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in copertina
The landscape of waste.

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Editorial
Less Waste and Waste Towards Landscape: Needs and Opportunities

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facing page
Gasometro, Roma 2007. (Photo A. Scippa).

In scientific research it is normal to investigate a specific question also by empirical way. It assumes different connotations according to the field in which it is experienced. However, design research assumes as common denominator of its various expressions the fact that it is not possible to perform experiments. This is due to substantial reasons and involves more than one significant condition. It is not possible to isolate the experiment from the reality in which it is performed, nor to avoid the effects on it, which are also substantial of the indicative capacity of the experience. The places of the project and the landscape to which they belong to constitute the only practicable laboratory. It is then not possible to replicate the experiment a number of times and in ways suitable for obtaining statistical evaluations. In fact, the space-time uniqueness of the 'laboratory' does not allow it, and before them, the execution times and costs. Finally, it is not possible to perform the experiment through models of reality. They are necessarily partial, thematic, however complex and sensitive. Therefore, the models do not allow complete simulations of the structures, the operations and the dynamics of the landscapes and the systems that compose and connote them. However, these same variables are fundamental for the design synthesis, which cannot avoid the joint consideration. In design research, the experiment and experience coincide as the laboratory with reality, with its peculiar identity of place, landscape and population.

In order to focus on an argument empirically, it is necessary to find the availability of a numerically significant set of 'experiments' performed or experiences made, becoming part of the change of a place, a landscape, a population. The availability of experience data allows studying a theme through the multiple perspective of the conceived, developed and implemented design solutions to address their generalities, necessarily entering into relation with the specifics. This is the case of the number we publish, in which a question is precisely investigated through a set of projects, in more cases realized, which have faced it in many specific problems. Focusing on a topic in the form of a magazine requires that you dedicate at least one volume to it, which for the thematic profile of these articles configures a special number. In this case, the unique prove-

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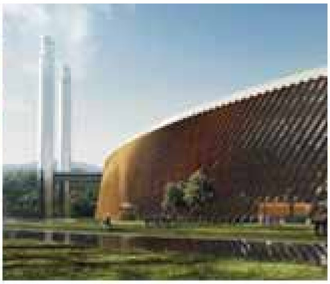
nance of the contributions from a technical conference also determined a further feature that requires a special contextualization for a scientific journal. Some articles deal with technical and technological aspects directly related to specific applications, thus not assuming the typical forms and contents of scientific publishing. They return significant information to research as also practical applications to trigger possible theoretical setups.

The contemporary interpretation of the relationship between waste and habitat is the theme of this special issue. The subject is increasingly treated, not only in the technical and technological terms of environmental engineering. What do we do with the waste that must be stored anyway, even considering efficient processes for the selection and recycling of waste generated by production and consumption? The latter processes are still under way, but still far from reaching optimal dissemination, efficiency and effectiveness requirements. What do we do with everything we abandon, after a more or less intelligent use, and we cannot return to the production cycle under any useful form, being it 'matter' or 'energy'?

Ultimately, do we have to let waste to occupy areas to be considered completely reserved for the sole purpose of their storage for hygiene and environmental protection, precluding any other use and any other function of the spaces involved in the landscape of which they are part? It is evident that the waste storage and treatment sites have their own functioning and management. However, this does not mean that ecological and sociological processes are excluded from the transformation of these spaces, once their load capacities are exhausted, as with specific conditioning, even during the cultivation stages. Many experiences are increasingly demonstrating the potentials of integrated approaches that look beyond sectoral needs. Some cases emerge on the international scene due to the particular effectiveness and the demonstrative meaning that they express in the evolution of the sites towards stages of environmental and visual regeneration and identification and social colonization. There are experiences like those of Barcelona, with the Vall d'en Joan, in the El Garraf massif; of New York, with the Fresh Kills Park; the one of Tel Aviv metropolitan area, for which we invited Tilman Latz to explain us the project of the conversion of Hiriya landfill. These are convincing demonstrations of the possibility of changing the more thrust marginality into precious centrality, of how and how much the landscape can develop a vital layer on what has been rejected and accumulated. However, it is not only the striking cases known to be significant. It is essential to study the problem also

in its most common expressions, in the smaller dimensions of the sites, as well as the available financial resources and, last but not least, in the different cultures expressed by the territories in the landscapes and in the populations.
The International Waste Working Group (IWWG) has a well-established organization of the Sardinia Symposium, a two-year international initiative on waste management and storage. The Arcoplan studio in Padua is responsible for the Waste Architecture section of the symposium. We publish some works proposed by them based on a selection of what was discussed in the editions of 2015 and 2017. The colleagues who introduce this number on the following pages accompany us in the history and structure of this articulated international initiative that constitutes a reference point for researchers, technicians and managers.

Florence, June 2018

WA
WASTE ARCHITECTURE
PLATFORM

Introduction
Reversing the waste paradigm
Waste Architecture Platform and beyond

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facing page
WA sessions at Sardinia 2017 were coordinated by Studio Arcoplan

Speaking about waste management, nowadays there is a need for a global plan to link the different features of the land and drive the correct siting of plants in order to transform them into public spaces. From a lack of use of the areas improperly used in the past for disposal, it has now evolved into a process that generates new applications to use these spaces.

Indeed, the planning and design stage of the management and development of waste disposal plants may comprise a sort of landscape design focussed on integrating the site into the surrounding urban area (area of public interest and use) rather than representing the result of an emergency. The need to integrate waste disposal systems into an environmental planning strategy connected to the landscape, to urban and extra-urban spaces requires an integrated planning activity and a multidisciplinary approach.

From this perspective, the technical aspects, once exclusive domain of environmental engineering, nowadays give rise to an interesting synergy with architecture.

Today, architects play a minor role in the design of industrial and infrastructural projects. In the specific context of Waste Management, in common practice (exception made for a few cases) architects remain conspicuously absent from the conception, design, and implementation of major related works (waste-to-energy facilities, landfills, treatment plants, systems for the collection of waste in the cities, etc.).

Waste Architecture is a new and relatively unexplored conceptual and design topic, which aims to trigger a lively debate between environmental and architecture/urban design professionals.

One of the fundamentals of Waste Architecture is that «it is possible to use the most advanced waste management processes to promote interdisciplinary cooperation in which the architectural, structural and thermodynamic aspects, suitably combined, would generate urban units with new political and social contents» (Kara et al., 2017).

Waste Architecture Platform was created in 2015 with the specific aim of exploring the unexpressed role of architecture for the proper evolution of these projects, from the planning stage to the full realization. Waste Architecture Platform is a complex pro-

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ject conceived as a container of initiatives devoted to environmental architecture in connection with interventions relating to the collection, disposal and management of waste. It was conceived by Studio Arcoplan with the aim of developing a new and relatively unexplored conceptual and design topic, by means of a series of initiatives involving environmental professionals, architects and experts from waste related disciplines in the framework of seminars, round tables, design workshops, publications, etc.
The International Workshop on Waste Architecture represented the first of a series of thematic seminars on environmental design and interventions focussing on waste collection, disposal and management. This first appointment, held at Forte Village Resort on October 6th-7th 2015, was focused mainly on the architectural, functional and landscape rehabilitation of old landfills.
The workshop was organised as a parallel event of Sardinia 2015 / 15th International Waste Management and Landfill Symposium, a world-renowned event registering the attendance of approximately 800 experts from all over the world. The International Sardinia Symposia were established in 1987 to make ideas and experiences in the rapidly developing field of waste management and landfilling readily available to professional communities worldwide. Since then the symposia have rapidly become the international reference forum where every two years planners, operators, public officials and scientists present their relevant experiences and discuss new concepts and technologies of waste management.
Arcoplan coordinated the International Workshop with the scientific support of the Department of Architecture, Design and Planning / University of Sassari and the Department of Industrial Engineering / University of Padua.
The purpose of the Workshop was to stimulate a debate on the requalification of landfills and analyse all related aspects, including architectural/landscape quality, compatibility with site reclamation and state-of-the-art, encouraging a comparison between the situation in Italy and the rest of the world.
The workshop lasted 2 days, with the first day consisting in the presentation of oral contributions in thematic sessions to be followed by opportunities for discussion and debate. On the second day, professionals in the field organized and coordinated a practical landscape design lab. The two days of intense work and networking with different professionals revealed how existing modern landfills can represent an opportunity to provide new spaces for the community and thus yield a benefit. With this prerogative, it would be of particular interest to

study during the design stage, potential functional uses for not only existing landfills, but also specifically landfills that have yet to be developed, applying an approach that takes into account from the outset the future use of the plant from a technical and economical viewpoint.
Following the interesting experience of the International Workshop on Waste Architecture, in 2017 Waste Architecture was included in the main programme of Sardinia 2017 / 16th International Waste Management and Landfill Symposium. The purpose of the oral sessions dedicated to Waste Architecture was to stimulate a debate on architecture for the environment and, more specifically, the architecture of major works related to waste management.
In this international context, the thematic sessions provided the setting for in-depth discussion on this specific topic, aimed at not only environmental professionals, but also experts in architecture, landscape planning and design, and town planning, represented an opportunity to make contact with the world-leading experts in the field. Several interesting talks focused on the potential contribution of architecture and design in promoting an enhanced integration into the local context of the structures needed to obtain energy from waste (incinerators) and addressed the multiple aspects linked to their potential reuse in the future.

References

Cossu R., Comitato Tecnico Discariche (CTD), 1997. *Linee Guida per le discariche controllate di rifiuti solidi urbani*, CISA-Centro di Ingegneria Sanitaria Ambientale, Cagliari.
Kara H., Asensio Villoria, L., Georgoulias A., 2017. *Architecture and Waste. A (Re)Planned Obsolescence*. Actar, Barcelona, New York.

Developing associative models to guide typological strategies for better integrating Waste to Energy plants in an urban context

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Abstract

Despite many advantages may be offered including architectural expertise in the design and delivery of industrial buildings and power plants, in recent times it has generally been excluded from this process, probably because of the lack of clearly defined roles for architecture to play in the formulation of these, typically complex and technical, buildings. As population densities increase, growing numbers of Waste-to-Energy (WtE) plants may be needed to cope with mounting volumes of waste, particularly in urban areas. The two-year investigation on WtE by the Harvard University's Graduate School of Design: "Architecture and Waste: A(Re)Planned Obsolescence" (2017), offers guidelines and tools allowing designers, the public and other major stakeholders to reconsider the role of architecture in the design of industrial facilities and demonstrate that architects' contributions can be crucial to integrating WtE plants within their context and counteracting negative public perceptions of such facilities. This paper provides a detailed account of the development and application of these design tools to waste to energy architectural projects.

Keywords

Waste to Energy, Industrial Typology, Associative Modelling, Parametric Design

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Introduction

The design research project described in this paper was part of a larger funded research initiative conducted through the collaborative efforts of faculty and researchers from the Harvard Graduate School of Design. The specific research project covered by this paper was carried out by the GSD Waste to Energy Design Lab operating under the overall aegis of WtE Design Lab between 2014 and 2017 and was led by the authors of this paper.

The Waste to Energy Design Lab (WtE Design Lab) was tasked with a general mandate to identify the roles that Architecture may play in the design of waste to energy facilities as well as explore the tools and processes that may be developed to support this process. The Design Research was sponsored by Tyrens Trust.

