INFRASTRUKTURA I EKOLOGIA TERENÓW WIEJSKICH
INFRASTRUCTURE AND ECOLOGY OF RURAL AREAS

Nr IV/1/2016, POLSKA AKADEMIA NAUK, Oddział w Krakowie, s. 1229–1241
Komisja Technicznej Infrastruktury Wsi

DOI: http://dx.medra.org/10.14597/infraeco.2016.4.1.090

THE CONCEPT OF LAND USE DEVELOPMENT OF A MUNICIPAL SOLID WASTE LANDFILL: THE CEGŁÓW COMMUNE CASE STUDY

Jolanta Kwiatkowska-Malina, Sylwia Dybowska
Warsaw University of Technology

Abstract

The presence of municipal solid waste landfills is an inevitable spatial phenomenon that expresses the planning properties of the process of land use, economic development and the relationship to the environment. The process of land use is continuous, in which a period of planning, development and management of its operation is followed by a period of decline in the performance of (aging) and the fall of the land. Closing the landfill and reclamation results in the appearance of problem areas, i.e. of degraded areas both on the site and in the area of its influence.

The paper presents the concept of development of a closed municipal solid waste landfill in the village Woźbin in the commune Cegłów and adjacent areas. According to the 'Project of closure and reclamation of municipal solid waste landfill in the village Woźbin, in the commune Cegłów' after the operation of the landfill as well as the technical and biological reclamation, can be implemented forest restoration direction. The concept of developing the reclaimed municipal landfill and the adjacent land is assumed to introduce the planned forest reclamation and complement the recreational function which will increase the attractiveness of the area and will enable its use in a more economical way aimed at integrating the municipal solid waste site with its surroundings.

Key words: land use development, municipal solid waste landfill, reclamation, recreation

INTRODUCTION

The currently dominant way of municipal solid waste disposal in Poland is deposition in landfills. At the end of 2014, there were 394 operational landfill sites receiving municipal waste. These landfills occupied the total area of 1927 ha. In 2014, as many as 66 landfill sites of this type were closed, with the area of almost 158 ha (Central Statistical Office, 2015). In order to adjust landfill sites to technical and organizational requirements resulting from the provision of law, the number of operational landfill sites has been systematically falling for several years. Closed landfills do not fulfil the requirements of the Regulation of the Minister of the Environment of 30 April 2013 on waste landfills (Act 2013, item 523) and may have severe impacts on the environment, and particularly to groundwater and soils. The degree of environmental threat from landfills particularly depends on the type and age of deposited wastes, way of deposition, and hydrographical and hydrogeological conditions (Koda, 2009). The reclamation of closed landfills is the final stage in the process of exploitation of this type of objects. Pursuant to Act on the Protection on Arable and Forest Land (Act 1995, No. 16, item 78 consolidated text, as amended), reclamation is 'the provision or restoration of useful or environmental values of degraded land through accurate development of land relief, improvement of the physical and chemical properties, regulation of water relations, restoration of soils, strengthening of scarps, and restoration or construction of necessary roads'. Boundaries of areas requiring transformation and/or reclamation are determined in the study on the conditions and directions of spatial management of communes, or in local plans pursuant to Act on Spatial Planning and Spatial Management (Act 2003, No. 80, item 717 consolidated text, as amended). According to Siuta and Żukowski (2012), the process is defined as the renewal of the culture of the environment involving the restoration of ecological and economic usefulness of land surface degraded by the human. The reclaimed area of a landfill should be possibly well composed with the landscape, and harmonised with the surroundings. The reclamation process should be 'incorporated' in the exploitation of a landfill. In that case, after closing the landfills, it is considerably easier, faster, and more economically efficient to obtain the best results (Jamróz, 2012). The reclamation process can be divided into five basic stages: (i) preparation of reclamation, considering the previously adopted direction of reclamation, (ii) technical reclamation, (iii) biological and detailed reclamation, (iv) restoration of economic usefulness of the area with biological management, (v) monitoring of effects of reclamation (Manczarski, Lewicki, 2012).

