

## LANDSCAPE FORMS IN THE ARCHITECTURE OF WASTE MANAGEMENT FACILITIES IN CITIES

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### ABSTRACT

Architectural objects and engineering structures which are imitating nature – in a literal or in an imaginary way – are based on patterns found in the natural landscape. In cities, artificial landscapes have become an important element of innovative ecological concepts, aiming at the restoration of urban environment. In this article, various examples of objects related to processing, recycling and storage of waste have been reviewed. Then, three types of artificiality of nature were assigned to them, namely: continuing nature, imitating nature and suggesting nature. The article examines how architects of artificial landscapes, looking for new ideas, find inspiration in real life models of nature and how they transform them, creating innovative solutions for industrial facilities in the urban environment.

**Key words:** architecture, waste, nature, industrial infrastructure, artificial landscape

### INTRODUCTION

In the history of architecture, there are numerous examples of projects and realizations imitating landscapes that are copies or artistic representations of nature. These include objects and field structures (pyramids, ziggurats, burial mounds, stupas, caves, mounds, temples), which are an interpretation of natural landscape patterns that are often the subject of spiritual symbolism of prevailing religions, beliefs or myths.

Contemporary architectural solutions illustrating nature<sup>1</sup> are the result of the evolution of civilizational development, especially technical development, and the inspiration is found in natural, landscape-like forms<sup>2</sup>.

The industrial architecture of waste treatment is in this area an important field of experiments and innovations due to the necessity to change its negative image in social perception.

Are artificial architectural landscapes a literal imitation of landscapes or are they transformed? How much nature is there in them and how much creation? These are the questions which were asked while examining the following examples.

The analysis of the issue of artificial landscape forms was based on case studies<sup>3</sup>, which were carefully selected, on the basis of the criterion of landscape artifice, according to the typology proposed by Portal (2017): as a continuation (hybridization) of the natural landscape, as imitation and as suggestion. The adopted

<sup>1</sup> It should be understood as extended nature, including elements related to human activity.

<sup>2</sup> These are usually landscape forms related to the topography of the area: mountains, caves, rivers, farmlands, etc. (Gissen, 2007).

<sup>3</sup> A case study is an examination of an object or properly selected objects in terms of selection criteria that can be supplemented during research in accordance with well-established theory.

classification, due to its lack of strict dividing criteria, gives the possibility to interpret individual cases heuristically. Such broadening of interpretation made it possible to include certain types of examples with “blurry” characteristics.

Then, according to this criterion, various examples of solutions illustrating particular types of artificial landscape forms were selected. The analysis of the solutions was carried out separately on two sets – namely on landfills and on waste treatment facilities.

The problem studied here shows the possibilities of designing waste management objects as elements of the “new nature” in the urban environment. The examined process of “inventing nature” creates new opportunities for building a new ecological city, forming a contemporary formula of the symbiosis of nature and the city.

## MODELS OF LANDSCAPE FORMS AND TYPES OF ARTIFICIAL LANDSCAPES

The term “natural landscape model” refers to the visual values of the landscape<sup>4</sup>, and its selection often results from the personal preferences of the designers<sup>5</sup>. Models can be seen as aesthetic prototypes of the landscape, or they can refer to the characteristic landscape forms, which often play a symbolic role in certain communities.

Models used by architects, as references to architectural solutions, do not differ significantly from historically shaped landscape patterns. For example the “natural mountain” model is represented by the Alpine mountain prototype<sup>6</sup> (Jakob, 2011).

Designing artificial landscape refers both to the idea of building a “second nature”<sup>7</sup> as well as to creat-

ing “artifacts”<sup>8</sup>. “Second nature” as an artificial form of landscape imitating a model, should fulfil the same functions as the natural landscape, but it should also constitute a new formal interpretation of the model (“artefact”), which will reflect the creative possibilities of the architect.

## LANDSCAPE FORMS OF LANDFILLS

The problem of transforming landfill sites is even more important due to their harmful ecological effects and their proximity to urban areas. Landfills, although located outside built-up areas, are perceived by residents as symbols of consumption and waste of modern civilization.

Landfills began to appear on a mass scale along with the demographic explosion on the outskirts of urban centres shortly after the industrial revolution. The creation of waste collection sites begins at the same time as increased urbanization. Landfills have been growing in size and number as the life cycle of consumer goods and their packaging have been growing shorter.

Contemporary landfills are subjects of revitalization. Not only does it give them a new function but it also modifies their shapes by re-creating the existing context, imitating known landscape forms or creating their artistic interpretations.

In the 1970s of the last century a new field of art was invented. It was called land art. As its material it has chosen, among others, post-industrial areas, shaping or correcting their landscape. Post-mining quarries, quarries and excavations have become the area of large-scale artistic projections. The landscape of

<sup>4</sup> Daniel and Vining (1983) distinguished five models for visual analysis of landscape quality, from objectivist to subjectivist: ecological model, aesthetic model, psychophysical model, psychological model and phenomenological model.

<sup>5</sup> The most subjectivist model is a phenomenological model. It focuses on how each person assigns personal meaning to landscape attributes in the personal interpretation of the landscape (Daniel & Vining, 1983).

<sup>6</sup> “There is probably nothing more artificial than the Alps. In urban and lowland areas things created by man are clearly visible, but the barely visible – and sometimes invisible – system of mountains has been completely modified by a man” (Jakob, 2011).

<sup>7</sup> In the concept of the “other nature”, constructing a landscape that continues or imitates nature is just as valuable, and sometimes even superior, to its original version (Geuze & Skjonsberg, 2011).

<sup>8</sup> The definition of an artifact treats the artificial landscape as “created by art and human technology, not by nature” (Bertrand & Bertrand, 2014). and is an anthropogenic action that puts a man in the role of a “demiurge” who replaces the forces of nature.

the revitalized Emscher Park area (Ruhr area) is worth mentioning here, with its art trail leading through post-mining heaps, each of which is a separate artistic event. Using the mass of waste as a flexible material in the construction of the landscape, inactive landfills in Hamburg, Cologne, Madrid, Copenhagen and other cities in the world were successfully transformed into city parks.