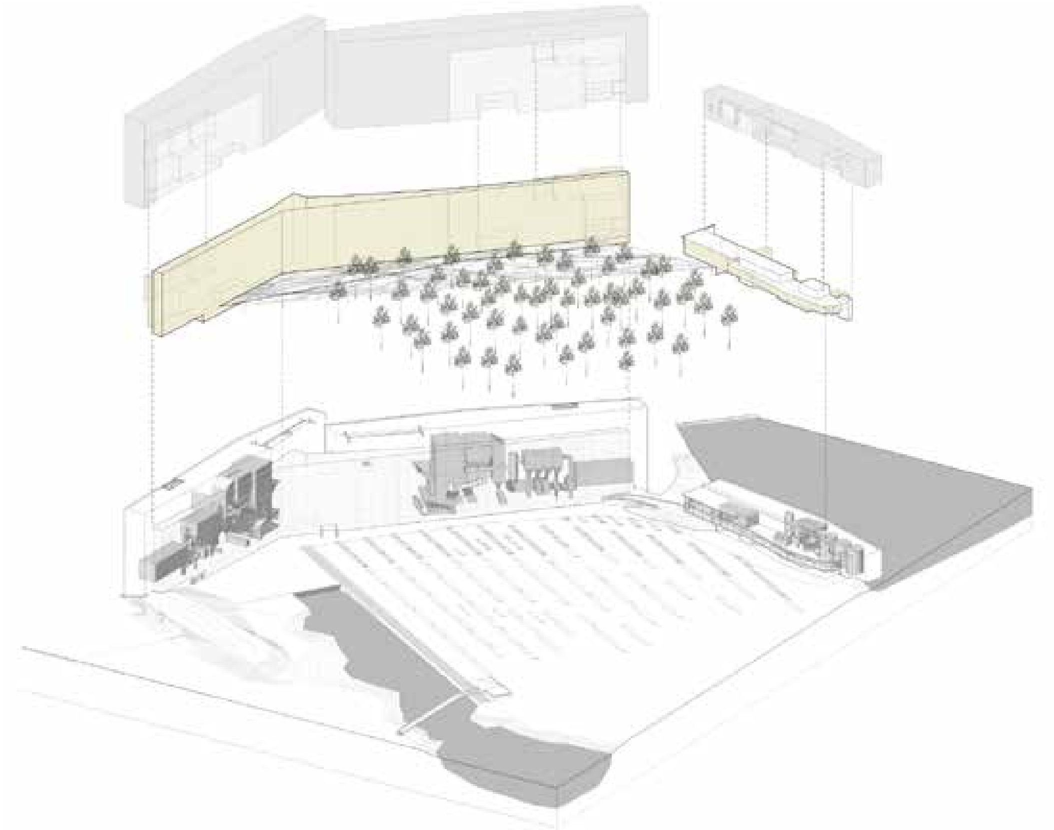
In the last decade despite the emergence of transformational infrastructural and industrial projects borne out of economic and ecological challenges, the role of the designer and specifically the architect remains minor or non-existent in this field. This is in part due to the fact that there is the perception of a lack of a clearly-defined roles that architects can play in the process as it has come to be perceived solely through technical and engineering concerns.

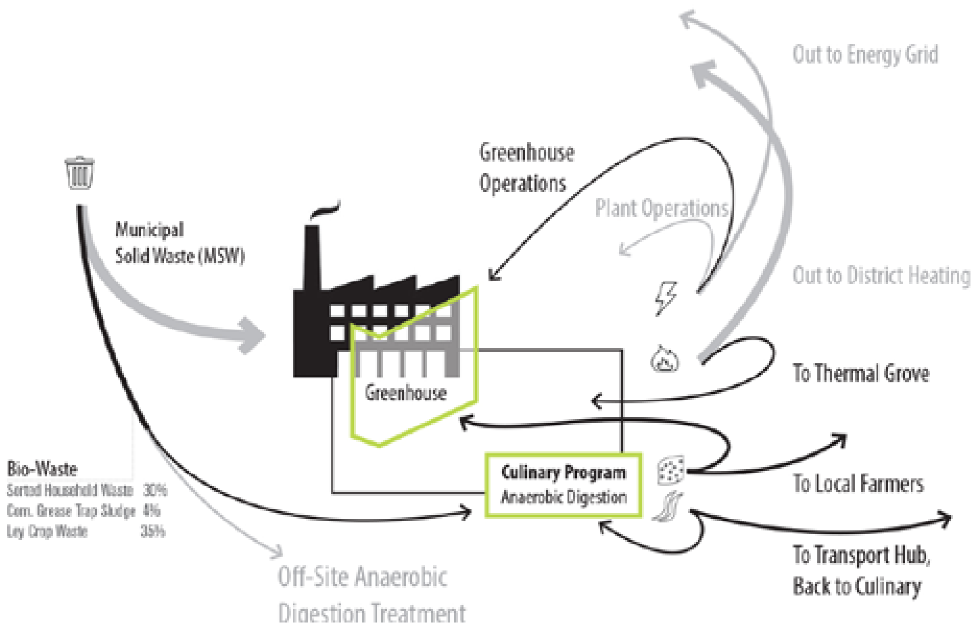
However, the projected increase in the construction of industrial buildings within urban and peri-urban contexts to facilitate the transformation of energy infrastructures towards clean energy practices (such as waste to energy plants) in countries like Sweden, present an opportunity for the engagement of architects (Kara et al., 2017).

One of the pressing needs surrounding this trend is the development of design strategies that allow for sensitively integrating these facilities closer to urban areas, which are its fuel source. To keep transportation costs to a sustainable level, WtE plants would be better placed closer to urban centers. A reduction in traffic associated with the operations of these facilities and a corresponding decrease in pollution are likely benefits for such an urban siting strategy. (Fig.1)

The skillset as well as the disciplinary and professional remit of the architect, makes them well placed as key agents in addressing how these often-large buildings may be integrated both physically and programmatically within urban or suburban contexts in an appropriate manner as well as addressing how the generally negative perception of industrial buildings may be addressed through design.

This research sought to develop design strategies and tools, which allow architects to envision and test the technical feasibility of different plant configurations that allow for a variety of plant sizes to coexist with residential or other programs in an ur-




Out to Energy Grid
Greenhouse Operations
Plant Operations
Municipal Solid Waste (MSW)
Out to District Heating
To Thermal Grove
Greenhouse
Bio-Waste
Sorted Household Waste 30%
Com. Grease Trap Sludge 4%
Ley Crop Waste 35%
Culinary Program
Anaerobic Digestion
To Local Farmers
To Transport Hub, Back to Culinary
Off-Site Anaerobic Digestion Treatment

opposite page
Fig. 1 – Large-scale integration strategy by Laura Smead and Felipe Oropeza Jr, WtE Design Lab.
Fig. 2 – Thermal Grove, project developed by Michael Clapp and Mike Jonhson at Harvard University, Graduate School of Design under the supervision of Hanif Kara and Leire Asensio Villoria.

ban context, thus potentially strengthening the case for WtE plants in denser areas.

Through our research and survey of existing projects at the WtE Design Lab, we found that in the rare occasions when an architect is involved in these types of projects, their role can often be reduced to the scope of designing the envelope and they are rarely involved with the interior organization of these plants. We believe that this is partially due to a lack of tools and design handbooks/literature that allows architects to engage with the technical complexity of the equipment associated with these buildings.

While several parallel lines of inquiry were pursued within the WtE Design Lab, this paper will specifically cover the lab's development of associative digital models that are intended to operate as design aids and tools for designers in the elaboration of waste to energy facilities.

The development of associative models[1] for use in parametric or associative design can help to alleviate this technical hurdle for architects, particularly in the earlier stages of the design process. The tool has the potential to allow architects to generate other building configurations that allow these facilities to be better integrated within existing urban or suburban fabrics while still accounting for technical feasibility.

Associative modelling and design are a maturing area of exploration in architecture and are being adopted widely by the professional field. These tools and processes are often used to support the design of technically complex building types such as high rises or are also used to reverse engineer complex forms for buildability. However, there are no known precedents of associative models developed specifically for the architectural design of waste to energy facilities and the development of the first example of such tools by the WtE lab is the subject of this paper.

The aims of this paper are to provide an account of how this novel associative modelling tool for the design of waste to energy facilities was developed. The paper outlines the considerations, methods and aims for the tool as well as reflections on its efficacy in application.

The research process included opportunities to track and evaluate the application of the tool in a few actual design processes. The paper will describe these exercises and reflect on as well as evaluate actual practical applicability of these tools. Reflections on the applicability of the associative models will be framed by considerations on how seamlessly the integration of the tool in the design process was, how it functioned as a tool for collaboration with other parties involved in the design process (such as engi-

Fig. 3-4 – Thermal Grove, project developed by Michael Clapp and Mike Jonhson at Harvard University, Graduate School of Design under the supervision of Hanif Kara and Leire Asensio Villoria.

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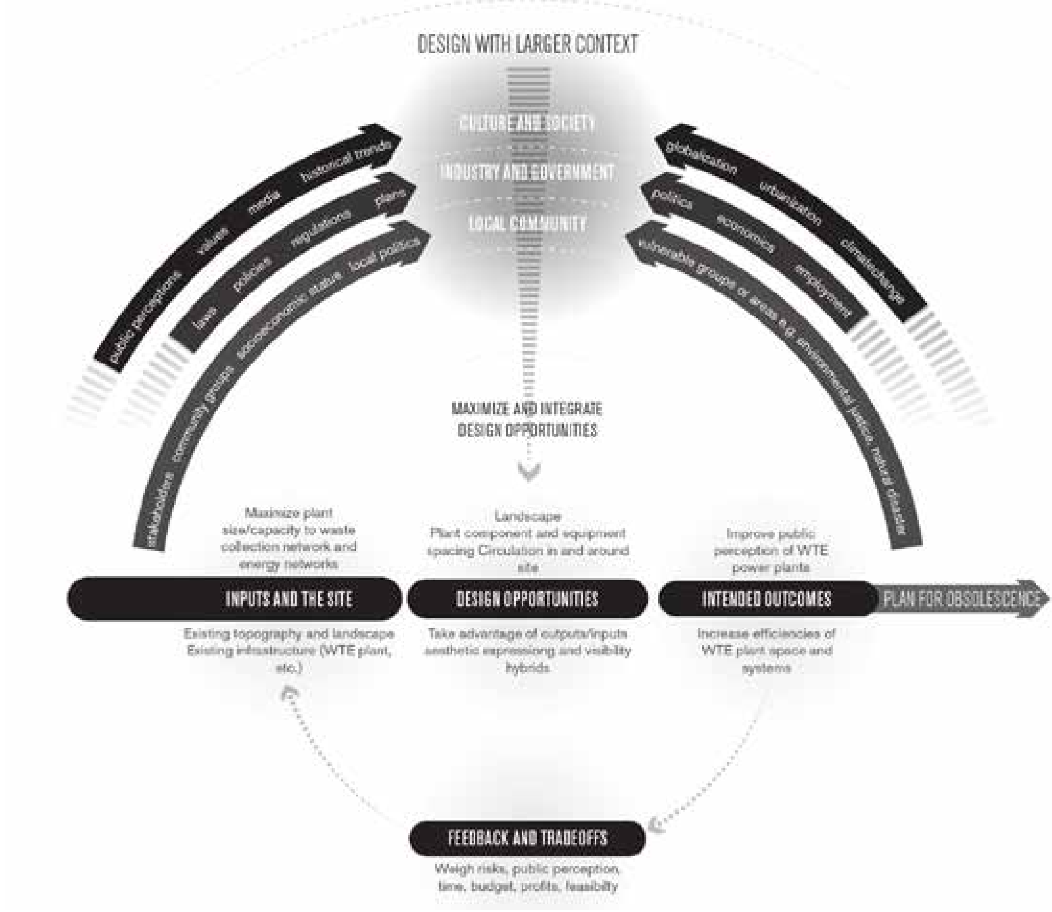
Fig. 5 – Waste, Reuse, and the PARKspace, project developed by Felipe Oropeza Jr. at Harvard University, Graduate School of Design under the supervision of Hanif Kara and Leire Asensio Villoria.



neers) and its capacity to allow for the development of schematic designs of novel WtE facility configurations while allowing for real-time checks for technical feasibility and its effects on wider urban systems as well as contexts.

Method and Materials

In this paper, we will place specific emphasis on the methods that we developed for integrating data and parameters associated with WtE facilities into a computational architectural and urban design generation as well as evaluation process. More specifically, this culminated in the development of associative design models that link digital spatial models to parameters and limits that define the operational integrity of WtE facilities as well as the capacity for real-time evaluation of the measurable performance and potential transgression of these technical limits of different design instantiations.

This project focused on decoding the crucial operations and internal organization of these types of plants as well as siting considerations. One consideration adopted by the team involved the generation of a manual/handbook that indexes each of the components that form these plants. The WtE Design Lab developed both an inventory of the different components that form these plants, specifying their spatial requirements (dimensions, distance to other components, accessibility and maintenance needs, etc.) describing their function as well as dimensional and spatial constraints. These constraints were integrated into a spatial 3D digital model as modeling limits that would allow architects to test a variety of organizations while checking for technical performance in real time. A second equally important consideration was the generation of a tool that would allow to test the viability of different scenarios for locating such facilities in different sites (with their associated constraints) also in real-time.

A parametric framework for design and analysis was generated by integrating information from the inputs and outputs required and generated by these plants as well as the technical handbook that describes the dimensional and spatial constraints of each of the plant's components[2].

