

**REHABILITATION OF AN OPEN  
DUMPS IN GLIWICE POLAND**

**1. Introduction**

In this case study, an analysis was made of the operation and reclamation of open dumps that do not have the required permits by law, based on the example of an open dumps in Gliwice, Poland, belonging to the Silesian Voivodeship. The open dumps have been operating since 1989 without proper site preparation. Both typical municipal waste and waste belonging to the group of hazardous waste were deposited there. Currently, the first plots of the open dumps are closed and undergoing reclamation processes, but there is no official administrative closure decision as the open dumps is divided into several plots and the rest are still in operation.

The open dumps described in this case study is an irregularly shaped lump, and the area around the open dumps is at a level of 272.0 - 267.4 m above sea level. The open dumps are located in Gliwice, at Rybnicka Street, in the south-western part of the city, about 4 km from the city center. The operation of these open dumps is an example of 'Open dump', it was operated in an unprepared area, without proper sealing and protection, especially when it comes to securing the ground against contamination. However, due to their location and subsoil layers, open dumps leachate does not present as much of a risk as the leachate migrates towards the natural decline. The operation of these open dumps was carried out at a time when there were no relevant regulations and restrictions regulating the existence of open dumps.

The open dump in Gliwice is one of the largest open dumps in Silesia, the location is shown in Fig. 1. The current state is 4 open quarters, and the closed part of the open dumps discussed in this case study. In the described case, we focus on the closed part of the open dumps, treating the investment somewhat separate and not related to the entire plant. The open dump was put into operation in 1989 and the recultivation process started in January 2001.

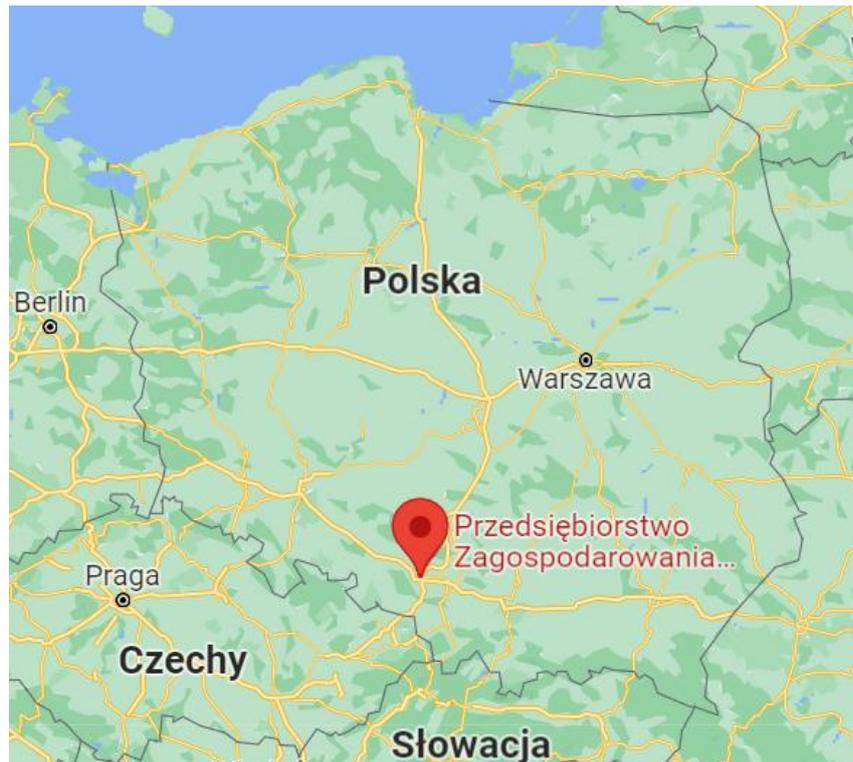


Figure 1. Location of the open dumps in Gliwice, Poland [Source: google maps].

Currently, the open dumps are managed by Przedsiębiorstwo Zagospodarowania Odpadów Sp. z o. o. in Gliwice by performing its own tasks of the Gliwice Commune, which is the owner of this area. The main task of the Company is to secure the management of waste from the area of the Gliwice Commune, but also to monitor the old part of the open dumps - the quarters, which have been closed.

The PZO company in Gliwice also operates and runs municipal waste processing installations, processes and produces electricity and heat, and carries out a number of activities related to environmental education.