It remains an open question as to what extent can landfills be considered as continuing, imitating or just inspired by natural forms of landscape. Although the similarity of the geometrical form to the model and adjusting it to the context of the surrounding area constitute the basic criteria of classification, taking into account the long-term process of creating landfills and their often autonomous naturalization<sup>9</sup>, its form can be interpreted as a second nature, not differing from the natural, original one.

#### Continuation of the natural landscape

Landfill as a continuation of the landscape means maintaining the existing topography of the area and forming its new part in an artificial way, partly or completely integrated with the original landscape form.

Reclamation of the Valdemingomez site in Madrid is an example of the integration of an artificial landscape with the surrounding area. In terms of topography, it is an extension of the existing form of a hilly landscape, and in ecological terms, Valdemingomez is an example of an integrity of both an existing and man-made ecosystem, based on local species of flora (Alba, 2012). Functionally, the area has been transformed into a public space, with paths for pedestrians and bicycle lanes, where one can observe both the life of the restored nature and the city (Fig. 1).

The continuation of the topography may occur in the form of hybridization, i.e. merging a new part with the existing landscape form. This usually requires the use of advanced-topographical analysis and visualization technologies.

An example of such a continuation is the formation of the Monte Ferrino mountain slope from the waste material created during the construction of the tunnel for the Trans-Alpine high-speed train in Sigririno<sup>10</sup>. It was decided that the stone material from the tunnel would be transported to the slope of the Sotto Ceneri mountain range, raising its current height<sup>11</sup> by over 150 m. This place is a significant natural zone and is



**Fig. 1.** The Valdemingomez site: a – bird's eye view; b – situational plan (©Subliminal / de Guzman; source: [https://www.archdaily.com/795780/valdemingomez-forest-park-israel-alba-estudio?ad\\_medium=gallery](https://www.archdaily.com/795780/valdemingomez-forest-park-israel-alba-estudio?ad_medium=gallery))

<sup>9</sup> Post-industrial landscapes, after some time, begin to create forms integrally associated with the place and unique ecosystems appear.

<sup>10</sup> Sigririno is located 5 km from Lugano in the southern part of Switzerland.

<sup>11</sup> The construction of the high-speed rail tunnel will be completed in 2020.

visible from the main highway and the railway line that crosses Switzerland towards Italy<sup>12</sup>. In order to achieve steep slopes<sup>13</sup>, anthropogenic waste stream was additionally used to improve the cohesion of the slope construction: varied gradations of urban compost were mixed with gneiss waste to form a stable hill form. The new mountain was built from the original material, and as a result of computer simulations was precisely “inserted” into the existing landscape, and then covered with vegetation, paths and water collection systems. In this case, the full hybridization of the new hill and nature is only a matter of time (Fig. 2).

### Imitating the landscape

Imitating the natural landscape means copying it, with the natural landscape model being an inspiration. In Hamburg, at the Georgswerder landfill, the process of revitalization led to the formation of an artificial

mountain, which has the features of a picturesque hill and serves as a vantage point. The completed project is unique: it creates an irregular hill form<sup>14</sup>, around the top of which there is a horizontal recreational footbridge. The interference into the shape of the hill was minimal; thus it gives the impression of the imitating natural landscape form (Giro, 2013).

In addition to its recreational function, the hill is a model example of the use of its topography for renewable energy production: photovoltaic panels are located on the southern slope, wind turbines<sup>15</sup> are placed at the top of the hill, and the gas emitting from the hill is used by a nearby copper smelter (Fig. 3).

The Slovak architects from the Nice Architects studio proposed a very interesting solution in the reconstruction of a former hospital in Adelaide (Australia). They suggested the construction of an artificial mountain, using construction waste from the demolition of



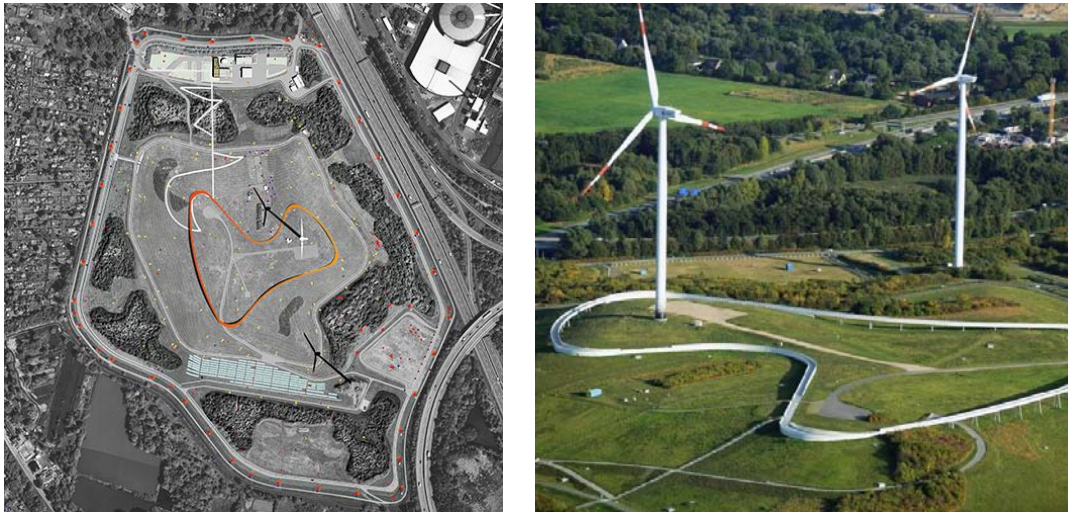
**Fig. 2.** Continuation of landscape form – artificial mountain in Sigirino (©Atelier Giro, 2013, source: <http://www.girot.ch/?project=altransit-depot-sigirino-canton-ticino>)

<sup>12</sup> Due to its sensitive location, an extremely large amount of material to be stored and the need to preserve the quality of the environment, landscape architects from the Atelier Giro studio participated in the project from the beginning of the design work, using innovative methods of design: “The works completed over the last decade on the hill in Sigirino show how the model of the three-dimensional point cloud made it possible to design an environment precisely adapted to the existing mountainous terrain” (Milligan, 2011).