The WtE Design Lab developed two associative models to help designers test various options to better integrate a WtE plant in a given context. These tools were tested in a series of sites with a varying set of conditions and constraints, allowing us to assess the effectiveness of the proposed tools, offering insights and findings on their applicability and the extent of support it offers designers in devising design proposals for specific WtE buildings.

Within the WtE lab's design research team, a series of design explorations were conducted by using the associative models to test the implementation of WtE plants in a series of urban and rural contexts, each of them with their specific population densities, urban fabric and thus varying typical urban block sizes. The sites used for this test were Barcelona, Beijing, New York, Boston, Stockholm, Phoenix and Preston, CT.

A second and third test was conducted in the context of an upper level graduate design studio as well as a graduate seminar course offered at the Harvard GSD where the associative models as well as a range of design strategies were handed to a group of students to aid them in the development of WtE schemes that responded to a number of contexts, two sites in the US, Preston and Bridgeport in CT, and two sites in Sweden, Vasteras and Hogdalen District in Stockholm.

The associative models account for a range of plant sizes as well as populations densities. The waste collection catchment area, strength of the energy network and the diversity of waste delivery transportation (such as road, train, boat, or ENVAC systems) are greatly impacted by the size and density of the surrounding communities. These metrics of communities are also a major consideration for which plant size (physical footprint) and capacity will work best.

The associative model developed in the lab accounts both for the district-heating output displaying the area that would be served by the plant given the urban density and programmatic distribution as well as for the possibility of compensating with a large energy-intensive program some of them already coded in the model.

Because WtE facilities are much more effective at generating heat than electricity, combined heat and power (CHP) plants are considered the more efficient and less polluting model rather than electricity producing boilers alone. In contexts where district-heating networks are available, WtE facilities are more cost-effective and efficient sources of energy.

When comparing two of the primary sites of study adopted for this design research; Sweden and the United States, district-heating networks are found to be far less prevalent in the US. Locating complementary programs near the plant is a strategy that can compensate for this lack of district-heating networks in the US. Programs such as a large energy-intensive facility like a stadium, hospital, or university could create a more localized heating network and improve the plant's efficiency. Various forms of district-heating energy systems (usually run on natural gas but also related with local renewable fuels (Henning and Gabremedhin, 2011; Ulloa, 2007) are already located within central business districts, university campuses and medical centers in the United States.

Associative Model I - Measuring associations between waste collection networks with electricity and heat distribution systems is possible at the city scale. The waste inputs and energy outputs associated with various scales of WtE plants are made available to designers and stakeholders in real-time through the associative model developed by the lab. The model is constructed to offer users (such as an architect, city planner, engineer, plant operator) the capacity to define a range of inputs (urban density, desired WtE plant size and the projected programs to be serviced by the plant) that are then evaluated and return outputs such as waste collection catchment area, urban area serviced in electricity and heat by the plant, and a datum for the maximum area that could be served by an associated vacuum waste collection system (Fig.6).

The platform used by the WtE Design Lab to develop this associative model is a plugin for the digital three-dimensional modeling software Rhinoceros called Grasshopper with additional customized components scripted in the C# programming language.

The associative model is established to relate to a given city's population density, city fabric, urban density, parcel size, waste production, as well as heat and electricity consumption per capita. However, it does not factor for geological barriers to district heating, potential losses in electric and heat trans-

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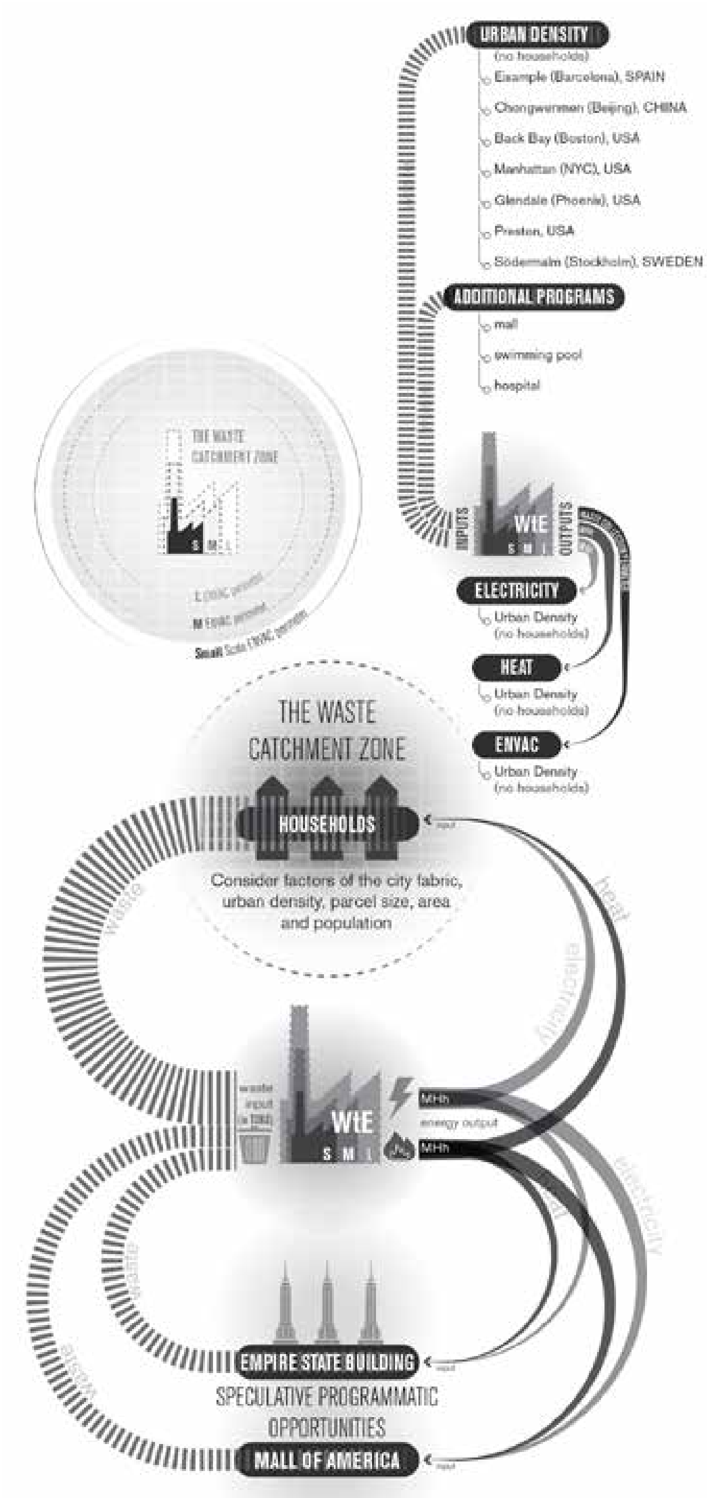

Fig. 6 – Large-scale integration strategy by Laura Smead and Felipe Oropeza Jr, WtE Design Lab.

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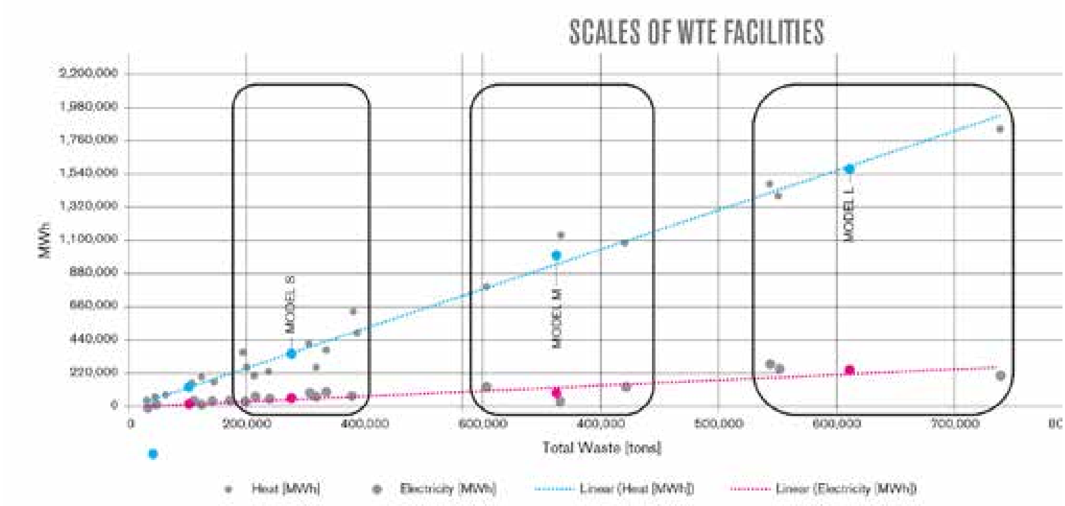
Fig. 7 – Scales of WtE Facilities by Georgios Athanasopoulos and Felix Raspall Gali, WtE Design Lab.

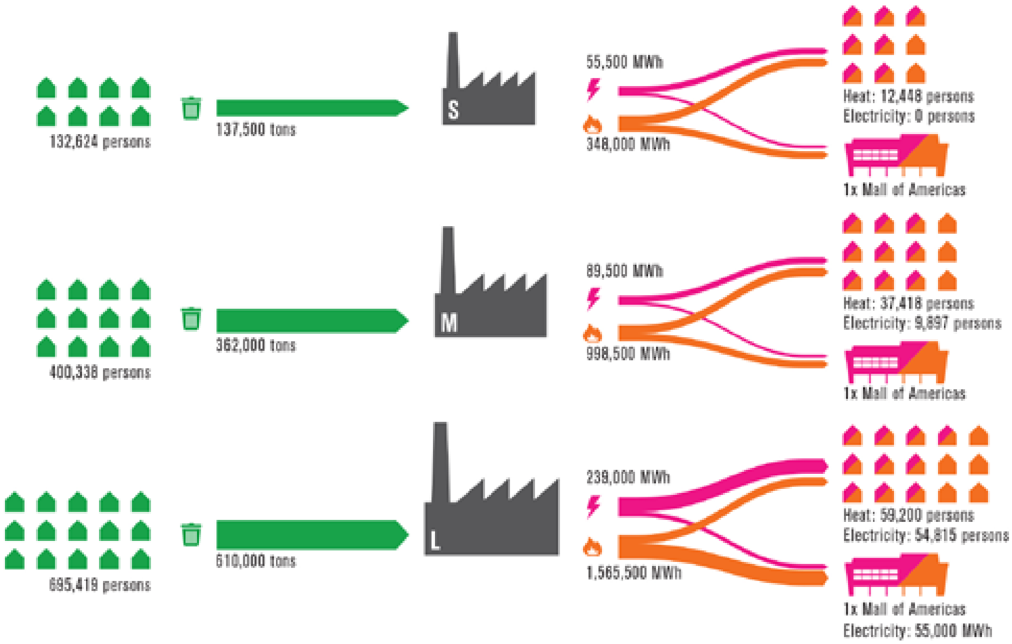


mission, land values, transportation costs or household size.

A range of existing urban density inputs based on model urban areas are already coded as defaults in the associative model. While the input values are variable and easily customized by the user, the urban densities of Barcelona's Eixample, Beijing's Chingwenmen, Boston's Back Bay, Manhattan, Phoenix's Glendale, Preston in Conneticut and Södermalm in Stockholm as well as three industry typical plant sizes; small (100,000 to 200,000 tonnes of waste), medium (300,000 to 400,000 tonnes of waste) and large (550,000 to 750,000 tonnes of waste) are established as default input options in the associative model (Fig.7). A series of programs that could be served by the plant such as residential, hospitals, swimming pools, or malls are also established as default measurable options. This offers the user the ability to measure and test the efficiency and general metrics of different scenarios. For example, one may investigate how many Empire State Buildings a medium-sized plant can feed and how that affects the input and output of the urban grid through the model. Another scenario could be the examination of an existing model such as the Mall of Americas, where the model affords us the ability to see how much waste the complex is providing to the plant and how much of its energy needs are covered (Fig.8).

Besides offering the capacity for locating these plants in a variety of urban densities and fabrics, the investigation into alternative plant configurations was also framed by an ambition to allow for testing the feasibility of different WtE building volumes and configurations that may be more suitable for integration or hybridization with other programs. This complementary or integrated relationship with other programs has efficiency, environmental and operational benefits while also establishing associations with these facilities that could potentially positively address public perception of urban integrated industrial buildings.