Adopting a direction of reclamation requires preparing design documentation including detailed analyses of the environmental conditions and financial possibilities of the entity responsible for the reclaimed area, as well as entries in plan-

ning documents. The accuracy of selection of the direction of reclamation depends on factors characterising the reclaimed area and its surroundings in the spatial and socio-economic sense (Ostręga, Uberman, 2010). In Poland, the most frequently adopted directions of reclamation include: agricultural, forest, recreational, and construction (Gliniak, Sobczyk, 2014; Gonda-Soroczyńska, Kubicka, 2016; Kwiatkowska-Malina, Wyszomierska, 2014). The adoption of the recreational direction of reclamation of landfill areas and management of adjacent areas including providing new useful value involves among others conducting monitoring of the landfill area for 30 years from the moment of discontinuation of exploitation pursuant to § 5.1 of the Regulation of the Minister of the Environment of 30 April 2013 on waste landfills (Act 2013, item 523). This contributes to the minimisation of the negative impact of the landfill, and integration of the anthropogenically transformed area with the surroundings. Such a purpose is supported by the vicinity of urban structures, as well as forest management of the adjacent areas.

The objective of the paper was to develop a project design of a concept of land use development covering the area of a closed municipal solid waste landfill located in the Woźbin village, and the adjacent areas in the Cegłów commune.

MATERIALS AND STUDY METHODS

The project design of the concept of land use development was performed for the area of the closed municipal solid waste landfill located in the Woźbin village in the Cegłów commune, and the adjacent areas, including those located in the neighbouring Mrozy commune. The commune Cegłów is located in Miński poviat, the eastern part of Mazowieckie voivodship and within the boundaries of Warsaw Metropolitan Area. The concept of land use development was based on map documents, ortophotomap, numerical data, and planning documents (Study 2010; Development plans and strategies 2007-2013, Cegłów 2008) referring to the study area. Moreover, in the scope of supplementation and verification of the obtained materials, a land inventory was performed. The design of land use development together with the drawing for the area of the closed landfill, with a proposal of supplementation of the tourist infrastructure, i.e. network of tourist paths in reference to the developed project, was prepared with the application of AutoCad 2014 and ArcGis 10.2 software.

DESCRIPTION OF THE STUDY AREA

Location and general data.

The study area covers the closed communal municipal waste landfill located in the Woźbin village on a parcel (number 99), with a total area of 1.66 ha,

and adjacent areas located in the northern part of the Cegłów commune (Miński poviat, Mazowieckie voivodship). The landfill was operated in the years 1995-2014. The reclamation measures performed in the landfill involved technical activities permitting the implementation of the forest direction of reclamation not earlier than after 10 years from its closing. The area of the landfill neighbours to a forest to the north, and is surrounded by grasslands and young forest to the east, north, and west.

Spatial policy towards the study area.

Planning documents concerning areas of municipal waste landfills at the scale of the country generally describe the proper direction of dealing with such areas. More detailed provisions regarding the location of the municipal waste landfill in Woźbin are included among others in the Plan of Spatial Management of the Mazowieckie Voivodship and/or in the Voivodship Plan of Waste Management. Detailed information concerning the analysed area is included in the Study of the conditions and directions of spatial management of the Cegłów commune prepared in 2010 (Study, 2010). It is the most important binding planning document, regulating the form of land management in the landfill area and its vicinity. The Study (2010) stipulates the spatial policy for the Cegłów commune in the context of the conditions specified in Article 10 of Act on Spatial Planning and Spatial Management (Act 2003, No. 80, item 717 consolidated text, as amended), resulting from the state of the environment, current land management and purpose, simultaneously considering undertakings and solutions based on the potential of the commune. The future form of land management in areas adjacent to the landfill was the forest direction (text and graphic part of the study, 2010; land predisposed for forestation). The area of the landfill in the Study (2010) was marked as the area of removal of solid wastes (ARSW). Therefore, in 2010, its closing was not taken into consideration, but its further operation was planned (its rules are included in the chapter describing waste management in the commune).This suggests, however, that afforestation is the most desirable direction of ARSW land management, as planned for areas surrounding the landfill. Afforestation is aimed at evening out of the irregularly distributed forest areas and increase their areas, and development of compact environmentally active complexes.