<sup>13</sup> The slope is 2 : 3.

<sup>14</sup> Building rubble, municipal waste and industrial waste transported there till the end of the 1970s created a hill about 40 m high (Häfner/Jimenez Landscape Architecture, 2014).

<sup>15</sup> The wind turbines together with a solar plant on the southern slope generate electricity for 4,000 households (Häfner/Jimenez Landscape Architecture, 2014).



**Fig. 3.** An observation deck at the Georgswerder site in Hamburg (©Häfner/Jiménez, source: <http://www.landezine.com/index.php/2014/12/georgswerder-energy-hill-by-hafnerjimenez-buro-fur-landschaftsarchitektur/>)

existing buildings. An imaginary topography imitating “a natural mountain” indicates the use of digital models in generating its form<sup>16</sup>.

In this project, an artificial hill with a height of 56 m serves as a recreation centre for the city inhabitants, as

well as for the residents of neighbouring buildings. The hill is linked to the area of a nearby botanical garden and is visible from almost every place in the city, encouraging the local people to hike and admire the spectacular view from its summit (Grozdanic, 2013; Fig. 4).



**Fig. 4.** Nice Architects propose a hill built from construction rubble for Adelaide Rocks in Australia – visualization (©Nice Architects, source: <https://inhabitat.com/wp-content/blogs.dir/1/files/2013/12/Adelaide-Rocks-Nice-Architects-2.jpg>)

<sup>16</sup>Digital technology offers practically unlimited possibilities of visualization and modeling of the geographic, natural and anthropogenic environment. These technologies are also used in landscape architecture.

### Suggesting a natural landscape form

Landscape forms of modern landfills are often a suggestion of a natural mountain. Monumental forms of the mound or pyramid are used here, symbolically emphasizing the importance of the place in modern civilization.

The form of a monumental mound-cone is represented by Leppe waste landfill in Lindlar, near Cologne, which was revitalized and transformed into a park. The topography of waste accumulation here defines a surreal landscape, created as a result of reconstructed integration on the slopes of the natural ecosystem and “the artificial mountain”. The long, monumental compositional axis combines recreational areas at the base of the mountain with its peak, at a height of about 100 m, where a panoramic viewing terrace was designed, with a characteristic form symbolising a volcano crater (Metabolon – vom Ab-



**Fig. 5.** Metabolon educational park in Lindlar, near Cologne. View of the whole park (©BAV, source: [https://www.bavweb.de/media/custom/2886\\_122\\_1\\_g.JPG](https://www.bavweb.de/media/custom/2886_122_1_g.JPG))

fall zum Wertstoff, 2013). The main axis also connects spatially all the functional zones of the park: the pavilion of research and education, recreation and gas production (Fig. 5).

Northala Fields Park in London was designed in the area of a former landfill. In its construction large amounts of building rubble from investments throughout London were used<sup>17</sup>. Four conical Northala Fields hills form a creative interpretation of the landscape, suggesting a range of natural hills. The conical hills dominate over the horizon, creating a monumental landscape assumption. It is now one of the largest parks in London and artificial “land-art”<sup>18</sup> at the same time. A number of new ecological habitats have been created in this area: the dominant vegetation types are different kinds of meadows and grasslands. A forest, water and wetlands complete the ecosystem, creating habitats for fauna. The park function, along with the amphitheatre and open walking areas, is completed with children’s playgrounds, sports fields and fish ponds where you can go canoeing (Fig. 6).

The suggestion of a mountain in the form of a monumental pyramid of “trash” appears in the project Design Earth for Detroit. A landfill is an artefact whose function is to constantly remind residents of waste as a hyper-important element of social life. By placing landfills in the immediate vicinity of the urban environment, the project is a suggestion for the local residents to consciously participate in the processes of sorting, storage and recycling of waste. The authors proposed a strategy of action in which the rubbish was “transformed

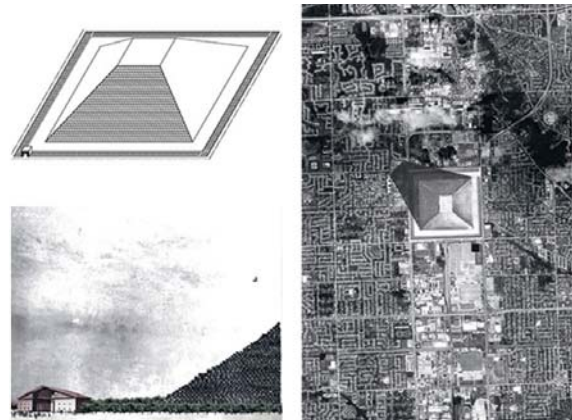
<sup>17</sup> This concerned, among others, investments such as Heathrow Terminal 5, White City and Wembley Stadium. Recycling of debris from these investments has significantly contributed to reducing the ecological footprint of London by avoiding 165,000 truck journeys to distant suburban landfills. The authors of this project are the artist Peter Fink and an architect Igor Marko from the FoRM design studio. The search for ecological solutions for storing waste that eliminates the transit of rubbish outside the city, thus limiting the production of carbon dioxide, is an element of shaping the city centre’s landscape (Marko&Placemakers, 2012).

<sup>18</sup> The authors of this project are the artist Peter Fink and architect Igor Marko from the FoRM design studio (Marko&Placemakers, 2012).