#### Decision to close the open dumps and its rehabilitation

According to the hierarchy of waste management methods, preventing their generation is a key activity that can help in combating the problem of the growing mass of waste. Preparation for re-use, recycling, other recovery and disposal processes. If, for technological, ecological or economic reasons, waste cannot be subjected to the preferred methods of disposal, it is sent to open dumps. Over time, open dumps are closed and reclaimed. This process means giving or restoring degraded land for use or natural value. These areas should be properly protected, shaped and strengthened, in a manner safe for the natural environment against the harmful effects of waste and allowing for

gradual integration of the reclaimed area with the surroundings. The process of closing the open dumps and its rehabilitation consists of several stages and also depends on the situation and conditions in which the open dumps were used. The open dumps presented in this case study belonged to the open dumps type open dumps [2].



Figure 2. Top view of the open dumps, the closed part in red [Source: google maps].

## **2. Situation plan of the site before filled**

Unfortunately, due to the fact that the stored area was initially an unplanned open dumps, it was not possible to find the source of photos and documentation from before the operation. Pictures of satellite maps, e.g. from Google Maps, date back only from 2012.

## **3. Final situation plan**

The open dumps currently have 4 open quarters and a closed part of the open dumps. The layout of the repository is presented in Fig. 3. Point 1 shows the part that is currently under development, the Ecological Education Center is being built in this area. The investment is already underway, the first construction machines have already entered this area. The diagram shows the drainage, drainage and degassing system (Fig. 4.).



Figure 3. Scheme of the open dumps [Source: PZO Gliwice].

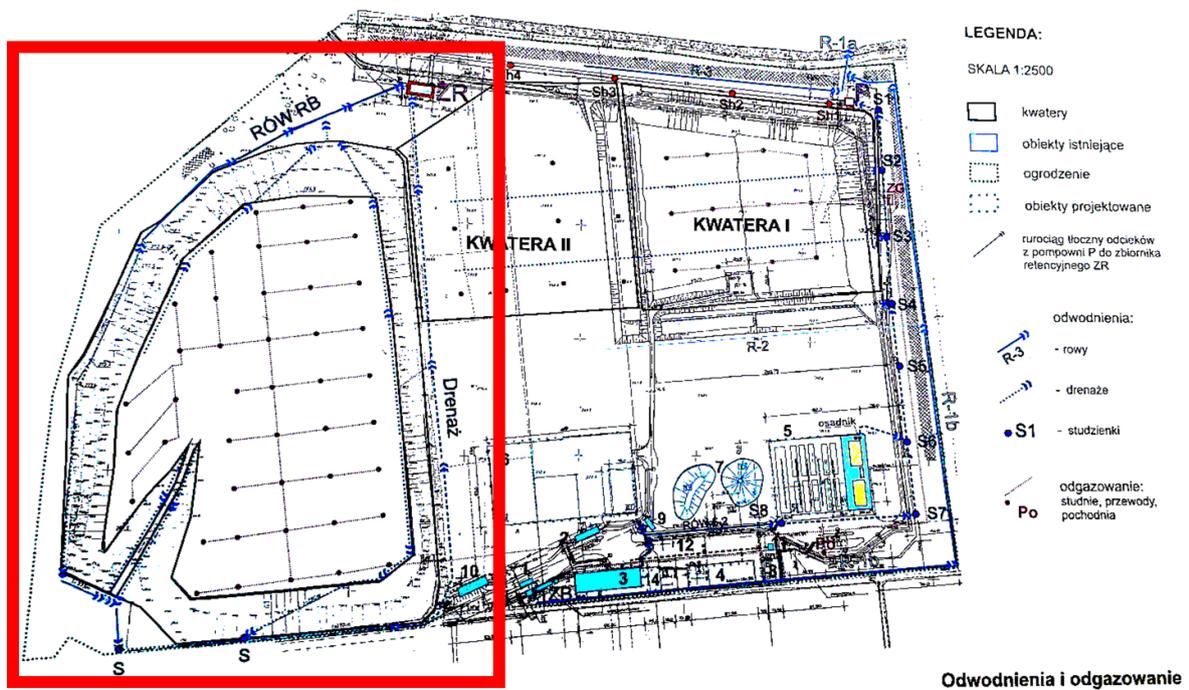


Fig. 4. Scheme of the open dumps with drainage markings and a drainage and degassing system [1].