In the scope of protection of the existing forest areas, and particularly protected forests, the Study (2010) stipulates conducting forest economy in accordance with the rules of management included in the Regulation of the Minister of Environmental Protection, Natural Resources and Forestry of 25 August 1992 on detailed rules and course of recognition of forests as protected, and detailed

rules of conducting forest economy in such forests (Act 1992 No. 67, item 337). Moreover, the Study (2010) shows an important role of field tree stands and forests in river valleys. For the purpose of preserving their function, including among others the development of favourable water balance, establishment of local ecological corridors and places of abiding of animals, and landscape management, forest owners should observe the obligation of proper maintenance of tree stands. In the Study (2010), land neighbouring with the landfill was purposed not only for family house building development, but also holiday building development. Due to the environmental attractiveness of the area, the number of agritourist farms and other recreational objects is increasing.

Tourist management in the Cegłów commune.

The environmental values of the Cegłów commune, i.e. large forest complexes with rare species of fauna and flora, small rivers with natural course, and numerous nature monuments, determine the tourist attractiveness of the region. Moreover, convenient location and very good transport connections with the local rural centres and Warsaw contribute to the tourist potential. Walking and cycling trips are the most popular form of recreation.

The existing tourist base includes trails and walking and cycling tourist paths prepared by Polish Society of Tourist Sightseeing and the Mińsk Mazowiecki State Forest District. The location of the beginning and end of trails near bus and railway stations is very convenient. In the 'Jedlina' reserve in the Mieńskie Forests, a walking and cycling educational-recreational paths have been established. The Forest Cycling Path runs through the Uroczysko Mienia swamp until the 'Jedlina' reserve. The tourist base also includes sport-recreation (school sports fields and playgrounds) objects located in five villages. The tourist base also covers buildings with a holiday function and agritourist farms with various offers (e.g. horse stud).

The catering services requires supplementation, because it only includes two objects (a bar and restaurant). According to the Local Development Plan by 2013 (updated), the commune should develop its offer, particularly in the scope of infrastructure related to the tourist base (Cegłów, 2008). Moreover, a positive tendency has been observed involving the implementation of original ideas for thematic events (e.g. Sójka Mazowiecka-Regional festival), as well as development of an offer based on active recreation. Such a form of tourism does not require high financial spending, and its flexibility and possibility of expanding the proposals provides tourists with better conditions for familiarising themselves with the region, and the commune with chances for local development.

THE CONCEPT OF LAND USE DEVELOPMENT OF THE CLOSED MUNICIPAL SOLID WASTE LANDFILL AND ADJACENT AREAS IN THE CEGŁÓW COMMUNE

Selection of the direction of reclamation of the municipal solid waste landfill and land use development

The direction of land reclamation and management is particularly determined by the previous manner of land use, and the function of the land it fulfilled in the environment and space in the past. It also depends on the provisions included in planning documents, as well as on economic, socio-economic, and technical aspects considering the difficulties and benefits of the implementation of a few functions in the degraded area. Pursuant to the 'Project of closing and reclamation of the municipal solid waste landfill in the Woźbin village, Cegłów commune', after the discontinuation of exploitation and conducting technical and biological reclamation, the forest direction of reclamation can be implemented (not earlier than after 10 years). The afforestation, particularly in the form of supplementations of the existing forest complexes around the waste landfill is planned, in accordance with the currently binding Study of the conditions and directions of spatial management of the Cegłów commune (2010). Therefore, the concept of management of the closed waste landfill adopted the forest direction of management, recognising it as the most appropriate.

At the first stage of reclamation of the closed landfill, all necessary measures should be performed related to technical and biological reclamation, as well as relevant shaping and stabilisation of the ground. The forest direction of reclamation is proposed to be supplemented with the recreational function increasing the attractiveness of the area, and permitting its use in a more interesting and cost-effective way. The primary elements of the concept of management include a rope park in the area of the closed municipal solid waste landfill. The integration part of the park will be an environmental-educational path around the area of the former landfill, with the leading theme of waste deposition, reclamation, and ways of new management of the area. An element connecting the idea is supplementation of the network of the existing tourist trails with a new trail connecting attractive places in the Cegłów commune in terms of interests of a potential tourist.