More complex scenarios that associate WtE operations with combinations of different hybrid uses and programs are also integrated as capabilities within the model. Through the associative model, realistic proposals for a complete WtE program is made more accessible to designers while also allowing for the study of comparatively different scenarios to aid in the decision-making process related to identifying optimum or most appropriate plant sizes for specific locations and hybridization programs. Two different notation or diagrammatic systems



are established for representing or visualizing the input and output data. For the first notation system, a planimetric interface is adopted to allow for the clear visualization of the typical urban fabric, size of the WtE plant, waste collection catchment area (green), urban area served electricity by the plant (blue), urban area served heat by the plant (red), and the potential use of vacuum waste collection system (represented by a dashed line).

Associative Model II - A second notation system adopts a systems visualization format that resonates with the Odum diagram, which place the data and information variables into a flow diagram of associated or relational inputs and outputs. WtE plant size as well as the size of other programs served by the plant are linked by lines of varying thickness that represent that value of the specific input and output. One graph visualizes the relationship between the city and the plant in terms of spatial ratios of inputs and outputs while the latter translates it in a quantitative manner.

Offering the user the ability to test different design scenarios with ease and allowing for the search of better integration of the plant into a given urban context, all the information in the associative model can be modified and updated in real time. For example, the ratios between inputs and outputs of each plant type size are similar, however when adapting these ratios to different cities, we may see where some types may be more optimal than others.

A second associative model was developed to address the more immediate and tangible spatial and formal consequences of organizing the constituents of the WtE plant into different configurations. The WtE Design Lab produced this model to allow for the generation of a variety of possible configurations that a WtE plant could adopt, while allowing for a real-time evaluation of each organizational instantiations technical and economic feasibility. This model accounts for all the components that form a WtE plant as well as all the constraints attached to them. It allows designers to move components

Fig. 9 – WtE components in typical order by Daniel Hemmendinger, Alkistis Mavroeidi, Felix Raspall Gali, WtE Design Lab.

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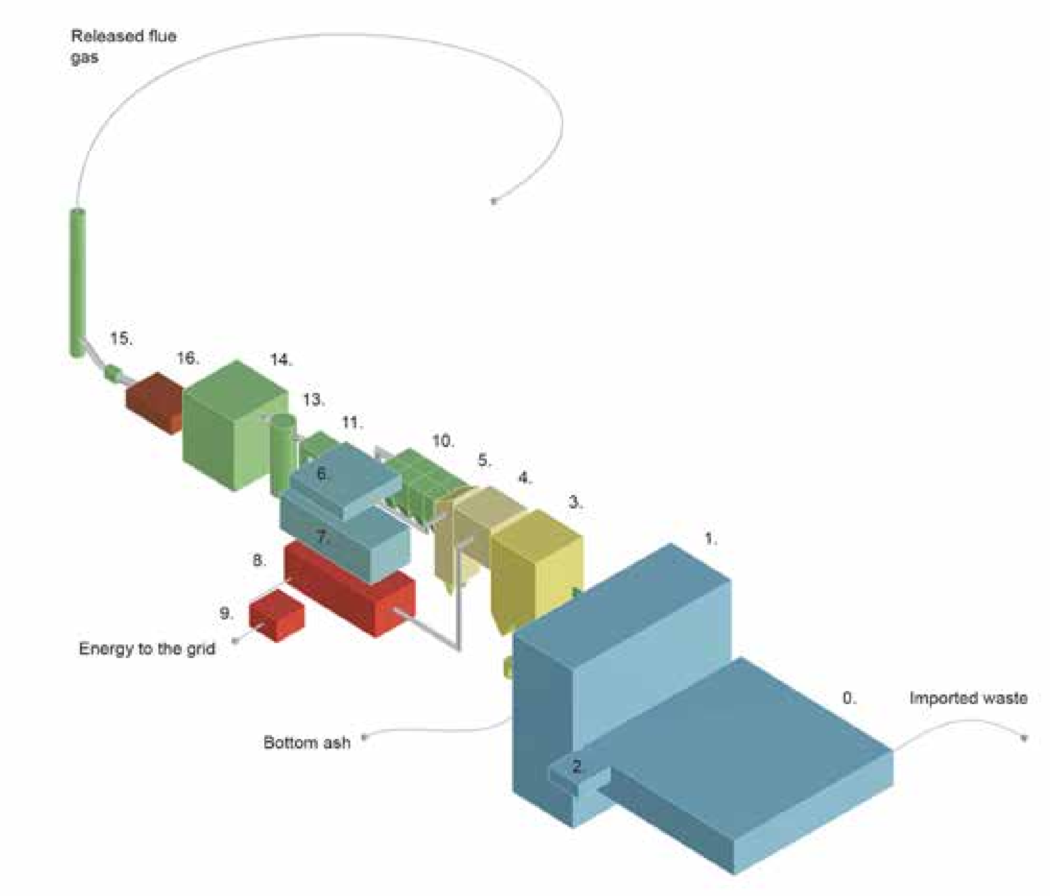
Fig. 8 – Hybrid inputs and outputs by Alkistis Mavroeidi, WtE Design Lab.



Tipping & Feeding
0. Tipping Hall
1. Bunker Hall
2. Control Room

Incinerating & Boiling
3. Incinerator
4. Superheater
5. Economizer

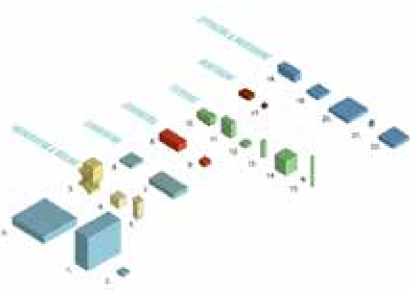
Condensing
6. Feed Water Tank
7. Air Cooled Condensers (for plants generating power only)

Generating
8. Turbine, Generator, and Heat Exchanger (for plants that generate combined heat and power)
9. Power Transformers

Filtering
10. Baghouse Filter
11. Wet Scrubbers
12. Water Treatment
13. Condensing Unit
14. Selective Catalytic Reduction Filter
15. Induced Draft Fan and Chimney

Monitoring
16. Emissions Control Station
17. Sampling Station

Operating & Maintaining
18. Storage Silos
19. Automation
20. Switchgear Equipment
21. Emergency Diesel
22. Lockup/Storage



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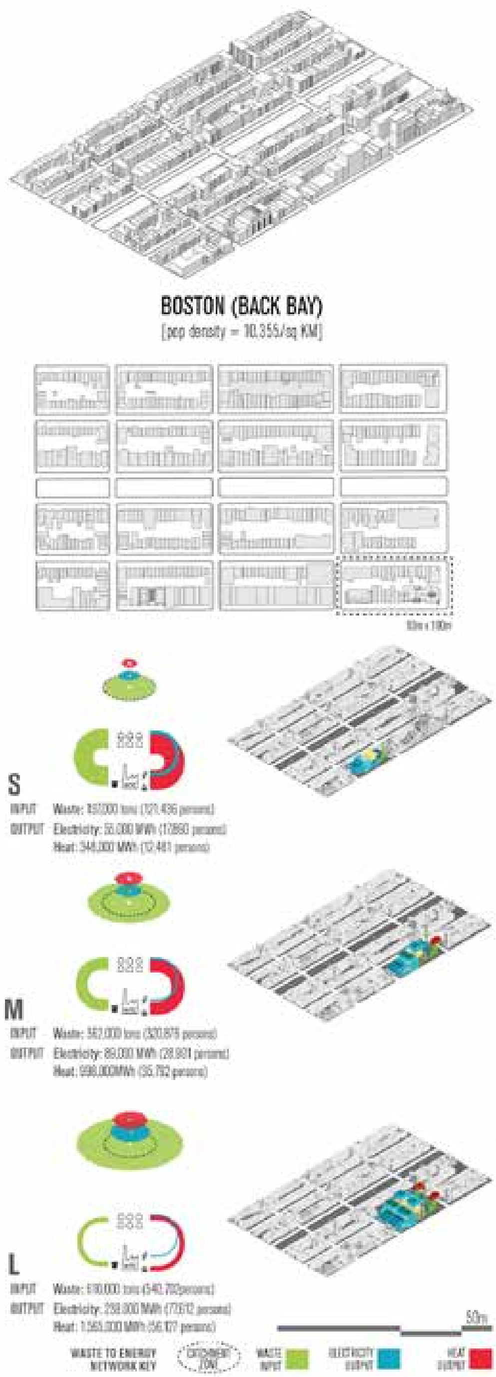
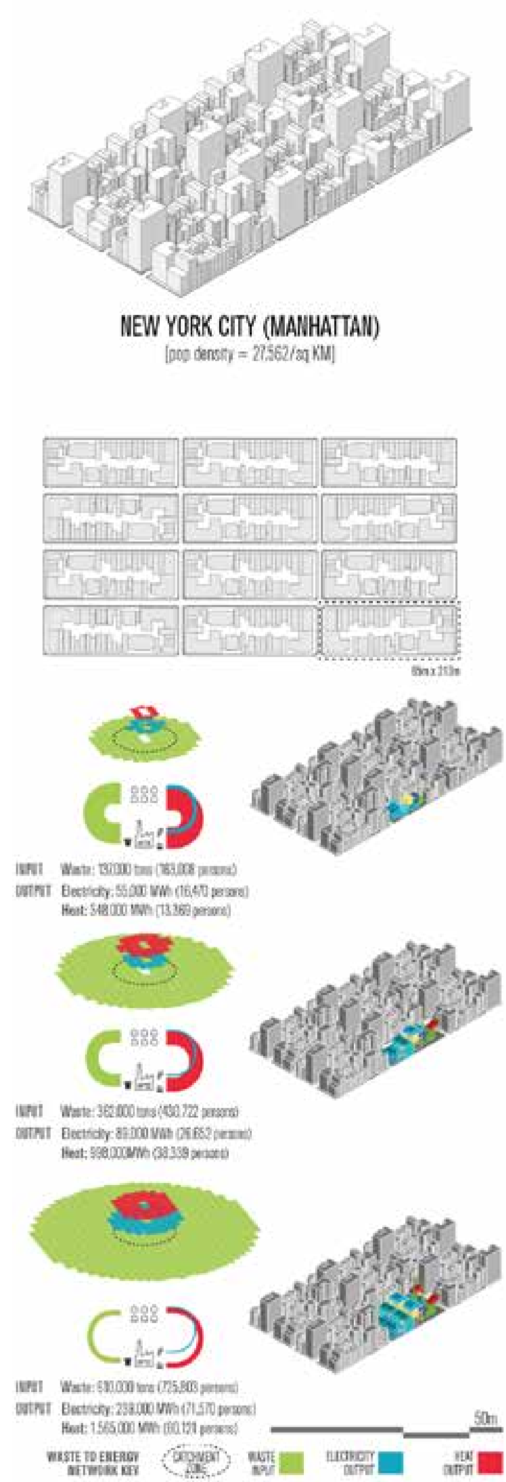
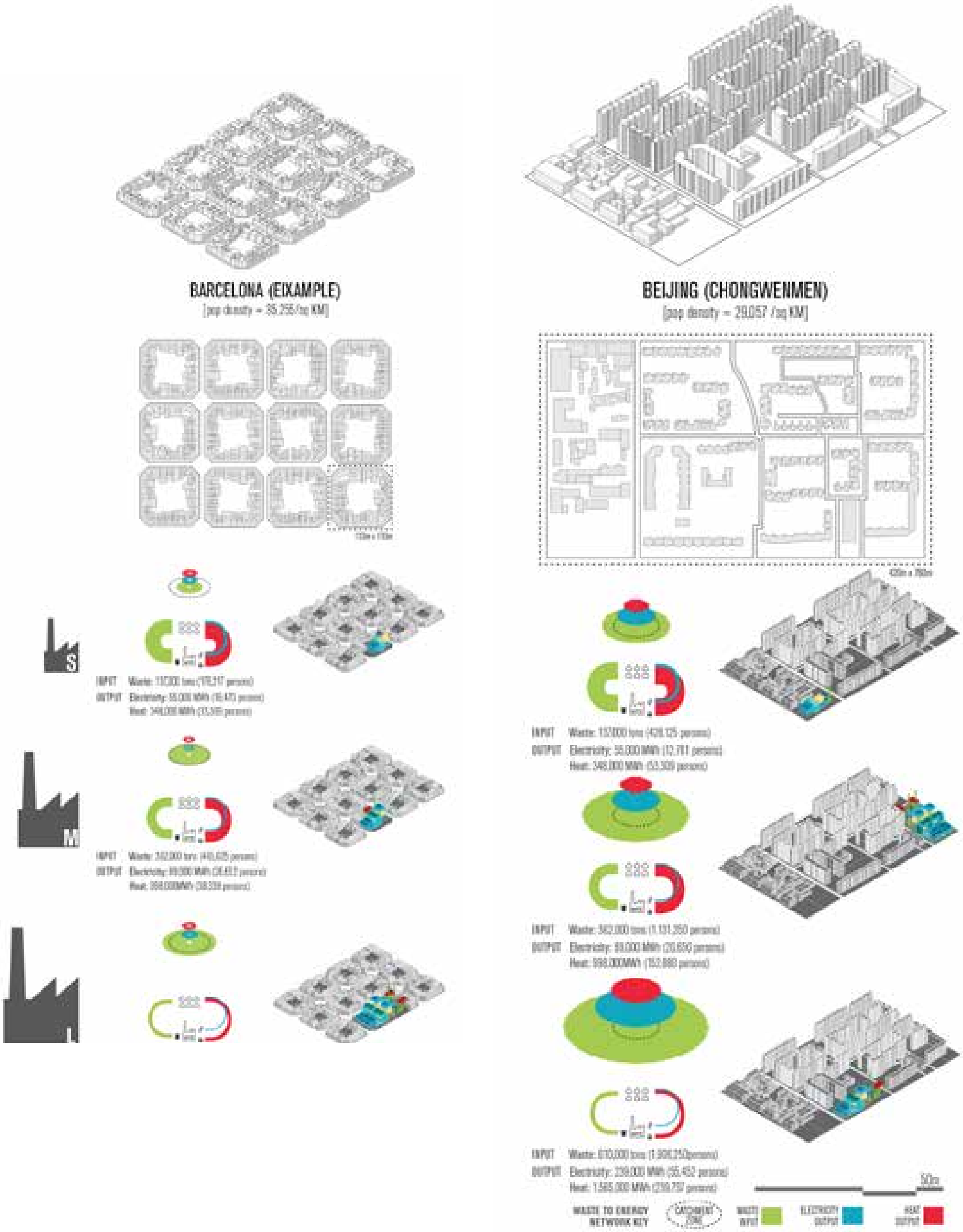
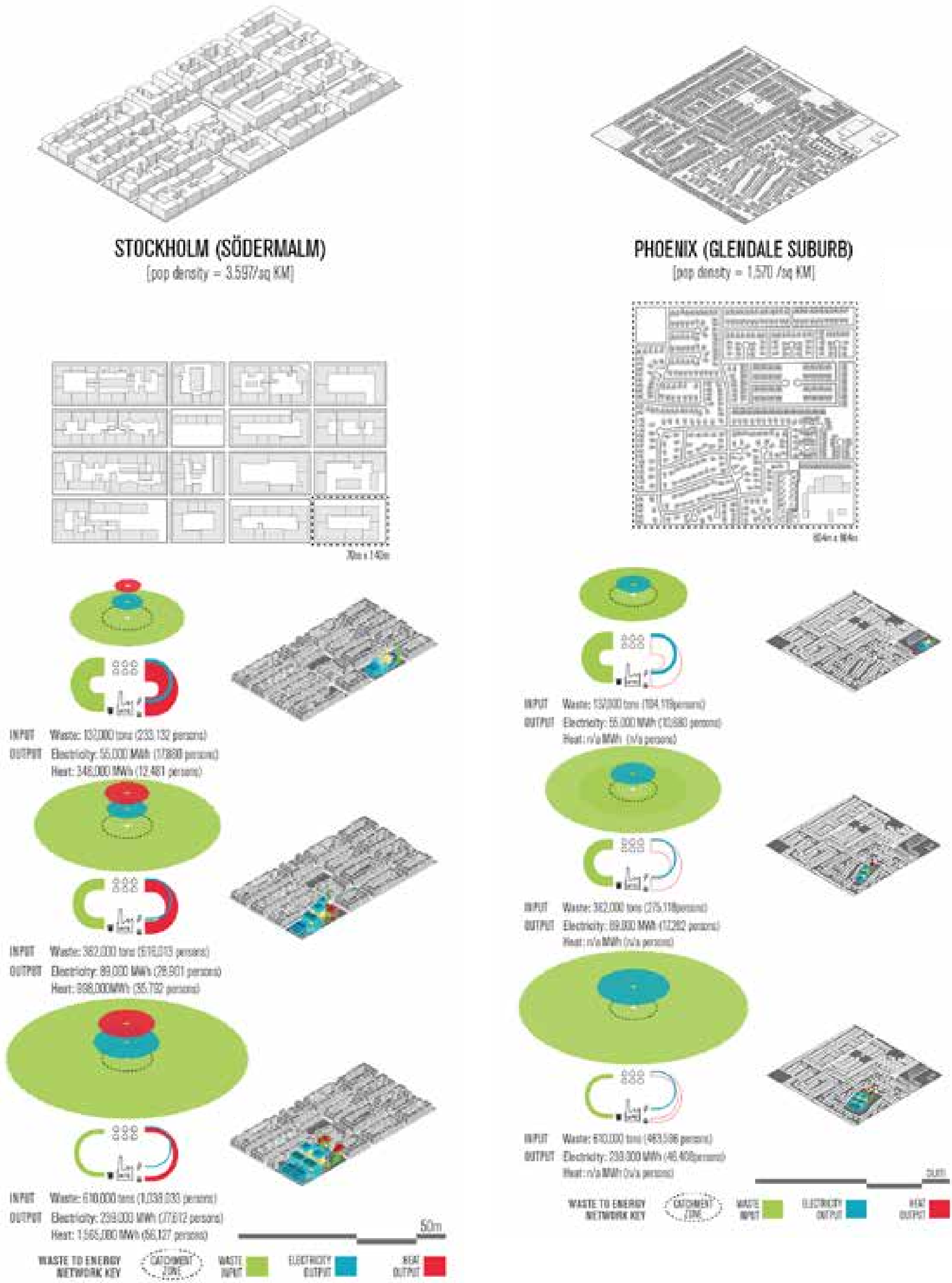