#### 4. Type and amount of waste stored, photographs of the site

The open dumps discussed in the case study, and especially the already closed part, was a municipal open dumps. Municipal waste from Gliwice and the surrounding area was collected there [Fig. 5-9]. It is impossible to precisely determine the mass of landfilled waste, but the scale of the open dumps is currently around 53 tons of waste in 2013, up to 70,000. in 2020. Assuming that, since 1989, about 30 thousand tons of waste could have been deposited in the open dumps (on average until 2001), the mass of waste deposited on the closed section may amount to about 390 thousand tons of deposited municipal waste.

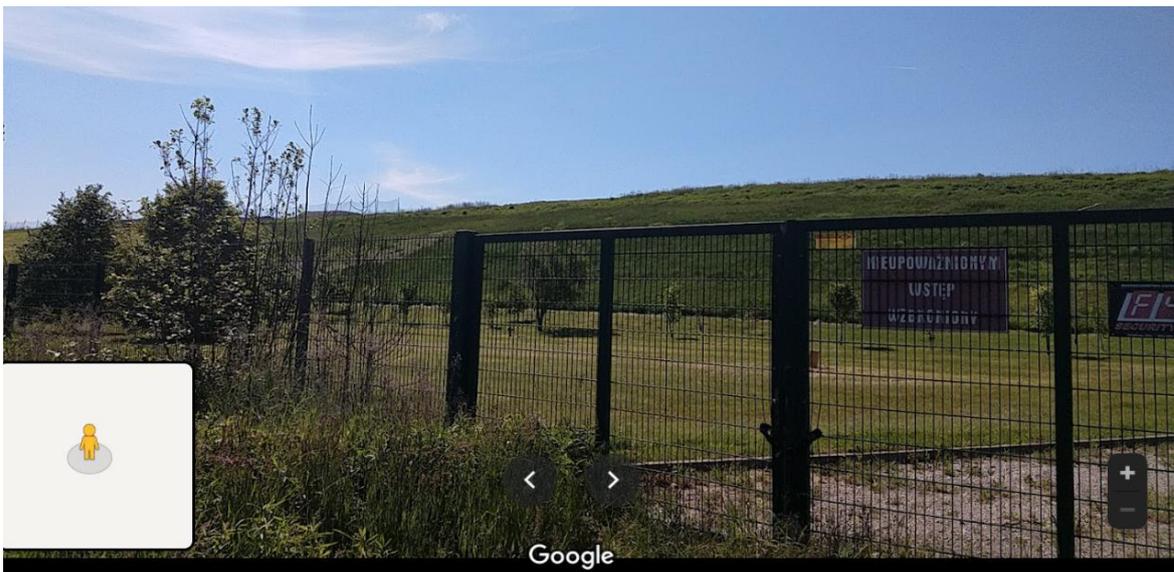


Figure 5. View of the open dumps from the south, 2012 [Source: google maps].



Figure 6. Aerial view of the open dumps 2022 [Source: Google Earth].



Figure 7. Top view of the open dumps from the north, 2012 [Source: Google Maps historyczne].



Figure 8. Top view of the open dumps from the north, 2017 [Source: Google Maps historyczne].