The priority in the planning of new management was the preservation of the forest character of the management of the commune. The proposed supplementations of forest areas aim at emphasising the role of forests in the commune. Moreover, the project corresponds (Figure. 1) with the slogan promoting the commune: 'Cegłów Green Commune', and pro-ecological activities organised in Cegłów. The idea of establishment of a rope park and supplementary tourist

management in the closed municipal waste landfill in Woźbin was based on several important factors: (i) activation of the area of the reclaimed landfill and providing it with a new function, (ii) increasing the attractiveness of the offer of the commune in terms of tourism preserving the slogan "Cegłów Green Commune", (iii) development of the sport-recreational offer in the region, (iv) promotion of healthy and active lifestyle, (v) supplementation of environmental education with the application of the rope park and environmental-educational path for children and youth from local schools.

Rope park

A rope park is a course with rope obstacles fixed high on trees or poles. A rope park is an installation with a character of small architecture, treated by law as a technical device (Act on Construction Law, art. 3 point 4, Act 1994, No 89, item 414 consolidated text, as amended.). In the eastern part of the Mazowickie voivodship, there is no large objects of the type function. Therefore, the implementation of a rope park in the vicinity of Mińsk Mazowiecki is justified. The offer of a rope park is directed both to individual recipients and groups, including school groups. Participants of rope obstacles can be adults as well as children supervised by an adult. No experience is necessary, only sufficient height (minimum 130 cm).

Over a part of the study area, it is proposed to introduce a new function in the form of a rope park fixed on the existing trees. The area purposed for the function amounts to approximately 1.5 ha. The area will include structures related to the rope park, and the necessary accompanying infrastructure, among others a technical building, building for equipment storage, an office, and a catering facility. It is also planned to prepare an area for a mini lasertag field, playground, picnic area, archery and air gun shooting area, and smaller objects such as a trampoline or free-standing climbing wall, etc. It is assumed to fence only a small fragment of the area, on the northern side directly neighbouring with the forest. The proposed name for the park is 'Green Adventure'.

The implementation of the investment requires relevant preparation of the area and ground. This involves among others clearing trees directly threatening the safety of participants. In places requiring paving, due to the construction of buildings, the ground will be strengthened with additional layers of material, and the most favourable slope inclination will be ensured for scarps. Trees making it impossible to implement elements of management, or with poor state of health will be removed. In the scope of compensation and enrichment of the landscape, as well as maintenance of the forest direction of reclamation, it is planned to plant new trees with a species composition corresponding with firm characteristic of the Cegłów commune. Moreover, areas with special functions will be separated with alleys, with oaks, hornbeams, poplars, and birch planted along

them. Point tree stands are also designed in recreational areas, perfectly composing with the landscape, increasing the aesthetic values, and providing shade for people resting in the park. Various species of grass vegetation will be introduced directly to the areas of zones with a given function to naturally emphasise the division of space with differences in colours.

The functionality of the designed area largely depends on the transport system and introduced forms of building development. In the case of the said rope park, the road network of external connections is related to the existing routes running around the study area. They are communal roads with asphalt surface, and a network of local, mainly dirt roads. The main access road was from the west, i.e. from the road running from the Woźbin village. The existing transport network was determined to be sufficient for the implementation of the investment. Supplementation through establishing additional routes for road traffic is not needed. It is advisable, however, to modernise the road surface, and particularly the road leading to the rope park. Considering pedestrian traffic, a network of alleys and paths were proposed in the park. Their additional role is spatial division of the area into functional-spatial zones among them, an educational-ecological path was established.

The basic zone in the rope park is the area purposed for the management of rope installations and various obstacles arranged in tracks. At the first stage of the implementation of the investment, it is planned to designate minimum three-four tracks with different degrees of difficulty for various age groups, and a training track. The first track, the easiest one, will be dedicated for children and youth encountering this form of activity for the first time. Two tracks at a medium level of difficulty, universal, created for both children and adults. One of them will end in a climbing wall. The most difficult and highest track, will have a system of obstacles with two rope slides with a length of approximately 85-110 m, running above the basin of the reclaimed landfill.