**Fig. 6.** A bird's eye view of the Northala Fields Park in London (©Marko&Placemakers, source: [http://markoandplacemakers.com/sites/default/files/styles/project-scale-635x450px/public/Northala\\_01\\_aerial%20photo\\_s.jpg?itok=9BR6cwAC](http://markoandplacemakers.com/sites/default/files/styles/project-scale-635x450px/public/Northala_01_aerial%20photo_s.jpg?itok=9BR6cwAC))

into an architectural spectacle in which all residents participate” (Ghosn & Jazairy, 2016). The project in five “scenes” shows garbage as an element of social life. Georama Trash, meaning “earth spectacle of rubbish”, creates public and spatial waste management practices (Fig. 7).

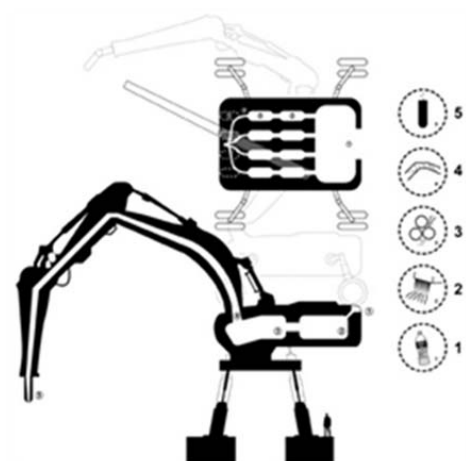


**Fig. 7.** The final part of the spectacle: a monumental pyramid of waste located directly next to the motorway (Ghosn & Jazairy, 2016)

In densely populated metropolitan areas, waste storage projects in the future assume their close integration with the urban environment in the form of skyscrapers that suggest artificial mountains. An example of this is the waste utilization project Rapid Re(f)use<sup>19</sup> in New York. Municipal waste is a construction material in this project, and robots (from the ‘family’ of waste compactors) are building the object, shaping waste into easily assembled units (Joachim, 2008; Fig. 8).



**Fig. 8.** A city with a waste-vision of New York in the future (©TerraForm One, source: [http://www.terreform.org/terreform1\\_rapid\\_refuse\\_liberty\\_web.jpg](http://www.terreform.org/terreform1_rapid_refuse_liberty_web.jpg))



<sup>19</sup> TerraForm, “Waste as resources for the city 2120”. Authors: Mitchell Joachim, Maria Aiolova, Melanie Fessel, Emily Johnson, Ian Slover, Philip Weller, Zachary Aders, Webb Allen, Niloufar Karimzadegan, Lauren Sarafan.

Closing the presentation of landfill cases as artificial landscape forms, it should be noted that cities that absorb landfills into their environment transform them into public areas. In the future it will lead us to create a new topography of a city, defined by “remnants and waste of everyday life”. According to Gissen (2011), transforming “rubble” urban areas into green areas restores them to the state from before the destructive period of industrial urbanization. Transforming municipal landfills into monumental topographic forms – “late-modern ziggurats covered with flowers” makes the inhabitants visiting these spaces “discover their own collective participation in their creation”.

### LANDSCAPE FORMS IN THE ARCHITECTURE OF WASTE RECYCLING FACILITIES

With regard to the architecture of waste processing and recycling facilities, the naturalization of forms is particularly important due to the ecological and socially active dimension of their functions in the urban environment. Architects’ activities concentrate on giving those facilities shapes that continue, imitate or suggest landscape forms. In fact, they are all a form of camouflage of the real function of the objects, an attempt to neutralize the negative emotions the residents associate with them and the lack of acceptance for the location of such facilities in the urban environment.

### Continuation

In waste processing facilities, landscape hybridization is a rare form of shaping the architecture of an industrial building, and is usually reduced to an integration of an object with the environment by means of an added, artificially formed, landscape element.

One of the many examples of the integration with the landscape context is the municipal waste sorting and recycling facility located on the outskirts of Valencia (Spain), near the airport. Its architecture and the colouring scheme of ochre and green reflect the typical fertile agricultural land of the Mediterranean climate. The geometry and divisions of the roof of the object represent the shape of the surrounding farmlands. The architecture of the sorting building is a continuation of the existing landscape, referring to the picturesque and distinctively agricultural character of the city’s peripheral areas. The roofs reproduce both the industrial process and the landscape that surrounds them. The solution is a hybrid of artificiality and nature, and at the same time establishes a close relationship between landscape and technology (Singhal, 2013; Fig. 9).

A slightly different formula of integration with the environment was used in the biomass incineration building at the Hotchkiss School campus in Salisbury (USA). The undulating roof structure is covered with vegetation in the colour of the local flora, which harmoniously blends into the surrounding landscape – almost disappearing from some vantage points (Centerbrook Architects & Planners, 2013; Fig. 10).



**Fig. 9.** Municipal waste utilization plant in Valencia – view of the topography of the plant (©Israel Alba, source: [http://www.israelalba.com/wp-content/uploads/2012/04/VALENCIA\\_WEB\\_6-975x650.jpg](http://www.israelalba.com/wp-content/uploads/2012/04/VALENCIA_WEB_6-975x650.jpg))





**Fig. 10.** The roof of the incineration building at the Hotchkiss School campus, Salisbury, USA (©O&G Industries, source: [https://www.ogind.com/sites/default/files/styles/flexslider\\_full/public/portfolio/h-biomass-primary.jpg?itok=6\\_Zy7ZIJ](https://www.ogind.com/sites/default/files/styles/flexslider_full/public/portfolio/h-biomass-primary.jpg?itok=6_Zy7ZIJ))