BARCELONA (EIXAMPLE)
[pop density = 35,256 /sq KM]
S
M
L
BEIJING (CHONGWENMEN)
[pop density = 29,057 /sq KM]
INPUT Waste: 137,000 tons (428,125 persons)
OUTPUT Electricity: 55,000 MWh (12,781 persons)
Heat: 348,000 MWh (53,309 persons)
INPUT Waste: 362,000 tons (1,131,250 persons)
OUTPUT Electricity: 89,000 MWh (20,650 persons)
Heat: 998,000MWh (153,880 persons)
INPUT Waste: 610,000 tons (1,906,250persons)
OUTPUT Electricity: 239,000 MWh (55,452 persons)
Heat: 1,565,000 MWh (239,737 persons)
50m
WASTE TO ENERGY NETWORK KEY
CATCHMENT ZONE
WASTE INPUT
ELECTRICITY OUTPUT
HEAT OUTPUT


STOCKHOLM (SÖDERMALM)
[pop density = 3.597/sq KM]
70m x 140m
INPUT Waste: 132,000 tons (233,132 persons)
OUTPUT Electricity: 55,000 MWh (17,880 persons)
Heat: 346,000 MWh (12,481 persons)
INPUT Waste: 362,000 tons (576,013 persons)
OUTPUT Electricity: 89,000 MWh (28,901 persons)
Heat: 998,000MWh (35,792 persons)
INPUT Waste: 610,000 tons (1,038,030 persons)
OUTPUT Electricity: 239,000 MWh (77,612 persons)
Heat: 1,565,000 MWh (56,127 persons)
50m
WASTE TO ENERGY NETWORK KEY
CATCHMENT ZONE
WASTE INPUT
ELECTRICITY OUTPUT
HEAT OUTPUT
PHOENIX (GLENDALE SUBURB)
[pop density = 1,570 /sq KM]
INPUT Waste: 13,000 tons (184,119 persons)
OUTPUT Electricity: 55,000 MWh (10,680 persons)
Heat: n/a MWh (n/a persons)
INPUT Waste: 362,000 tons (275,118 persons)
OUTPUT Electricity: 89,000 MWh (17,282 persons)
Heat: n/a MWh (n/a persons)
INPUT Waste: 610,000 tons (463,596 persons)
OUTPUT Electricity: 239,000 MWh (46,408 persons)
Heat: n/a MWh (n/a persons)
WASTE TO ENERGY NETWORK KEY
CATCHMENT ZONE
WASTE INPUT
ELECTRICITY OUTPUT
HEAT OUTPUT

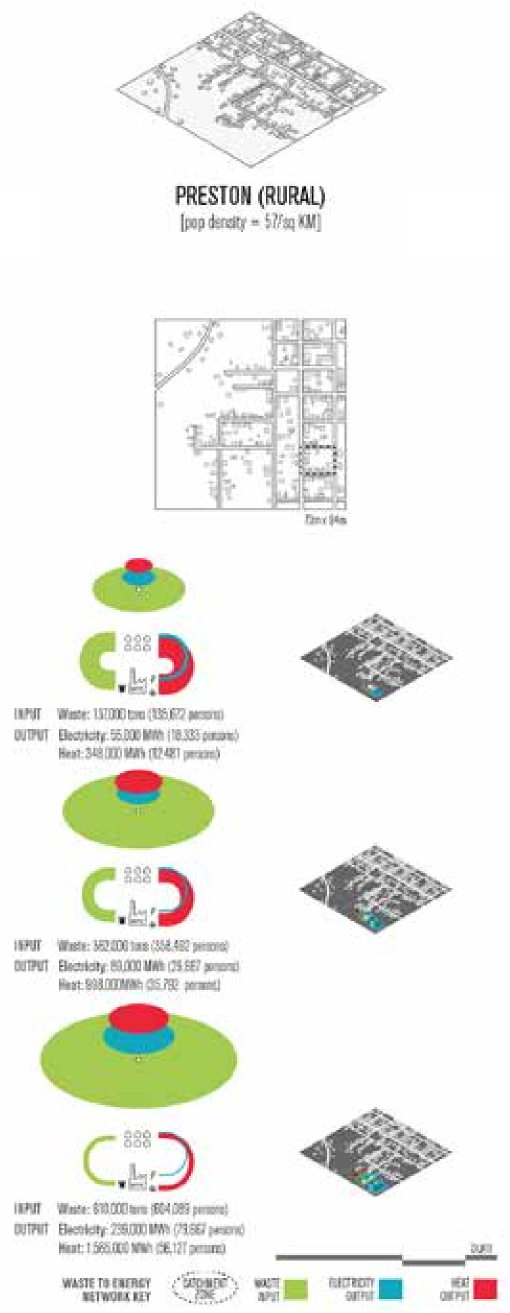


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Fig. 10-17 – WtE associative model network comparisons by Alkistis Mavroeidi, WtE Design Lab.

around to create novel WtE configurations where components can be moved, rotated, and stacked, and the model is able to detect problems, such as collisions, proximity constraints, and more in real time. This offers designers a faster front end process of iterative designing that allows for locating a better integration of facility designs within a given urban context and plot size. (Fig.9)

The central premise underpinning the development of this associative model is that every component of a WtE plant has connections to others or that nothing within this waste to energy system works in isolation. The relevant connections and parameters need to be accounted for so that a qualified and relatively efficient design decision making is enabled. The associative model facilitates this process by re-computing these connections at ease and highlighting areas of conflict so they may be provisionally addressed seamlessly within the early design process.

With this associative model, the WtE Design Lab tested a number of strategies for better adapting WtE plants to a range of urban contexts. The strategies were coded as compacting, stacking, fragmenting, bridging, surrounding, and burying and were tested in three urban contexts—Manhattan, Boston's Back Bay, and Stockholm's Södermalm.