Directly on the rope park, on the south-eastern side, an area is purposed for an original playground. It will feature randomly distributed hills with a small labyrinth naturally created among them. Dustbins, benches, and seats will be distributed among the hills. An outdoor gym is designed next to the playground, equipped with a group of systemic devices for recreational training and exercise in fresh air. A shooting ground is an interesting element of the concept of land development, purposed for typically recreational shooting. A fenced zone is also designated for mini-lasertag games. A picnic area is designed within the former basin of the landfill. The flat area covered with vegetation will be enriched with several wooden gazebos with tables and benches, and a bonfire area.

The concept of land development has been designed in such a way that it was possible to implement a phased investment. Modular patch introduce further elements will not only facilitate financial but allows modification and extension of the offer.

Educational-ecological path

The basic assumption of the concept was a coherent and comprehensive land use of the reclamed landfill and its surroundings. Therefore, part of the rope park will be surrounded by an educational-ecological path, which will be a learning tool in the field of reclamation and redevelopment of municipal solid waste landfills. The planned path will be clear and easy way of demonstration of the municipal landfill functioning and methods of reclamation and redevelopment opportunities. The path will be laid out along the crown plateau reclamed landfills, leading to the viewpoint (wooden lookout tower). On the path designed stop-information boards. It was suggested that the materials for all landscaping elements derived from recycled materials.

Tourist route

The existing network of designated tourist routes and cycling trails connects informally the 'Jedlina' reserve and 'Rudka Sanatoryjna' reserve. However, these routes are only the southern part of the Cegłów commune. The rope park and surrounding it educational-ecological path generated a landmark in the northern part of the Commune. Therefore it proposed to create another route/ pathway that not only complement the current network on the north side, but also would combine attractive areas of forest sacred spots with reserves. Rope park and an educational-environmental path will be an integrating element. The proposed route runs through the countryside to the wilderness of Kokoszki and Pełczanka. Another characteristic objective/point of that route is the village of Rudnik, and town municipal – Cegłów, including monuments and historical sites. The route continues east toward the village of Woźbin, which can be a destination. The designed route complements the tourist offer of the region, especially in the northern part of the Commune. The length of the planned route and the course allows to use the rope park for families with children and people in different condition and ages.

The combination of paths and bicycle-pedestrian communes Cegłów and Mrozy, whose focal point is a rope park can be a supplement to the offer community authorities Cegłów that organize summer bike ride (http://ceglow.pl). In addition, they organized two major cross-country events, i.e. Picnic Racing and Cegłowski Independence Run. Events such as Earth Day or family picnics could also be organized in the rope park areas. All these activities emphasize the impact of properly organized green areas and development of degraded areas such as municipal solid waste landfill on the environmental and sociological conditions. Moreover, it should be noted that the biologically active area occupies more than 90% of the area.