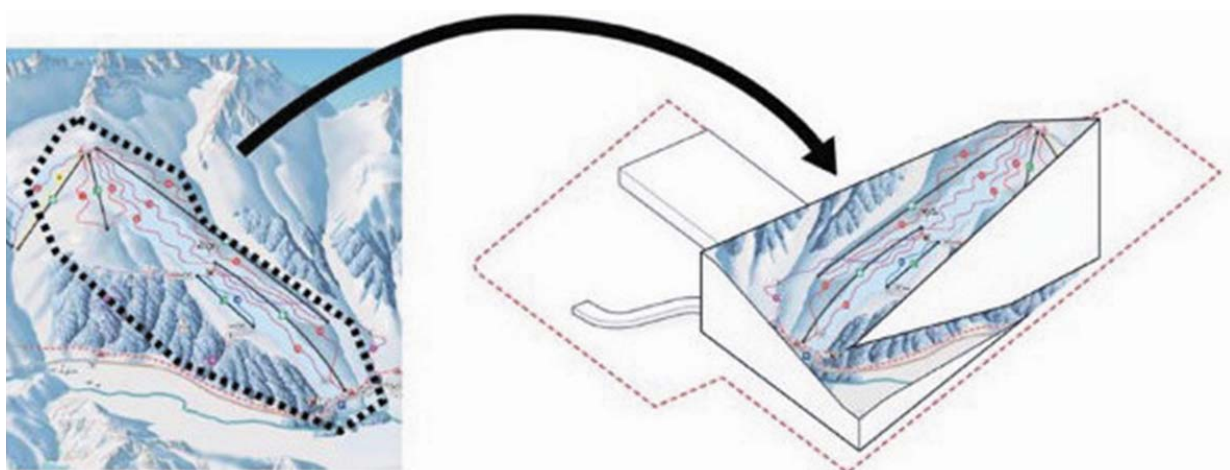
### Replication the natural landscape

The second form of architecture naturalization is replication or extraction of the existing landscape form to the urban environment. For instance, the imitation of a natural mountain occurring in waste processing facilities may be inspired by existing models in the landscape.

The ski slopes in Sweden were the inspiration for the Amager Bakke incinerator in Copenhagen. Its author, Bjarke Ingles, explains comically: “We thought, if Copenhagen doesn’t have real mountains, at least

we have mountains of trash. So why don’t we transplant one of the Swedish ski slopes and put it on top of the (trash) factory?” (Waite, 2013; Fig. 11).

The plant is kind of megaform (Frampton, 1999) – a combination of an industrial function with a recreational and sports function. Instead of a ski lift, access to the top is provided by a lift, located along the factory chimney. A viewing platform has been designed at the highest point of the building. The green façade made of prefabricated concrete elements with



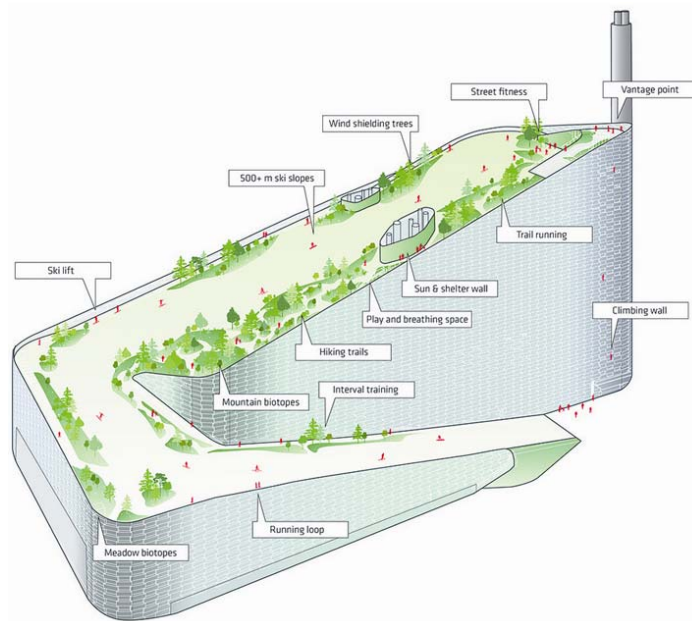
**Fig. 11.** “Transplantation” of a part of a mountain from Sweden to the Amager Bakke incinerator in Copenhagen (©BIG, source: <https://snowbrains.com/wp-content/uploads/2013/07/Amagerforbr%c3%a6ndingen-Waste-to-Energy-Plant-BIG-10.jpg>)

plant cuttings and the slope with native biotopes will look like a green hill in the future. The park, which is created at the foot of the artificial mountain, will be connected with the surrounding residential areas with a system of footpaths and cycling, providing residents with easy access to recreational areas (Figs. 12, 13).

Increasingly, in projects concerning the future of cities, ecological problems are combined with the me-

tabolism of cities – including recycling and processing of waste in vertical factories located in a compact urban development.

An example of such a solution is the future design of a waste processing plant for the capital of the Philippines, Manila. A characteristic feature of the architecture of this vertical factory are landscape forms built out of waste materials. Nature is reproduced,



**Fig. 12.** Amager Bakke incineration plant: the imitation of the mountain as an element of city naturalization (©SLA, source: [https://images.adsttc.com/media/images/5a4d/32df/f197/ccee/cd00/0019/slideshow/SLA\\_ARC\\_DIAGRAM\\_Text\\_UK.jpg?1515008723](https://images.adsttc.com/media/images/5a4d/32df/f197/ccee/cd00/0019/slideshow/SLA_ARC_DIAGRAM_Text_UK.jpg?1515008723))



**Fig 13.** Amager Bakke – realization, 2018 (photo by A. Amoretti, source: [https://images.adsttc.com/media/images/5af1/b090/f197/cc61/1900/031e/slideshow/31\\_BIG\\_ARC\\_DSC2356-2\\_Aldo\\_Amoretti.jpg?1525788809](https://images.adsttc.com/media/images/5af1/b090/f197/cc61/1900/031e/slideshow/31_BIG_ARC_DSC2356-2_Aldo_Amoretti.jpg?1525788809))

mimicked by the reconstruction of artificial rocks, caves, hills, etc. Replicas of landscapes, different on subsequent floors, are the camouflage for technological processes implemented in the recycling of waste inside the building (Fig. 14).

