road noise assessed by the L_{DWN} index, in the range of up to 5 dB. At night, 1 residential premises and 3 residents are exposed to exceedances of permissible road noise values, up to 5 dB. Both during the day and at night, in areas where permissible noise levels are exceeded, there are no facilities for the permanent or temporary stay of children and adolescents, as well as hospitals and social welfare homes [38].

4. SWOT ANALYSIS

SWOT analysis is an essential tool for assessing the environmental management system in the municipality, which can identify strengths, weaknesses, opportunities, and threats to the development of the municipality [39]. Based on the collected data, a SWOT analysis was conducted, and the results are summarised in Table 13.

Table 13. SWOT analysis

Strengths	Weaknesses
• widely developed water supply network; • significant reserves of drinking water intakes; • highly developed sewerage network within the city; • municipal sewage treatment plant with a capacity reserve; • rational waste management • implementation of the " Programme for Asbestos Abatement in Poland 2009-2032 • environmental funds”;	• underdeveloped sanitary sewerage system in rural areas; • lack of access to rainwater drainage throughout the municipality; • lack of access to gas network in rural areas; • underdeveloped environmental quality monitoring; • few companies introduce environmental management systems; • soil degradation;
Opportunities	**Threats**
• extension of the gas network in rural areas; • construction of a district heating network; • extension of the sanitary sewage network in rural areas; • construction of a rainwater drainage network throughout the commune or unblocking of existing drainage ditches; • rehabilitation of degraded soils; • improvement of road quality. extension of cycle paths;	• land contamination caused by leaking septic tanks; • high atmospheric emissions caused by local heating sources of buildings (solid fuel boilers) and linear emissions; • flooding resulting from lack of rainwater drainage; • soil degradation resulting from intensive agricultural production;

5. CONCLUSIONS

1. The analysis shows that the Municipality of Rzgów is a strongly developing area within Łódź Province. The municipality's development is in line with the principles of sustainable development. Environmental management is carried out according to the laws established by the legislator. The municipality's development is implemented in accordance with planning documents such as local spatial development plans, studies of spatial development conditions and directions, municipal development strategies or environmental protection programmes. The documents are drawn up with the support of external companies. but also, of the office staff. Information is available in the Public Information Bulletin on the municipality's official website. Easy access to information raises awareness among residents and members of the public.
2. Numerous subsidies are being implemented in the municipality to support environmental protection measures. The way forward is to raise awareness of companies about environmental management systems. Few companies take part in ISO 14001 certification, most of them only declare that their business wants to support measures to reduce their environmental impact, without taking any steps to do so. Environmental management systems could be of mutual benefit to both companies, through increased competitiveness against other companies, reduced utility bills, but also, to the environment.
3. The condition of the utilities that serve the basic needs of the inhabitants of the municipality can be assessed as good. More than 90% of residents have access to water supply networks and drinking water intakes are working with a large reserve. The quality of the water intake is good and only requires de-ironing. Work is being carried out in the municipality to further expand and modernise the water supply network. Efforts are being made to provide a ring system of the water supply network, which is more reliable in the event of a water intake failure.
4. The Municipality of Rzgów has its own wastewater treatment plant to which wastewater from most areas is discharged. The municipality's wastewater treatment plant was designed with a large capacity reserve, which provides for the connection of all current residents and potentially new ones. Treated wastewater is discharged into the River Ner and its quality is continuously monitored. The residents of the town, Starowa Gora and Stara Gadka have access to the sanitary sewerage network, while work is underway to further extend the sewerage system in other areas. This is due to the need to replace the unlined tanks, which are leaky and can pose a threat to groundwater and soil. Rainwater sewers run along major traffic routes and areas that have been subject to flooding. The municipality is taking measures to reduce the damage caused by unmanaged rainwater through projects to build rainwater drainage networks and to unblock local drainage ditches that occur in large numbers in the municipality.
5. The waste management system in the municipality works without any problems. Selective collection is carried out, taking into account the segregation of waste into paper, metals, plastics, glass, mixed waste and biodegradable waste. All this waste is collected by an external company. In 2015, a decision was taken to close the landfill site, which is currently being rehabilitated. There is a Municipal Selective Waste Collection Point in the municipality, where residents of the municipality can hand over selected municipal waste. The Municipality of Rzgów actively participates in the programme to rid the country of asbestos, which runs from 2009 to 2032. In addition. subsidies are being provided in this area.
6. The problem of air quality affects the whole country. including the Municipality of Rzgów. Measures taken to improve it include numerous subsidies for replacing heating sources and improving road quality.

7. Soil degradation is a problem that also affects the Municipality of Rzgów. Numerous farms have a negative impact on the condition of soils, groundwater and surface water. Measures should be introduced to reduce the negative effects of agriculture by making the local community aware of available organic farming methods.
8. Municipal development depends on the financial resources available to the municipality. Obtaining external funding broadens the horizons in many areas, including environmental protection. The degradation of the environment is proceeding at a very fast pace, which is why environmental protection tasks should be one of the basic objectives of the municipalities.
9. The employees of the Rzgów Municipality have the necessary knowledge of environmental management. Environmental protection is part of the municipality's policy, and the progress of the municipality is based on the principles of sustainable development, taking into account both the development of the municipality, infrastructure and environmental protection. The increase in the number of inhabitants in the municipality, the conversion of agricultural plots into building plots should not cause negative impacts on the environment. Problem areas are being remediated. However. in terms of environmental management, the municipality should introduce educational and promotional measures to encourage businesses to take advantage of these initiatives. This will reduce the negative impact on the environment in which we all live and whose goods we use.

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