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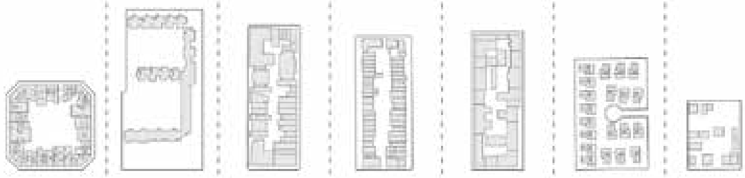


		BARCELONA (EIXAMPLE)	BEIJING (CHONGWENMEN)	NEW YORK CITY (MANHATTAN)	BOSTON (BACK BAY)	STOCKHOLM (SÖDERMALM)	PHOENIX (GLENDALE)	PRESTON (RURAL)
SMALL WTE PLANT (i = 100k - 200k tons/yr)								
S	EXISTING		■	+	+	+	+	+
MEDIUM SCALE STRATEGIES see pgs. XX	compacting	+	+	+	+	+	+	+
	stacking	+	+	+	+	+	+	+
	fragmenting	+	+	+	+	+	+	+
	bridging	+	+	+	+	+	+	+
	surrounding	+	+	+	+	+	+	+
	burying	+	+	+	O	+	+	+
MEDIUM WTE PLANT (i = 300k - 450k tons/yr)								
M	EXISTING	+	+	+	+	+	+	+
MEDIUM SCALE STRATEGIES see pgs. XX	compacting	+	+	+	+	+	+	+
	stacking	+	+	+	+	+	+	+
	fragmenting	+	+	+	+	+	+	+
	bridging	+	+	+	+	+	+	+
	surrounding	+	+	+	+	+	O	O
	burying	+	+	O	O	+	+	+
LARGE WTE PLANT (i = 550k - 750k tons/yr)								
L	EXISTING	O	+	O	O	O	+	+
MEDIUM SCALE STRATEGIES see pgs. XX	compacting	+	+	+	+	+	+	+
	stacking	+	+	+	+	+	+	+
	fragmenting	+	+	+	+	+	+	+
	bridging	+	+	+	+	+	+	+
	surrounding	O	O	O	O	O	O	O
	burying	+	+	O	O	+	+	+

\+ compatible with urban fabric   O incompatible with urban fabric

opposite page
Fig. 18 – WtE associative model network comparisons by Alkistis Mavroeidi, WtE Design Lab.

Output and Data Analysis

The associative model was used in testing the implementation of WtE plant within a series of urban and rural contexts, each of them with their specific population densities, grid systems, urban fabric and thus varying typical urban block sizes.

Some of the findings from these different explorations are outlined in the following sections, where the design opportunities and efficiencies found to have been offered by the associative models are elaborated (Fig 10-18). For the associative model 1:

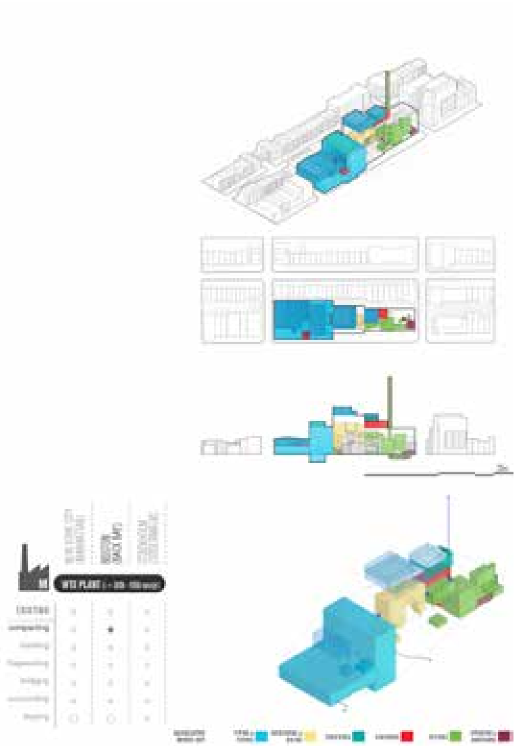
- Generally, the input/output ratio is more optimal with smaller plants. However, conversely, a dense city benefits from larger-scale plants, as it can produce substantial energy while minimizing waste transportation costs.
- The effect radius of larger plants generally surpasses the size of the city itself in low-density rural areas (such as Preston). Locating large WtE plants in low-density rural areas is often one of the most popular solutions; however, integration in these cases is minimal. The input radii are large while electricity and heating outputs fail to correspond to an analogous ratio.
- The effectiveness and economic advantage of WtE plants located in areas with the capacity for district heating is significantly higher than areas that cannot support a district heating system. However, in colder climates (such as Boston, USA), the waste input requirements for heating consumption surpasses that of the volumes needed for electricity supply and therefore these two different resources will be distributed at different effect radii.

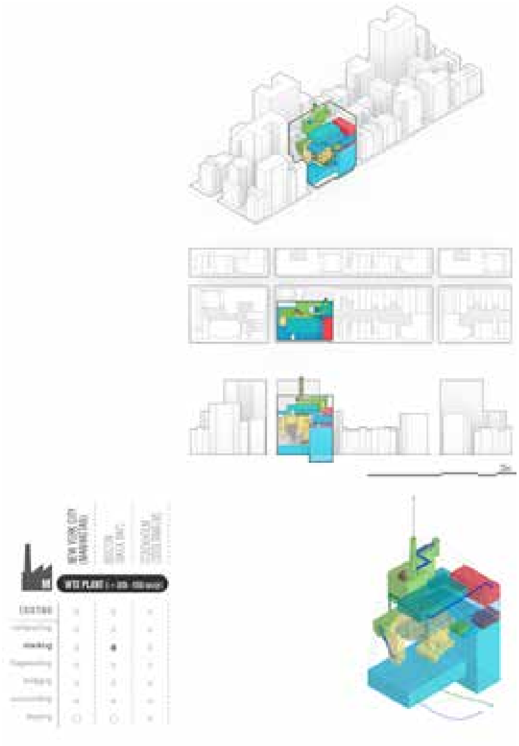
For associative model 2: the application explorations for associative model 2 leverages the capacity for the tool to test different configurations of the WtE plant components to arrange varying building volumes that may better address a diversity of site constraints and conditions. Several design strategies emerged out of this application process with a range of novel arrangements emerging from the negotiation of the requirements of the plant buildings with strict site limitations, while still retaining its technically viability (Fig.19).

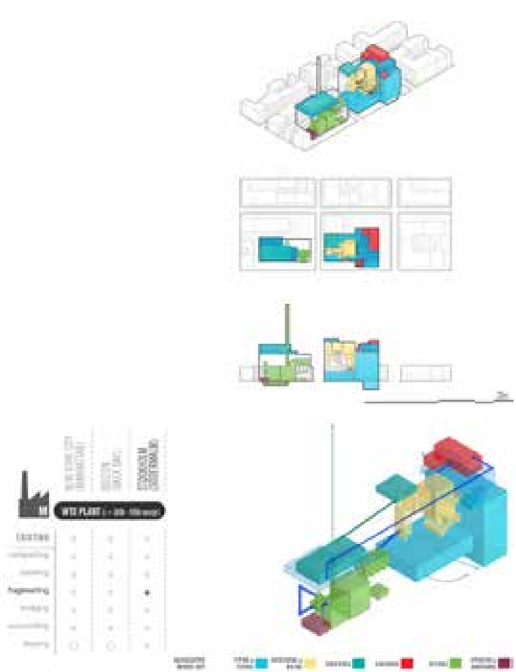
Boston (Back Bay)

A notable urban development, Boston's Back Bay follows a pattern of infill and consolidation on reclaimed land. Unlike the rest of Boston, the Back Bay was plotted in a planned grid of narrow streets and sidewalks. Today it is one of the most densely populated areas in Boston, generally consisting of low- to mid-rise buildings with a relatively small urban grain.

This scenario is aimed toward reducing the building







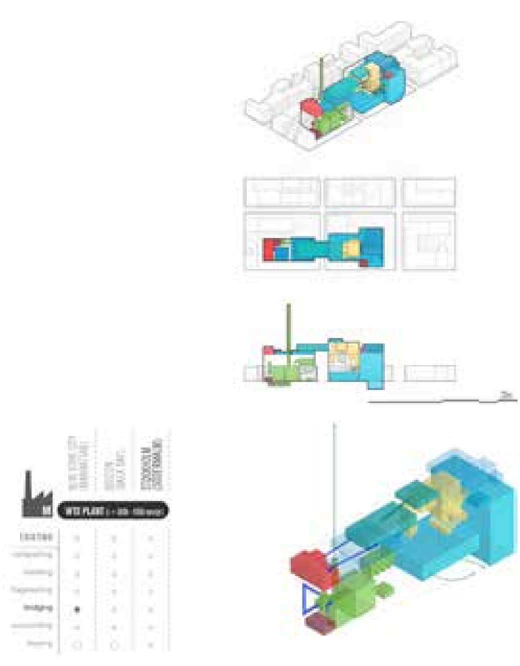


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Fig. 19-23 – Medium-scale strategy per urban context, comparison matrix by Alberto Embriz de Salvatierra, WtE Design Lab.

footprint and height which was achieved through compacting the WtE components to fit and operate within the limits of a typical urban block in this neighborhood. The various operations of the plant are arranged in a linear but efficient sequence. An effort is made to respect existing parcel boundaries while maintaining an accessible perimeter for buffering and maintenance purposes (Fig.20).

New York (Manhattan)

Manhattan's urban fabric is compact with high-rise development being the common practice. Such dense contextual conditions pose a serious challenge for typical industrial applications.

A significant reduction of building footprint by stacking the overall organization of WtE processes is required in this application. Proper access and means of waste delivery to the tipping hall are principal. However, the stacking creates new spatial relationships by rethinking the way space, heat, and enclosure can operate dynamically in section (Fig.21).

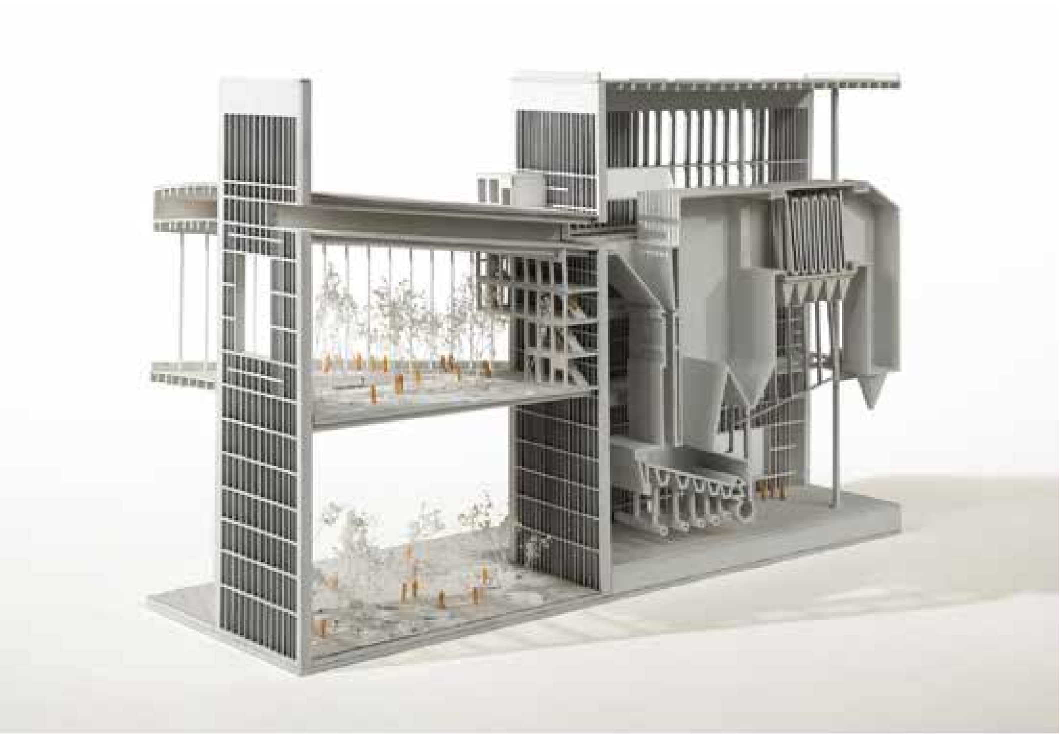
Stockholm (Södermalm)

Södermalm, a historic settlement, is the largest and one of the most densely populated boroughs in Stockholm. While pressure for development is now high, opportunities for building are scarce and developers need to forge creative strategies for development.

To achieve flexible integration into the urban context, the fragmentation of the components of the WtE plants, if developed strategically can be technically feasible. This will enable the location of constituents of the facility across a number of different available parcels rather than the potentially difficult task of consolidating existing properties to house the full plant building (Fig.22).

Another strategy for the integration of a WtE plant within Sodermalm's urban fabric, developed through the use of the associative model is achieved through an exploration of the potential of a conventional horizontal assembly of WtE components.

This speculative proposal involves elevating crucial WtE processes and components. This is done so that the plant may be accommodated within the city fabric yet allowing for pedestrian access through the fabric at a scale that currently exists. One major challenge with the introduction of industrial facilities in urban contexts is associated with the large and blank nature of these typologies, which can pose significant breaks in the continuity of the existing urban structure. This strategy is a means to address this by opening parts of the ground plane of the facility parcel as right of ways.