Another project of the municipal waste management plant in Xiamen (China) assumes the distribution of waste treatment facilities throughout the city in the form of artificial mountains (Egger, Dziedzic, Manago & Venugopal, 2012). Pre-sorted organic and non-

organic waste would be transported by underground pneumatic conveyor belts to different plants. In those processing plants, organic waste would be used to produce gas and manure, and non-organic waste would be burned to produce electricity. The factory's architecture imitates the mountain covered with greenery and is an exemplification of the thesis about a vertical, ecological, waste-free city (Fig. 15).



**Fig. 14.** A vertical recycling plant in Manila – Philippines (©Liu / Xie, source: <https://static.designboom.com/wp-content/uploads/2017/04/vertical-factories-in-megacities-tianshu-liu-linshen-xie-evolo-skyscraper-2017-designboom-818-818x600.jpg>)



**Fig. 15.** Waste management factories in Xiamen, China (©Egger / Dziedzic / Manago / Venugopal, source: <http://urban-gallery.net/tssr/wp-content/uploads/2013/05/Collage-Prototype-800x600.jpg>)

### Suggesting a natural landscape

These types of forms are increasingly popular in the ecological architecture of waste treatment facilities. Due to the size of these objects, the suggestion of a mountain or a mountain range is a commonly occurring association. The suggestion can be real or invented, but usually it is not articulated by designers, and the interpretation is left to the recipients-users of these objects.

Suggestion of the volcanic mountain has become the prototype for the Teesside biomass incineration project on the banks of the river Tees in post-industrial areas near Middlesbrough, in the north of England (Heatherwick Studio, 2010). Architects from Heatherwick Studio designed an 85-meter high object, integrated in one structure and modelled on the Augustine volcano<sup>20</sup>. The building's gentle "slopes", overgrown with vegetation, turn it into the landscape of the energy park, where residents can sunbathe or have picnics in the summer or go skiing or snowboarding in the winter (Fig. 16).

In the case of the incineration plant in Kraków<sup>21</sup>, the authors suggest the form of a range of hills, but without any reference to a specific landscape model.

In its original form, the range was supposed to be in the form of flowery hills, modelled on the colours of a folk costume<sup>22</sup>. This romantic vision of living nature has been reduced<sup>23</sup> to a multi-coloured casing made of aluminum sheet at the stage of implementation and has little to do with its ideals. The outer casing consists of segments of various heights – colourful ribbons. These segments are low at the beginning, they become higher as they approach the centre, where they reach a height of 40 m, and then they get lower again towards the end of the object (Fig. 17).

The object, in the designing phase, was meant to be smoothly connected with the surrounding area by a continuation of multi-coloured ribbons on the ground. Unfortunately, a different version was chosen in the implementation phase, and it does not support nor benefit the building's colour scheme.

In many waste incineration projects, although the authors do not specify their inspirations, references to natural landscape forms can be found. Single peaks are symbolized by such objects as the incinerator in Roskilde (Denmark) or the incinerator in Dublin (Ireland).



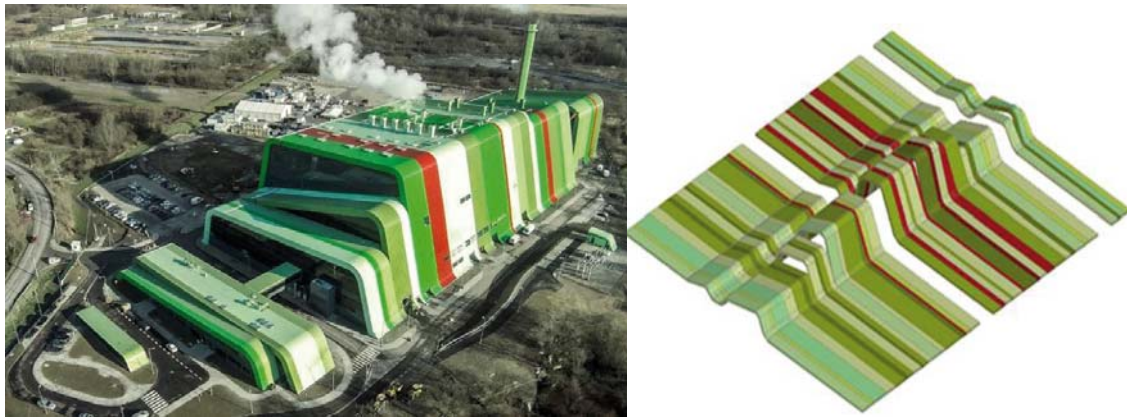
**Fig. 16.** a – Teesside power plant for biomass waste according to the Heatherwick Studio project (©Heatherwick Studio, source: <http://www.heatherwick.com/wp-content/uploads/heatherwick-Teesside-7872.jpg>); b – pattern for the Teesside power plant. Plume coming from the Augustine volcano during the eruption phase in 2005–2006 (photo by C. Read, source: <http://www.heatherwick.com/wp-content/uploads/heatherwick-Teesside-7878.jpg>)

<sup>20</sup> Augustine – strato volcano found on the island of Augustine, located in the Cook Bay on the southern coast of Alaska, 280 km southwest of Anchorage.

<sup>21</sup> The architectural competition in 2010 was won by the design studio Manufaktura Nr 1, authors: Bogusław Wowrzeczka, Michał Teller, Filip Łapiński.

<sup>22</sup> Łowicki outfit (source: <https://folklor.pl/kostiumy/stroj-lowicki>).

<sup>23</sup> In the competition concept, the vegetation was to create new biotopes and use the technological heat of the incinerator.



**Fig. 17.** Realized in 2017 waste incineration plant in Kraków and schematic diagram of the formation of the “landscape” around the object (©Wowrzeczka / Teller / Łapiński)

The Roskilde incinerator<sup>24</sup> uses the latest and most effective techniques for thermal waste treatment. The object, embedded into the flat landscape of the surroundings, close to the centre, is now the dominant feature of the city. Its form is interpreted differently<sup>25</sup>. In the building, which is almost 100-meter high, you

can find a similarity to the icon of the Swiss Alps – the Matterhorn peak (Fig. 18).