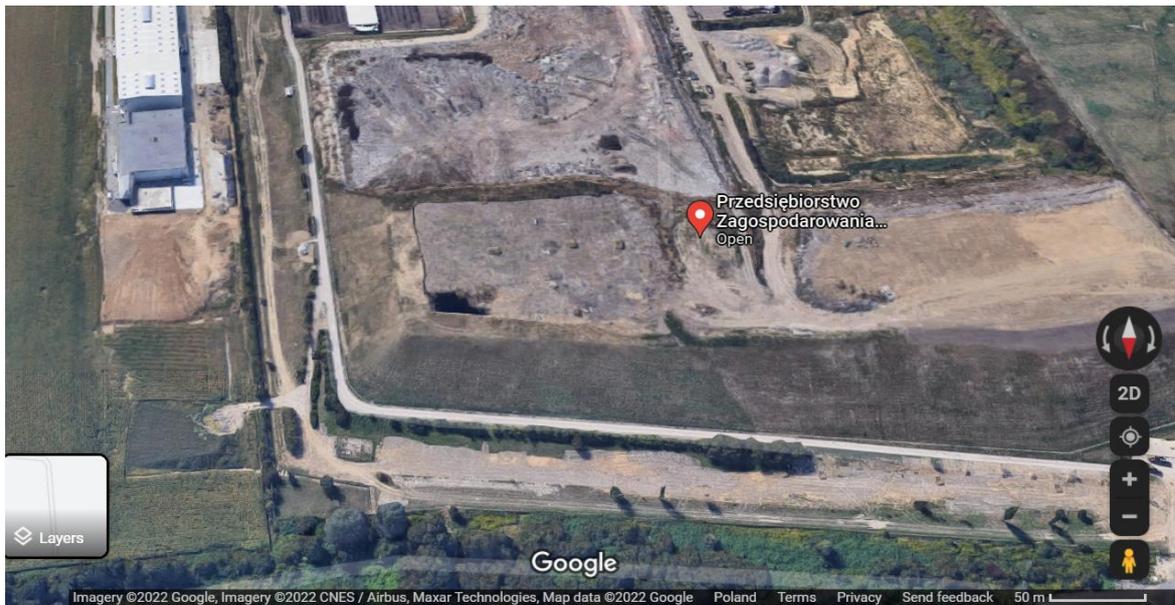


Figure 9. View of the open dumps from the north [Source: Google Earth].

## 5. Excavation fill plan

As a standard, land reclamation was performed after the liquidation of the open dumps headquarters, and consisted of backfilling the excavations with clean, properly compacted soil. The ground surface was grassed and greened in accordance with the terrain conditions and the plan. This method of reclamation is usually used when the environment has not been permanently contaminated by unsanitary open dumping.

As the soil in this area was loamy, no safeguards were needed. Clay as the substrate of this initially has proved to be very good as soil protection and seepage of pollutants into the deep waters.

## 6. Surface water drainage plan

To protect the open dumps and uncontrolled leakage of leachate into the environment, a double protection was used in the form of drainage surrounding the open dumps and a ditch on the surface led over the drainage, which also covers the open dumps. The leachate from both safeguards is collected into a retention tank, where it can be redirected further in a controlled manner.

The band drainage, consisting of two threads (a and b), was made of 100 mm diameter PEHD pipes, laid in a 4-8 mm sand back, surrounded by a 300 g/m<sup>2</sup> non-woven fabric. The total length of the drainage is 763 m (448 m for line a, 315 m for line b), and they are run along the eastern and northern part of the slopes of the open dumps.

Drainage ditches were made mainly for rainwater flowing from the canopy and slopes of the open dumps. They were made tight, like the drains, on a PEHD substrate. The ditches are 863 m long, including the RA 628 m ditch, and the RB 235 m ditch. In some places, the routes of the ditches overlap with the drainages. The entire bottom was secured with paving slabs, while the slopes were reinforced with PA azur slabs.

An additional protection is a pipe culvert with a diameter of 0.6 m, made of PVC pipe, secured with a grate made of bars, installed between the retention reservoir and the ditch. This is a protection against the ingress of large diameter solids that could damage e.g. the pump.

### **7. Gas management system plan (gas chimney section)**

The first stage of reclamation was degassing the open dumps. The process started in 2001. Appropriate openings and an installation for degassing the open dumps gas have been made. The scheme of degassing points is shown in Figure 10. The gas discharged through vertical pipelines was used in a power generator and partially burned in a flare. This stage was completed in 2005, when the amount of biogas was so low that it was not justified to continue the degassing process.

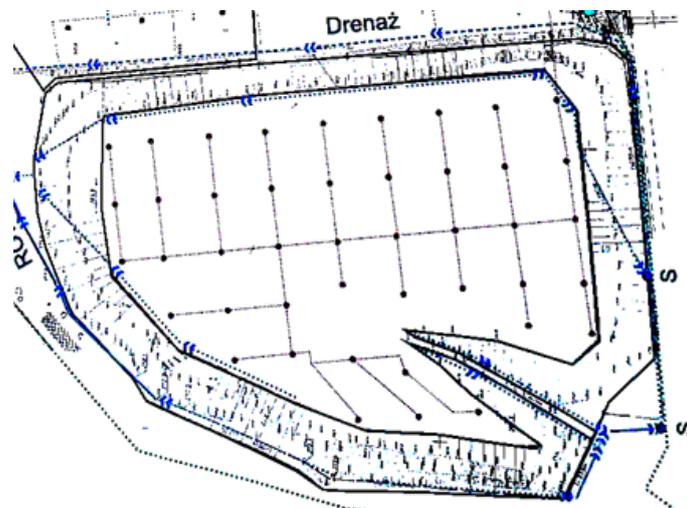


Figure 10. Scheme of degassing points of the open dumps (view from the west side) [1].