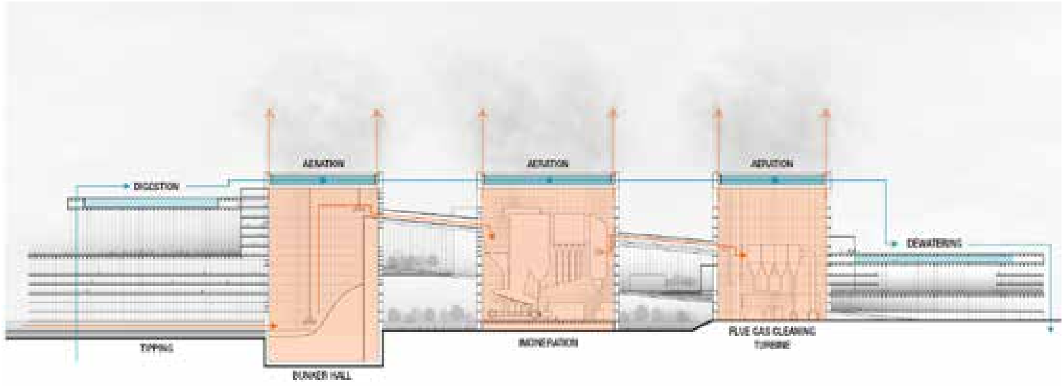


Fig. 26 – Progressive purification, project developed by David Hamm and Snoweria Zhang at Harvard University, Graduate School of Design under the supervision of Hanif Kara and Leire Asensio Villoria.

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Fig. 24-25 – Catalytic currents, project developed by Haggerty and Dana McKinney at Harvard University, Graduate School of Design under the supervision of Hanif Kara and Leire Asensio Villoria.

The associative model helped to test the technical feasibility of such an option. (Fig.23).

Conclusion

There is a generally accepted wisdom that industrial plants, including WtE plants, are better suited for rural or single-zoned industrial contexts. However, the location of a WtE plant closer to an urban context -even a city center- has a number of great benefits to its operation and has the potential to minimize its environmental footprint. Receiving waste directly from a plant's surroundings could help reduce transportation costs, allow for the implementation of efficient district heating, or make possible the development of hybrid facilities that integrate public life into the plant.
The WtE dLab at Harvard's Graduate School of Design invested in developing computational design tools as well as devising a taxonomy of design strategies for better integrating these facilities in urban contexts. These are intended to help guide and educate designers in being more resourceful when developing proposals for better integrated WtE plants while being mindful of their often-complex technical constraints.
It is intended that these tools can help facilitate the introduction of the much-needed participation of architects in the process of planning for these major energy infrastructural facilities. In specific countries such as Sweden, where there is an adoption of WtE technologies as crucial components of the national energy plans, the successful stewarding of the process of their integration within the wider built environment may well be determined by how well access to the management of the technical and engineering complexities of these projects may be given to architects. Indeed, as demonstrated through the design research conducted within the GSD WtE dLab and through the advanced option studio, with the help of these tools and design guides, the role of the architect in this process can certainly go beyond simple aesthetic flourish (Fig.24-27).
To gather valuable feedback regarding the effectiveness and applicability of the design tool in projects that encompassed a wide range of contexts and conditions, we conducted informal exit-interviews as well as we established more formal evaluations regarding their experiences, judgements, and their use of the associative tools. In the WtE lab, we also developed a large generated sample of design

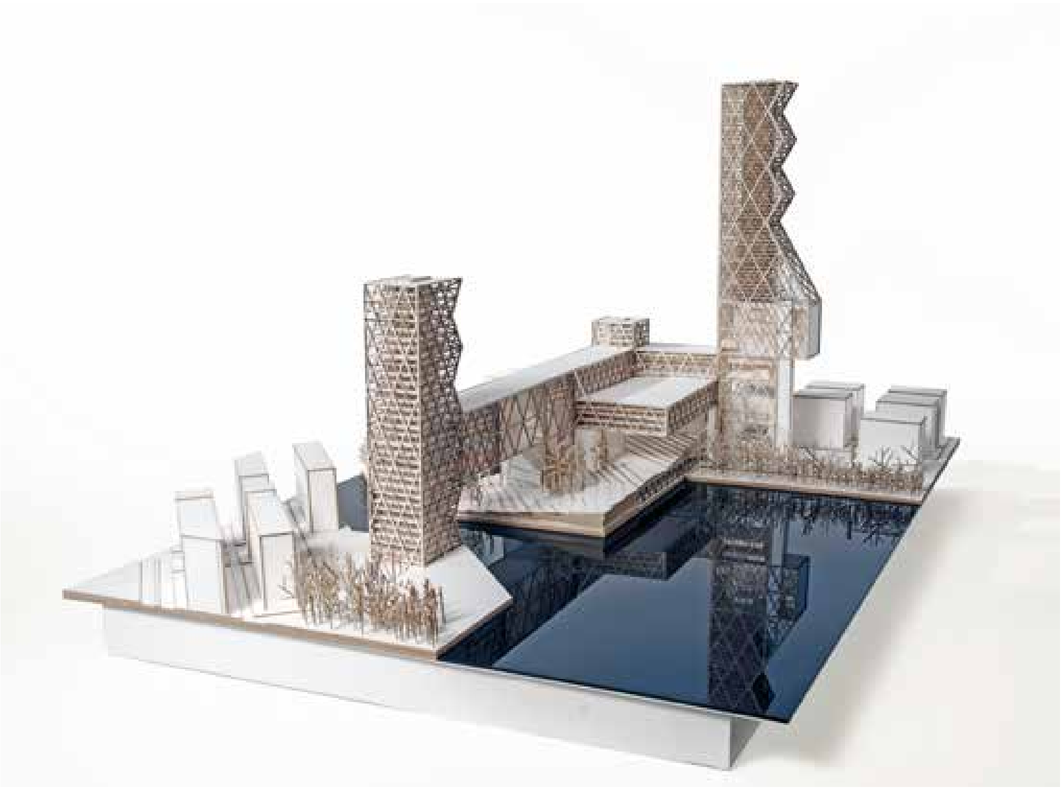

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Fig. 26-27 – 5H Hybrid, project developed by Alberto Embriz de Salvatierra at Harvard University, Graduate School of Design under the supervision of Hanif Kara and Leire Asensio Villoria.

applications in varying contexts and related to different hybrid programming strategies. In both cases, the associative models were found to be valuable instruments that operated as an accomplice in the design process. However, it was generally found that the responses from the students and findings from the lab showed a consensus on the view that the associative models were good tools but did not constitute an automation of the design process and did not preclude the need for a designer. Rather, it was found that it enabled better understanding and access to the technical complexities of these infrastructures but still needed the involvement of professionals with a domain expertise in architectural, landscape and urban design.

Endnotes

[1] Associative design is a design practice that relates performance parameters with the development of geometric and organizational design models. The practice is invested in the use of multiple performance parameters and information as the main drivers of the design process. This design approach also affords the capacity to rapidly generate different iterations of design models based on changes to the variables of these related parameters.

[2] This technical handbook was created by the WtE Design Lab through an extensive literature review focused on the anatomy and technology that drives/constitutes a Waste-To-Energy facility as well as close collaboration with the engineer Christer Anderson, AF Industry.

References

Asgharinejad A. 2013, *Mathematical Modeling of Solid Waste Incinerators*, «Research Journal of Applied Sciences, Engineering and Technology» vol. 5, no. 9, pp 2714–2723.

Kara H., Asensio Villoria L., Georgoulias A. 2017, *Architecture and Waste. A (Re)Planned Obsolescence, Best Practices and Missed Opportunities: Waste-to-Energy in Sweden and the United States*, Actar, Barcelona, New York

Dutch Waste Management Association, Transformation into Energy Factories: R1 Status Drives Up Energy Efficiency, Waste Forum, Nov. 2011. <http://www.wastematters.eu/uploads/media/wasteforum_november_2011_Transformation_into_energy_factories.pdf.>

Henning D., Gabremedhin A. 2011, *Environmental and Energy Study Institute (ESSI), Fact Sheet: What is District Energy?* in *District Heating and Cooling Enable Efficient Energy Resource Utilisation*. <http://www.districtenergy.org/assests/pdfs/White-Papers/What-IsDistrictEnergyEESI092311.pdf> in INTECH Open Science, 2012. *Sustainable Energy: Recent Studies*, <http://www.intechopen.com/books/sustainable-energy-recent-studies/district-heating-and-cooling-enable-efficient-energy-resource-utilisation>.

Ulloa P. 2007, *Potential for Combined Heat and Power and District Heating and Cooling from Waste-to-Energy Facilities in the US-Learning from the Danish Experience*. <http://222.seas.columbia.edu/earth/wtert/sofos/ulloa_thesis.pdf>

United Nations Enviroment Programme, Division of Technology, Industry and Economics, 1.5.2 *System Types, in International Source Book on Environmentally Sound Technologies* (ESTs) for Municipal Solid Waste Management (MSWM). <http://www.unep.or.jp/Ietc/ESTdir/Pub/msw/sp/SP5/SP5_2.asp.>

United States Environmental Protection Agency, Office of Air Quality Planning and Standards. *Stationary Source Control Techniques Document for Fine Particulate Matter*. Report. Sept. 30, 1997. <http://www3.epa.gov/ttn/caaa/t1/reports/sect5-4.pdf.>

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The Architecture of Waste
Designing New Avenues for Public Engagement with Trash

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Abstract

The system of waste processing currently exists as a linear process: trash flows from cities of high densities to sprawling landscapes of waste, but as cities grow and densify, critical systems of waste infrastructure must be re-evaluated. Instead of today's isolated and linear processes, urban and waste ecologies can become an interconnected and cyclical system. Current practices call for industrial processes to be pushed to the periphery of cities, thereby severing the relationship between the urban environment we inhabit and the one that is required to support the way we live. If architects and designers become engaged in the conversation of waste management and other industrial processes that support the demands of the city, they can begin to repair the physical and mental separation of waste and public activity while introducing cultural, economic, and environmental value in waste infrastructure.

Keywords

Waste Infrastructure, Public Engagement, Urban Design, Waste-To-Energy, Sustainable Cities

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Waste and the City

The system of waste processing in the United States currently exists as a linear process: trash flows from cities of high densities to sprawling landscapes of waste, but as cities grow in size and density, critical systems of waste infrastructure need to be re-evaluated. No longer can we think of waste management as an isolated process that is removed from the other systems that work together to support the needs of a city. These systems must be planned and designed in an integrated way to function as efficiently and sustainably as possible as cities grow ever more complex.

As countries all over the world are rapidly urbanizing, with cities increasing in population, density, and land area, the current method of waste management, most often landfilling in the United States, needs to be questioned and decisions about their futures must be made. Is there a more sustainable, more holistic, cyclical type of system we can envision that will help alleviate the burden that current waste management practices are placing on our cities? As Michael Manfredi and Marion Weiss examine in their book Public Natures: Evolutionary Infrastructures, within the complexities of modern cities lie synergies between infrastructure and public life that can be enhanced through designed interventions. These two realms cannot be viewed in complete isolation from one another; it is time to change and embrace the gray area that lies between stark black and white of infrastructure and the public realm. «Larger than life but part of it, infrastructure has an immediate presence; it shapes our environment and urban life in vital, authentic, and often messy ways [...] We look at the physical elements of infrastructure and the often marginalized sites they produce as possible contributors to a meaningful public realm. What if a new paradigm for infrastructure existed? What if the very hard lines between landscape, architecture, engineering, and urbanism could find a more synthetic convergence?» (Manfredi, 2015, p. 6).