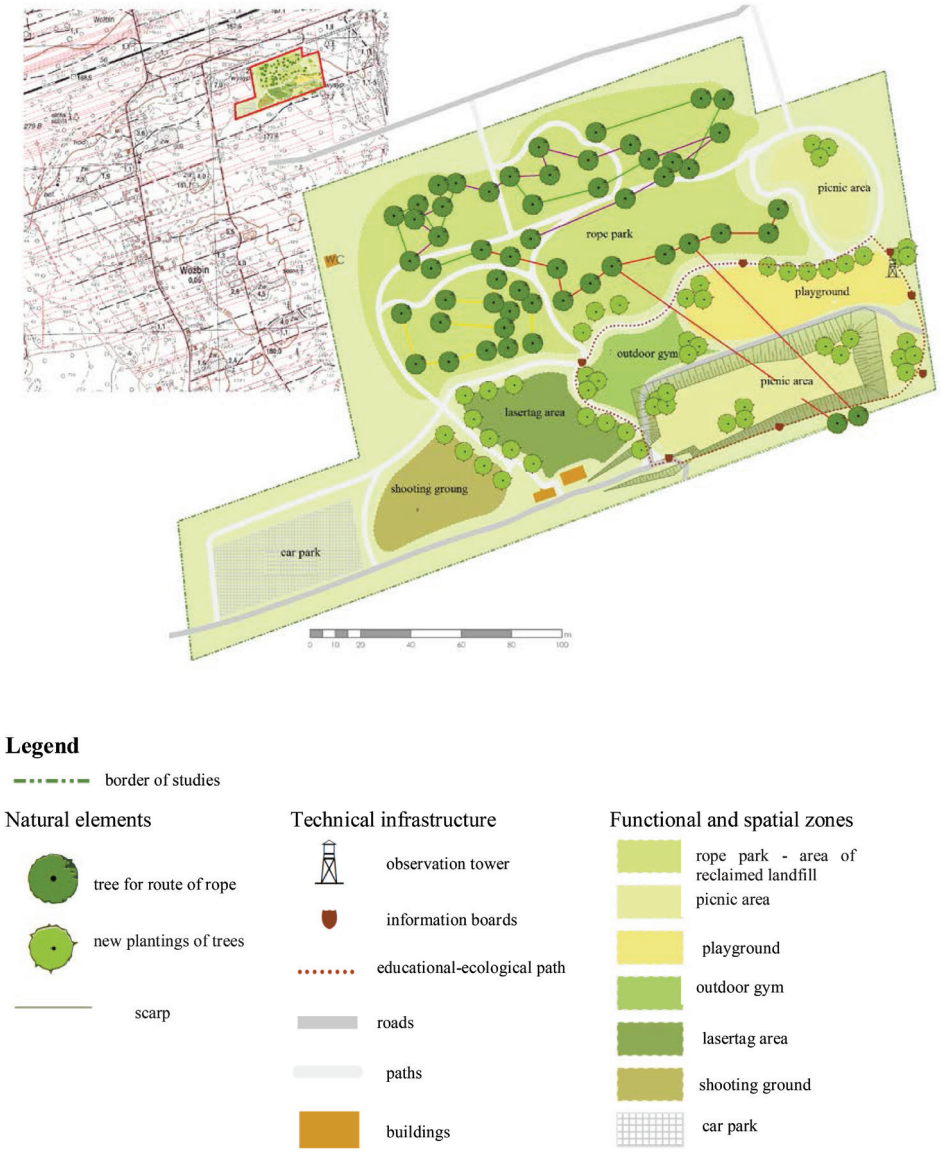

Figure 1. The spatial planning concept of a landfill site and adjacent areas in the Cegłów commune against a background of the village Woźbin location

SUMMARY

The proposed concept of planning of the municipal waste landfill and adjacent areas composes well with the surrounding space, simultaneously constituting an original proposal of use of the problematic post-landfill area. The primary element of land use in the areas around the closed municipal solid waste landfill and adjacent areas is a rope park with an educational-ecological path, perfectly using the high potential of the area. The project also involves the establishment of a cycling-tourist trail connecting two nature reserves located near the rope park. The proposal shows that it is possible to implement a new function coherent not only with the immediate surroundings, but also in a broader inter-commune scope. The proposal of the tourist trail supplements the network of the existing trails and uses the potential of forest complexes connects the most interesting places of the northern part of the commune, and constitutes a complementary element of the primary concept.

The rope park is a perfect way of promotion of the Cegłów commune in the region, and increase in tourist traffic. Moreover, it corresponds with the consequently conducted and continuously expanded pro-ecological policy of the commune, in accordance with the adopted slogan "Cegłów Green Commune". The proposed form of spatial planning has high chances for implementation, because it is not at variance with the study of the conditions and directions of spatial management of the Cegłów commune (2010). Therefore, it is feasible in legal terms. Moreover, considering the financial aspect, it is an economical investment, because: (i) it does not require high expenditures, (ii) it is possible to be implemented in stages, (iii) chances for obtaining subsidies from external resources exist, (iv) it generates income after a relatively short time of functioning, (v) the flexibility of the offer permits modifications or introduction of new and/or additional solutions supplementing and refreshing the offer, (vi) it is targeted at a broad range of recipients. The proposed concept of planning of the municipal waste landfill can constitute a model solution for communes. The original design for the use of problem areas, corresponding with current trends, is a good proposal for self-governments, and a chance for promotion of communes at the supralocal scale.

REFERENCES

Act *on Construction Law* from 7 July 1994, Act 1994, No 89, item 414 consolidated text, as amended.

Act *on the Protection of Arable and Forest Land* from 3of February 1995, Act 1995, No 16, item 78 consolidated text, as amended.