### **8. Upper impermeability plan (section of layers)**

The last layer of the open dumps protection (plateau) is soil 0.3 m high, covered with planting of bushes in the form of one species of clumps. This is to prevent wind erosion and improve the aesthetics of the site.

The slope of the open dumps and drainage were covered with grasses, and trees in strips were planted between the fence and the slope of the open dumps (Fig. 8.1). The open dumps use 3 types

of biological development area - A, B high greenery, C low greenery and grass. The following tree and shrub species were selected for reclamation:

- Trees:
  - Robinia pseudoacacia
  - Norway maple
  - Common government
  - White poplar
  - Silver birch
- Shrubs:
  - Common privet
  - Jasminowiec free
  - Bird cherry
  - Wild rose

Reclamation was carried out in stages, using appropriate fertilizers and taking care of the area so that the plants developed at the appropriate pace. Between the fence and the open dumps area, there is a layer of live humus, which also promotes the development of vegetation in the open dumps.

The planting distribution is shown in Figure 11.

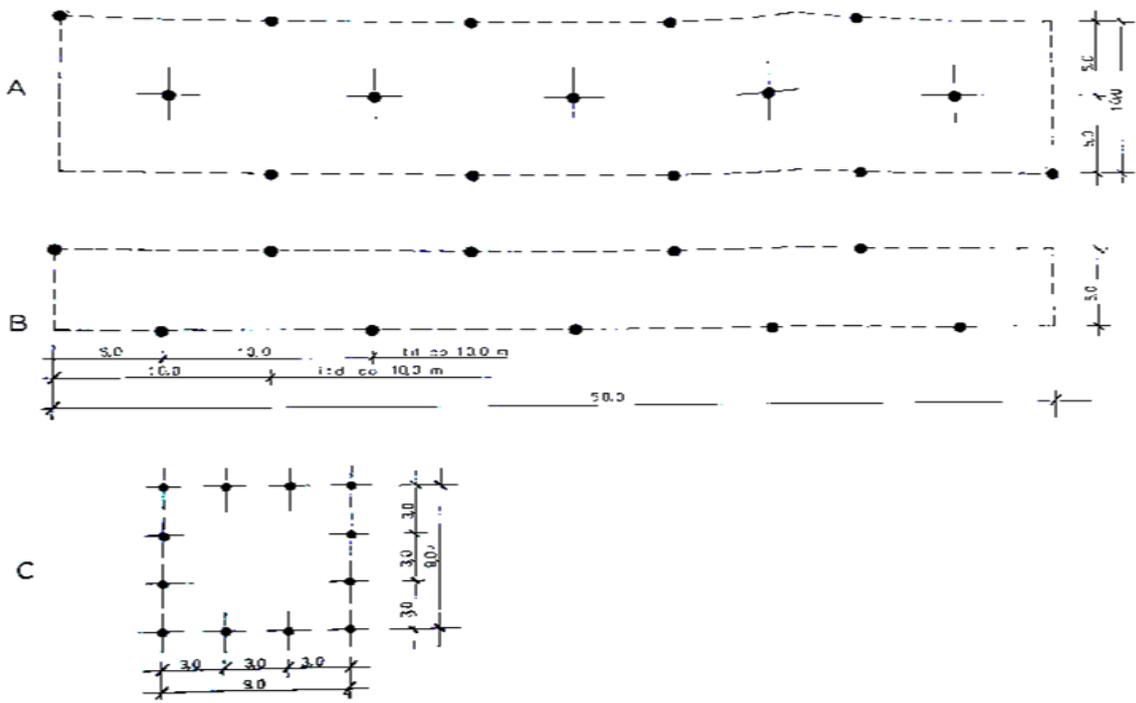


Figure 11. The scheme of plantings in the open dumps area [1].