The waste incineration plant on the Poolbak<sup>26</sup> peninsula in Dublin represents a descending hill (Rudden, 2015). The new incinerator is a characteristic unit in an industrial landscape with a facade that slopes



**Fig. 18.** a – Biomass incinerator in Roskilde, Denmark (photo by E. van Egeraat, source: <https://bustler.net/news/tags/incineration/8660/1790/erick-van-egeraat-builds-the-new-roskilde-incineration-line>); b – Matterhorn, Alps, altitude 4,478 m (photo by E. Bossi, source: [https://en.wikipedia.org/wiki/File:3818\\_-\\_Riffelberg\\_-\\_Matterhorn\\_viewed\\_from\\_Gornergratbahn.JPG](https://en.wikipedia.org/wiki/File:3818_-_Riffelberg_-_Matterhorn_viewed_from_Gornergratbahn.JPG))

<sup>24</sup> The author of the incineration plant is the Dutch architect Erick van Egeraat.

<sup>25</sup> Author Erick van Egeraat compares the object, because of its atmosphere, to a medieval cathedral, and the technological process to a lighthouse, which symbolizes the light of life. The medieval cathedral also symbolizes the mountain.

<sup>26</sup> The authors of the project are FRIIS & MOLTKE Architects.



**Fig. 19.** Poolbak incineration plant in Dublin – an example of a “hill descending” (photo by W.M. Nixon, source: [https://afloat.ie/media/k2/items/cache/a7d49f441957082b463b45b031d656fe\\_L.jpg](https://afloat.ie/media/k2/items/cache/a7d49f441957082b463b45b031d656fe_L.jpg))

inwards at an angle of 13°. The building, 52-meter high, consists of two pyramids truncated connected with a ramp, thus creating a continuous form suggesting ziggurat – the historical symbol of the mountain (Fig. 19).

The examples of landscape architecture of recycling and transforming facilities discussed above indicate that continuing, imitating and transforming nature builds a new landscape of the city and may be an alternative to the extensive nature of the urban environment.

## SUMMARY

Contemporary urban theories focus on the complex problem of sustainable functioning of a city. One of the most important elements is a harmonious landscape, in which its natural and anthropogenic elements are well balanced.

The landscape architecture of waste collection and processing facilities is part of the process of nature

reconstruction in contemporary cities. Their artificial topographies are important, and due to the scale, often the dominant elements of the city landscape.

The architecture of these objects is a kind of landscape “camouflage”<sup>27</sup> (Grudziecki & Buachoom, 2016), aimed at changing the perception of objects which arouse anxiety, which are perceived as threatening to the ecosystem or even as part of the “sub-nature”<sup>28</sup>.

At the same time, they exemplify the connection between the city and nature – the metabolism hidden inside them is the basic paradigm of a modern ecological city – a city without waste. Architectural studies of the use of artificial nature in these facilities indicate that there is a large variety of creating forms based on landscape models, both in relation to landfills and to waste treatment plants. For obvious reasons, nature hybridization is rare and difficult to implement due to the anthropological nature of the city landscape. Taking into account the advantages resulting from the city’s restoration process: aesthetic, ecological and social,

<sup>27</sup> As the name says, the purpose of this method is to disguise and blend new structures into the surrounding landscape, due to visual and/or practical aspects (Grudziecki & Buachoom, 2016).

<sup>28</sup> Subnature the undesirable by-products of urbanization, industrialization, war, abandonment, and societal collapse. Subnature includes things such as smog, dust, exhaust gas, industrial smoke, sewage, debris, rubble, vermin, and weeds (source: <https://en.wikipedia.org/wiki/Subnature>).

the solution most suited to their achievement is imitation, reproduction of the natural form. Unfortunately, due to technological and economic reasons such solutions are more common in futuristic projects<sup>29</sup> than in realizations. Nevertheless, design experiments in this area show that there is the possibility of renewing the symbiosis between the city and the nature in the form of artificial landscape forms with all the attributes of nature. The most commonly used solution referring to nature is its suggestion in the geometric form corresponding to the natural model. This solution, which is usually interesting for formal reasons, does not do much as far as the problem of restoration of the city is concerned.