Act *on Spatial Planning and Spatial Management* from 27 of March 2003, Act 2003, No 80, item 717 consolidated text, as amended.

Central Statistical Office (2015) *Municipal Infrastructure in 2014*. Statistical information and elaborates, Warsaw 2015.

Gliniak M., Sobczyk W. (2014) *Koncepcja zagospodarowania terenu poprzemysłowego 'Solvay'* [The concept of land-use brownfield 'Solvay']. Rocznik Naukowy Edukacja-Technika-Infrastruktura: Problemy edukacji ekologicznej i społecznej, Vol. 5, No. 1, 354-359, (in Polish).

Gonda-Soroczyńska E., Kubicka H. (2016) *Znaczenie rekultywacji i zagospodarowania gruntów w Polsce w kontekście ochrony środowiska.* Infrastruktura i Ekologia Terenów Wiejskich. Nr 2016/ I/1, DOI: http://dx.medra.org/10.14597/infraeco.2016.1.1.012, 163-175, (in Polish).

Jamróz, A. (2012) *Prawidłowa budowa, eksploatacja i rekultywacja składowisk odpadów komunalnych zgodnie z przepisami prawa polskiego.* Środowisko Czasopismo Techniczne Nr 1 – Ś/2012, 87 – 100, (in Polish).

Koda, E. (2009). *Geośrodowiskowe aspekty rekultywacji składowisk odpadów*. Inżynieria Morska i Geotechnika Nr 3/2009, 134-151*,* (in Polish).

Kwiatkowska-Malina J., Wyszomierska M. (2014) *Zagospodarowanie obszarów po eksploatacji kruszyw naturalnych na przykładzie złoża Sitno w gminie Rzewnie.* Infrastruktura i Ekologia Terenów Wiejskich. Nr 2014/II/3, DOI: http://dx.medra.org/10.14597/infraeco.2014.2.3.052, 705-717, (in Polish).

Manczarski, P., Lewicki, R. (2012) *Wytyczne dotyczące zamykania i rekultywacji składowisk odpadów komunalnych.* Warszawa, NFOŚiGW, (in Polish).

Ostręga A., Uberman R. (2010). *Kierunki rekultywacji i zagospodarowania – sposób wyboru, klasyfikacja i przykłady*. Górnictwo i Geoinżynieria Nr 4/34 445-461, (in Polish).
Plan rozwoju lokalnego rzeczowo-finansowy w latach 2007 – 2013 Gminy Cegłów, Cegłów 2008, unpublished (in Polish).

Regulation of the Minister of Environmental Protection, Natural Resources and Forestry from 25 August 1992 *on detailed rules and course of recognition of forests as protected, and detailed rules of conducting forest economy in such forests*, JOL 1992, No. 67, item 523.

Regulation of the Minister of the Environment from 30 April 2013 *on waste landfills,* JOL 2013, item 523.

Siuta J., Żukowski B. (2012). Wykonanie rekultywacji gruntów w latach 1975-2009, W: Współczesne Problemy Kształtowania i Ochrony Środowiska, Monografie nr 3p, „*Wybrane problemy ochrony mokradeł*" (red) Łachacz A. Wyd. Uniwersytetu Warmińsko-Mazurskiego w Olsztynie, ISBN 978-83-933953-9-2, 132-147, (in Polish).

Studium, (2010). *Studium uwarunkowań i kierunków zagospodarowania gminy Cegłów*, załącznik nr 1 do uchwały Nr XLI/204/10 Rady Gminy Cegłów z dnia 21 października 2010r., (Study of the conditions and directions of spatial management of the Cegłów commune prepared in 2010) (in Polish).

http://ceglow.pl/aktualnosci/ii-ceglowski-rodzinny-rajd-rowerowy-c3r/, access 23.09.2015, (in Polish).

Corresponding author:
dr hab. inż. Jolanta Kwiatkowska – Malina prof. PW
e-mail: j.kwiatkowska@gik.pw.edu.pl

mgr inż. Sylwia Dybowska
e-mail: syl.dybowska@gmail.com

Warsaw University of Technology
Faculty of Geodesy and Cartography
Department of Spatial Planning and Environmental Science

Received: 07.05.2016
Accepted: 25.09.2016