## 9. Landscape plan

The open dumps is located away from the city center, but on the main A4 motorway. There is very good access to it, and at the same time it does not disturb the city and minimizes the negative impact on the environment and surroundings. In Figure 12-13 view of the open dumps from the point of view of the fence.



Figure 12. View of the open dumps from the perspective of an inhabitant-behind the fence, south side, 2021 [Source: google maps]



Figure 13. View of the open dumps from the perspective of an inhabitant-behind the fence, south-west side, 2021 [Source: google maps]

## **10. Observation wells and control plan**

The completed plan of construction works related to the rehabilitation of the closed open dumps section also included:

- earthworks, loading, transport and leveling works with the use of heavy equipment along with operator services and fuel;
- crushing of construction and demolition debris stored in the open dumps into aggregate of different granulation;
- mixing the mineral fraction and biomass in the open dumps.

After construction works, all the necessary parameters of the open dumps, including the impact on the surroundings, were checked.

## **11. Rehabilitation**

The reclamation consisted in closing the open dumps, forming the target lump, degassing the waste mass, covering the entire surface with layers protecting the waste and introducing vegetation. The top layer was covered with soil and greened in order to improve the aesthetics of the area and to prevent wind erosion.

Reclamation of the open dumps was successfully completed, but without an official administrative decision. Due to the fact that the rest of the open dumps sites are operational, some of them are only closed. In the area of the former quarters, work is currently underway to prepare the construction of a new Ecological Education Center. In photos 14-15 presents the current state of construction works and the degree of advancement of the project. Figures 16.-22 show the plan of the target Center for Ecological Education and its visualizations. The source of the photos is the video published on the YouTube channel (screenshots from the film), and the authors own the copyright of the visuals.



Figure 14. The future site of the Ecological Education Center building, in the background the slope of the open dumps [4].



Figure 15. Visualization plan for the Ecological Education Center building, in the background the slope of the open dumps [4].



Figure 16. Visualization of the building of the Ecological Education Center and the space in front of the building, part 1. [4].



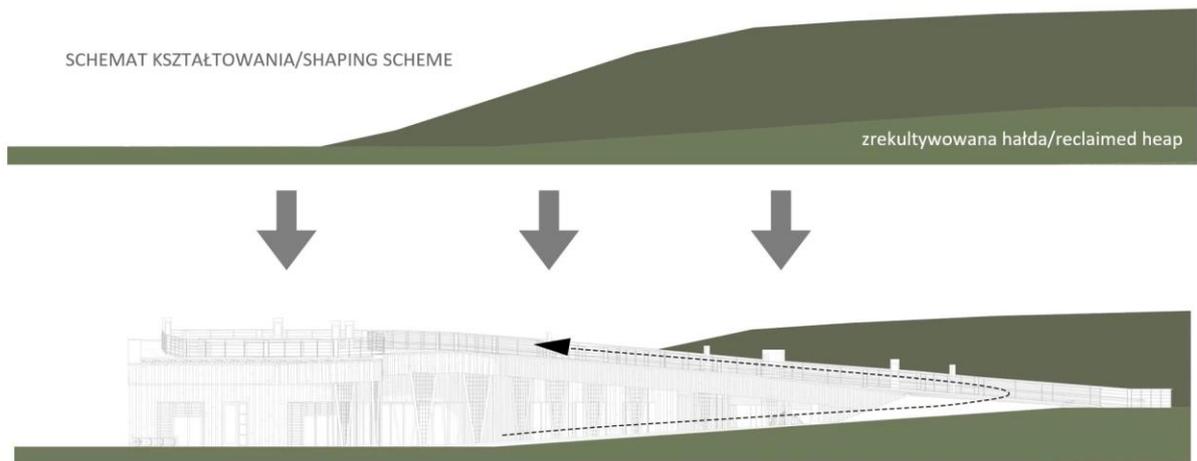
Figure 17. Visualization of the building of the Ecological Education Center and the space in front of the building with a fountain, part 2. [4].



Figure 18. Visualization of the building of the Ecological Education Center and the space in front of the building, top view, part 3. [4].



Figure 19. Visualization of the entrance to the Ecological Education Center [4].