## REFERENCES

- Alba, I. (2012). *Valencia waste treatment plant*. Retrieved from: <http://www.israelalba.com/en/proyectos/proyecto/planta-de-residuos-de-valencia/> [accessed 11.11.2018].
- Bertrand, C. & Bertrand, G. (2014). La nature-artefact: entre anthropisation et artialisement, l'expérience du système GTP (Géosystème-Territoire-Paysage). *L'Information géographique*, 78 (3), 10–25.
- Centerbrook Architects & Planners (2013). Hotchkiss Biomass Power Plant. *ArchDaily*, 6 March. Retrieved from: <https://www.archdaily.com/340641/hotchkiss-biomass-power-plant-centerbrook-architects-and-planners> [accessed 07.11.2018].
- Daniel, T. C. & Vining, J. (1983). Methodological issues in the assessment of landscape quality. In I. Altman, J. F. Wohwill (eds.), *Behaviour and the Natural Environment* (pp. 39–83). New York NY: Plenum Press.
- Egger, T., Dziedzic, Z., Manago, L. & Venugopal, S. (2012). *Underground waste management*. Retrieved from: [http://urban-gallery.net/tssr/?page\\_id=1692](http://urban-gallery.net/tssr/?page_id=1692) [accessed 10.11.2018].
- Frampton, K. (1999). *Megaform As Urban Landscape*. Michigan: University of Michigan.
- Geuze, A. & Skjonsberg, M. (2011). Second Nature: New territories for the exiled. In Ch. Waldheim, J. Czerniak, Y.-H. Hung, G. Aquino, A. Robinson (eds.), *The infrastructure research initiative at SWA. Landscape infrastructure: case studies by SWA* (pp. 24–29). Basel: Birkhäuser.
- Ghosn, R. & Jazairy, E. H. (2016). Georama of Trash. *ARQ (Santiago)*, 93. doi: 10.4067/S0717-69962016000200012
- Giroto, Ch. (2013). The Elegance of Topology. In Ch. Giroto, A. Freytag, A. Kirchengast, D. Richter (eds.), *Landscape. 3. Topology. Topical Thoughts on the Contemporary Landscape* (pp. 79–115). Berlin: Jovis.
- Gissen, D. (2007). *Anxious Climate: Architecture At The Edge Of Environment*. Maryland: Maryland Institute College of Art. Retrieved from: [https://htcexperiments.files.wordpress.com/2009/01/gissen\\_anxious-climate.pdf](https://htcexperiments.files.wordpress.com/2009/01/gissen_anxious-climate.pdf) [accessed 20.11.2018].
- Gissen, D. (2011). The Architectural Reconstruction of Nature. In S. Allen, M. McQuade (eds.), *Landform Building: Architecture's New Terrain* (pp. 456–465). Princeton: Lars Müller Publishers, Princeton University School of Architecture.
- Grozdanic, L. (2013). Nice Architects Propose a Hill Built from Construction Rubble for Adelaide Rocks in Australia. *Inhabitat*, 23 December. Retrieved from: <https://inhabitat.com/nice-architects-propose-a-hill-built-from-construction-rubble-for-adelaide-rocks-in-australia/> [accessed 08.09.2018].
- Grudziecki, J. & Buachoom, P. (2016). *The Landscape Architect's Guide to the World of Solid Waste* (degree project). Alnarp: University of Agricultural Sciences.
- Häfner/Jimenez Landscape Architecture (2014). *Georgswerder Energy Hill*. Retrieved from: <http://www.landezine.com/index.php/2014/12/georgswerder-energy-hill-by-hafnerjimenez-buro-fur-landschaftsarchitektur/> [accessed 10.11.2018].
- Heatherwick Studio (2010). *Innovative design for a new age in power*. Retrieved from: <https://archello.com/project/teesside-power-station> [accessed 10.11.2018].
- Jakob, M. (2011). On mountains: Scalable and Unscalable. In S. Allen, M. McQuade (eds.), *Land-form Building: architecture's new terrain* (pp. 136–164). Princeton: Princetown University School; Baden: Lars Müller.
- Joachim, M. (2008). *Rapid re(f)use: waste to resource city, 2120*. Retrieved from: <https://archinode.blogspot.com/2008/11/rapid-refuse-new-project-at-terreform-1.html> [accessed 23.10.2018].
- Milligan, B. (2011). *Decade Hillside: The Sigirino Depot Free Association Design*. Retrieved from: <https://free-associationdesign.wordpress.com/2011/06/06/decade-hillside-the-sigirino-depot/> [accessed 10.10.2018].

<sup>29</sup> Third Natures' presents the work and ideas of Spanish architects Cristina Diaz Moreno and Efrén Garcia Grinda and their Madrid-based studio AMID.cero9 (Moreno & Grinda, 2014).

- Marko&Placemakers (2012). Northala Fields Park, London, UK, Retrieved from: <http://markoandplacemakers.com/projects/northala-fields-park-london-uk> [accessed 17.11.2018].
- Metabolon – vom Abfall zum Wertstoff (2013). Retrieved from: <https://www.regionale2010.de/projekte/projekt/ressourcen-landschaften-fuer-die-region/metabolon/index.html> [accessed 20.11.2018].
- Moreno, D. C. & Grinda, G. E. (2014). *Third natures: a microtopia*. London: Architectural Association.
- Portal, C. (2017). La montagne artificielle: une nouvelle forme artialisée de la nature? [The Artificial Mountain: a New Form of “Artialization” of Nature?]. *Revue de géographie alpine*, 105 (2). doi: 10.4000/rga.3672
- Rudden, P. J. (2015). *Waste strategy: last element takes shape with waste to energy plant finally under construction*. Retrieved from: <http://www.engineersjournal.ie/2015/06/16/waste-strategy-poolbeg/> [accessed 15.10.2018].
- Singhal, S. (2013). *Waste treatment plant in Valencia, Spain by Israel Alba*. Retrieved from: <https://www10.aecafe.com/blogs/arch-showcase/2013/12/08/waste-treatment-plant-in-valencia-spain-by-israel-alba/> [accessed 10.11.2018].
- Waite, B. (2013). *Brain Post: Denmark Power-plant Houses Man-made Ski Resort on Roof*. Retrieved from: <https://snowbrains.com/man-made-ski-resort-on-waste-energy-plant-in-denmark/> [accessed 10.10.2018].

## FORMY KRAJOBRAZOWE W ARCHITEKTURZE OBIEKTÓW GOSPODARKI ODPADAMI W MIASTACH

### STRESZCZENIE

Obiekty architektoniczne i budowle inżynierskie naśladowujące w sposób rzeczywisty lub wyobrażony naturę opierają się na wzorcach spotykanych w naturalnym krajobrazie. W miastach sztuczne krajobrazy stały się istotnym elementem innowacyjnych koncepcji ekologicznych zmierzających do renaturyzacji środowiska miejskiego. Dokonano przeglądu przykładów architektury obiektów związanych z przetwarzaniem, recyklingiem i ze składowaniem odpadów oraz zaklasyfikowano je do trzech typów sztuczności natury, które reprezentują: kontynuujący naturę, naśladowujący naturę i sugerujący naturę. W artykule przedstawiono badanie, w jaki sposób architekci sztucznych krajobrazów poszukując nowych rozwiązań, inspirowani są rzeczywistymi modelami natury oraz w jaki sposób je przekształcają, tworząc innowacyjne rozwiązania obiektów przemysłowych w środowisku miejskim.

**Słowa kluczowe:** architektura, odpady, natura, infrastruktura przemysłowa, sztuczny krajobraz