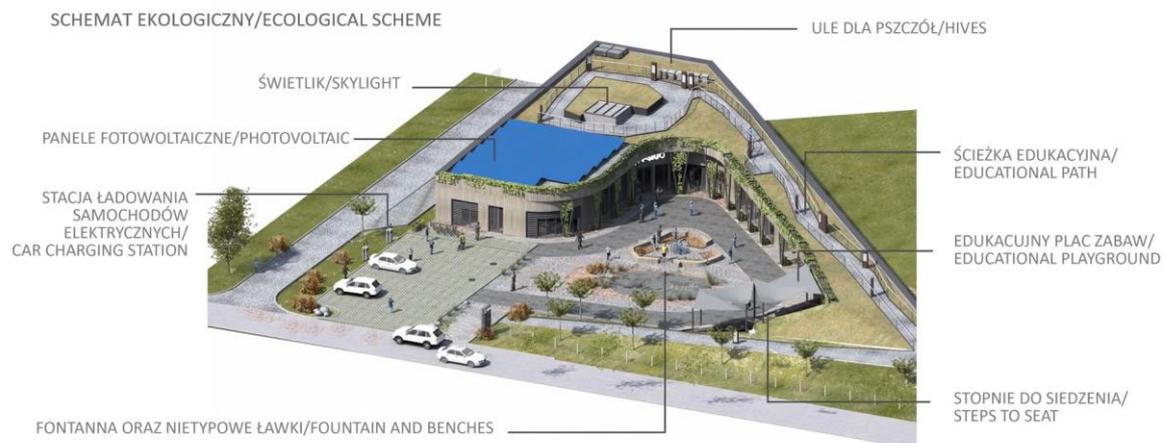
Zielony dach przystosowany do ruchu pieszych, który kształtem wpisuje się do zrekultywowanej hałdy  
*The green roof is adapted to pedestrian traffic and its shape fits into the reclaimed heap*

Figure 20. Diagram of the roof of the Ecological Education Center building and its location within the closed open dumps [4].



Obiekt zawiera też drugą ścieżkę edukacyjną, która znajduje się na wylot na kwaterę  
*The facility also includes a second educational trail, which is located right through the quarters*

Figure 21. Visualization of the educational path in the Ecological Education Center, located on the slope of the closed open dumps [4].



*Ścieżka edukacyjna, instalacje fotowoltaiczne oraz ule dla pszczół powstały w trosce o środowisko  
Educational path, photovoltaic installations and beehives were created out of concern for the environment*

Figure 22. The overall plan of the Ecological Education Center [4].

It is also worth noting that the entire Ecological Education Center was designed by BB Architekci. On the other hand, the exhibitions that will operate at the Center will present the proposals and proposals of students of the Faculty of Architecture of the Silesian University of Technology in Gliwice. It is an excellent example of how activities can be combined locally and how science supports the local environment. Students developed projects relating to 4 issues: the project of a stationary exhibition and a mobile exhibition, the project of creative games and solutions promoting the idea of segregation and knowledge in the field of waste management in the audiovisual room at the Center [4].

## 12. Monitoring

According to the law, the monitoring of the open dumps must be carried out for at least 30 years. At that time, ongoing works related to degassing and drainage of the open dumps and greening were carried out. Currently, slope landslides, displacements and the stability of the open dumps are controlled.

## Acknowledgment

Special thanks to the PZO Gliwice company, which is responsible for the reclamation of the open dumps, for providing the data for this case study for educational purposes.

## References

- [1] Own data from PZO Gliwice reports and projects, provided at the request of the author.
- [2] Press release: <https://przemyslisrodowisko.pl/decyzja-o-zamknieciu-skladowiska-oraz-jego-rekultywacja/>
- [3] Attachment no 2 to Regulations of the Minister of the Environment at 30 April 2013 r. about open dumps (Dz. U. poz. 523), available online: <http://isap.sejm.gov.pl/isap.nsf/download.xsp/WDU20130000523/O/D20130523.pdf> [dostęp:2021-06-15].
- [3] Act Art. 148 of the Act of December 14, 2012 on waste (Dz. U. z 2020 r. poz. 797)
- [4] Press release (available online 03.01.2022 r.): <https://gliwice.eu/aktualnosci/miasto/wtopione-w-przestrzen-w-gliwicach-powstanie-centrum-edukacji-ekologicznej>