We can think of cities as ecosystems, containing complex networks of organisms and systems that are self-sustaining in nature. A successful ecosystem is one that is able to support itself, using an output from one system as an input for another system, occurring in a cyclical nature. Unfortunately, most American cities do not function in this way; most cities' waste systems operate solely in a one-way fashion: waste is generated, collected, and exported to a landfill, where it remains without any future use. Pierre Belanger examines the city Kalundborg, Denmark as an example of a successful industrial economy that uses waste from one industry as fuel for another (Belanger, 2007). If American cit-

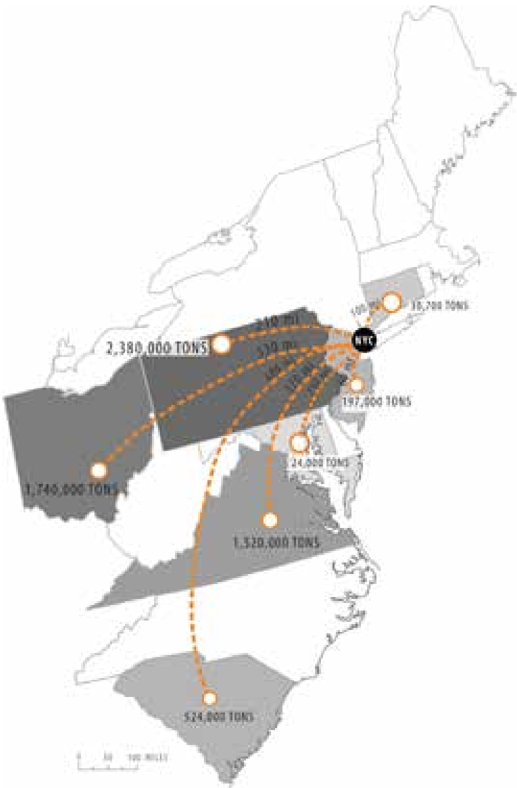

Fig. 1 – Export of New York City's Solid Waste (Image: author).

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Fig. 2 – Timeline of designers engaging in waste infrastructure (Image: author).

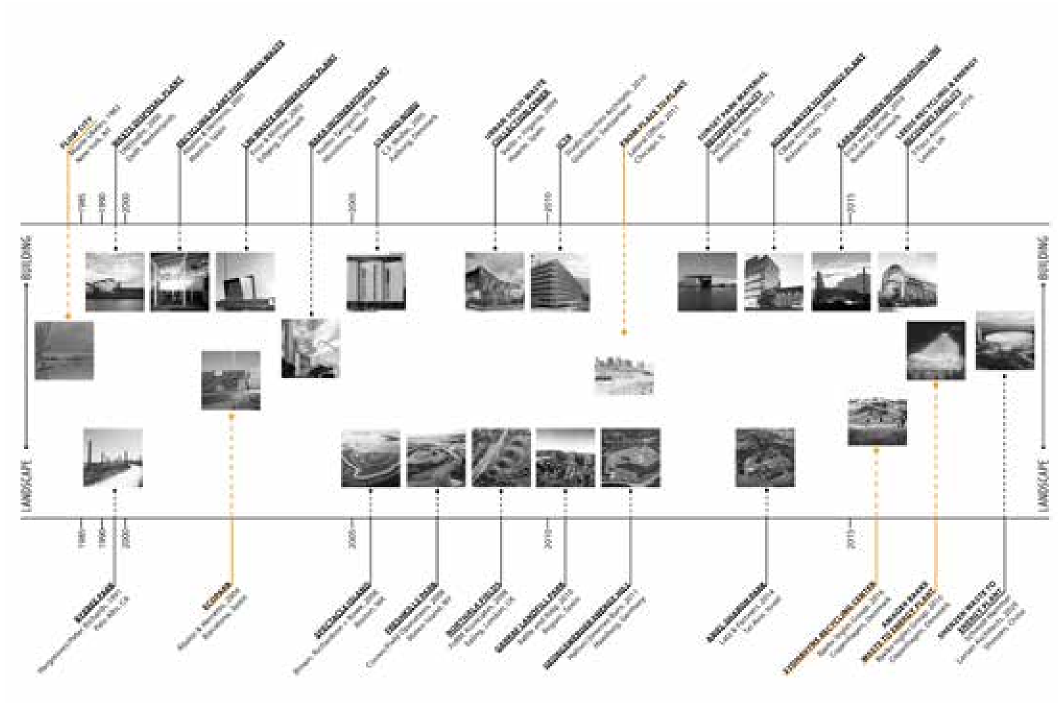
ies are going to continue to grow and thrive in the future, they must begin to think of themselves as self-sustaining ecosystems.

Imagine a city that is able to sustain itself: it processes its waste within city limits, using municipal solid waste generated from its citizens to feed an energy plant that eliminates the waste and in turn produces energy and heat to feed into the city's energy system to power people's homes. This closed-loop system would not be required to rely on outside resources to sustain the needs of the city; it could begin to sustain itself.

In stark contrast to this ideal city, New York City currently exports 6.4 million US tons of trash per day (Figure 1). None of this trash is processed within the city limits since the closing of Freshkills Landfill in 2001, but rather exported to nearby states such as Pennsylvania and Ohio, and as far away as 700 miles away via truck, rail, and boat to landfills; costing taxpayers an immense financial burden and harming the environment with all the pollution associated with motor vehicles (Accuardi, 2011). According to Pierre Belanger's Landscapes of Disassembly, «When long-term post-closure remediation is considered, estimates now place the full cost of waste dumping, including downstream impacts and greenhouse gas emissions, somewhere between 50 to 100 times the original price paid at the scales» (Belanger, p. 84). This equates to 2.3 billion US tons of trash per year plus unsustainable costs to sustain a city of 8.5 million people. This linear method of waste infrastructure cannot be sustained in a healthy way.

Valuing Waste

This short lived, linear method of waste management in which the lifecycle of trash ends quickly at the landfill illuminates the fact that there is no value placed on waste. This notion needs to be challenged as land and natural resources become scarcer while cities are growing larger, demanding more and more resources. If cities begin to place value on waste rather than spending resources of time, money, and fuel to simply dispose of it, waste can become a resource in its own right. It can become a fuel: producing energy to power people's homes, metals to be recovered and reused, and ash to be



used in construction and agriculture. If waste can be recognized and valued as a resource, it can shift its' identity from being the problem itself, to becoming part of the solution.

The lack of value in waste and other industrial infrastructures has manifested itself into the physical design of cities. These systems are inextricably tied to the way cities operate on a daily basis, yet they are designed to be removed from the public eye, essentially becoming invisible to the public and severing the relationship between the urban environment we inhabit and the one that is required to support the way we live. The disconnect between these two realms furthers the societal devaluation of waste and continues to support the notion of exporting waste to a location far outside the city that has no connection to the people that generated it.

Waste and the Designer – a Missing Link

Urban industrial zones, relegated to the periphery of cities are nevertheless a part of the built environment, and therefore should be considered within the scope of the urban environment we design. However, designers from all backgrounds from architects to urban designers to landscape architects have historically had no role in the creation of these systems. The designer has been completely left out of the conversation on waste infrastructure. If designers can apply their creative design thinking to the challenges of waste infrastructure, from the level of city planning down to the level of the building design and the landscape it sits within, the more integrated and thoughtful the solutions can be. If the industrial realm can be given the level of design consideration that is given to the traditional public realm, we can begin to break down the boundaries between the urban environment we inhabit and the one that supports us. We can begin to think of these realms overlapping and blur the lines between buildings, landscape, and infrastructure.

Because of this disconnect with the industrial landscapes that support our urban needs, as well as lack

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Fig. 3 – Delft Waste Disposal Plant (Image: curtesy of UNStudio).
Fig. 4 – Recycling Plant for Urban Waste (Image: curtesy of Abalos & Herreros).

of environmental and economic motivations, it is hard for the general public to understand and embrace the technological advances occurring in the field of waste management. By including designers in the conversations about waste management potentials, such as urban waste-to-energy, recycling, composting, they can create value in industrial environments and promote healthier communities. «Within this space of opportunity, new design concepts can offer hybrid solutions to generate clean energy, contribute to cities' social and cultural activities, and protect wider urban atmospheres and microclimates» (Georgoulias, 2015).

Today, we are at a critical junction in establishing best practices for waste management strategies as population density and consumption patterns in cities increase. With technological advances, it is time for sustainable infrastructure to be put in place to support current trends of consumption. Designers have the opportunity to bring the industrial periphery of urban environments back to the interconnected realm of public activity.

Relinking Design and Waste

In order to explore the role of the designer within the field of waste management, a timeline of projects imagined and completed by architects, landscape architects, and artists creates a visual history of the opportunities that lie when these worlds collide (Figure 2). These projects range from buildings to landscapes; from conceptual work, in-progress work, to completed works that are multi-functional in the way they engage with the process of waste. The analysis of these projects involves not only placing them chronologically, but also placing them on a spectrum from building to landscape: allowing projects to float in between these two binary conditions.

Many of the buildings in this analysis are waste-to-energy plants and recycling facilities, and the majority of the landscape projects are multi-functional parks created over capped landfills. Within this spectrum of 'building to landscape' lies a variety of program typologies and ideologies of waste management, ranging from ways to treat trash as it enters the waste stream to ways of reclaiming landscapes that have been left as residual from waste disposal.

The majority of these projects are located in Western European countries such as Denmark, the Netherlands, and Spain. Due to a variety of constraints such as political, geographic, and energy needs, many of these countries have been required to invest in alternate waste management strategies. The most common and even more primitive alternative to landfilling is burning waste. With technological advances, Waste-to-Energy plants have become

both a significant waste management strategy and a source of energy, as evidenced by their use across Europe for a significant amount of time. However, not all Waste-to-Energy plants are created equal: the projects of interest in this analysis are those that go beyond the pure functional requirements of the prescribed industrial needs and add architectural value to the built environment. The programs of the buildings examined include waste-to-energy plants, recycling, sorting, and composting centers. Many of them link an aspect of public outreach to them, whether it be a visitor's center, museum area, display area, public promenade, or other public amenity.

One example of a building that goes beyond its pure function to engage local culture is the Waste Disposal Plant in Delft, Netherlands (Figure 3). The architecture firm UNStudio elevated the program beyond its traditional use to serve as a symbol to its community: using the building's design and form to communicate the waste management policy of its city to its people. The programmatic requirements of the space include a recycling facility, compression facility, and transfer station. The movement of vehicles and waste determines the fluid form, while its gently sloping concrete surface wraps over itself to form a plateau, which separates the delivery and the sorting facilities from the public view to the river.

The Recycling Plant for Urban Waste (Figure 4) in Madrid, by Abalos & Herreros in 2001, is another example of a building that is industrial function is expanded through the architect's design. The recycling plant is «part of a wider political initiative to reevaluate and regenerate an area southwest of Madrid, which has been used as a large dumping ground and suffered social and environmental deprivation as a result» (Phaidon Atlas). The objective of this facility is to reconstruct the hillside through the generation of compost from organic waste. The building's function is greater than purely gathering waste from the surrounding region, but extends beyond to mend the scars of industrialization that the

Fig. 6 – Diagram of Amager Bakke Waste to Energy plant (Image: author).
Fig. 7 – Diagram of Sydhavyns Recycling Center (Image: author).

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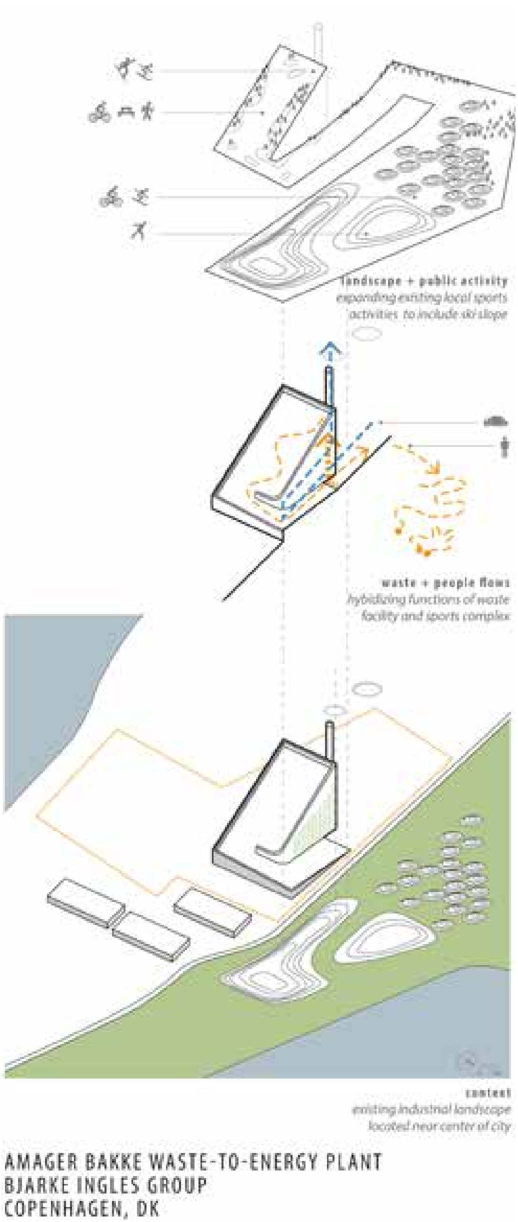
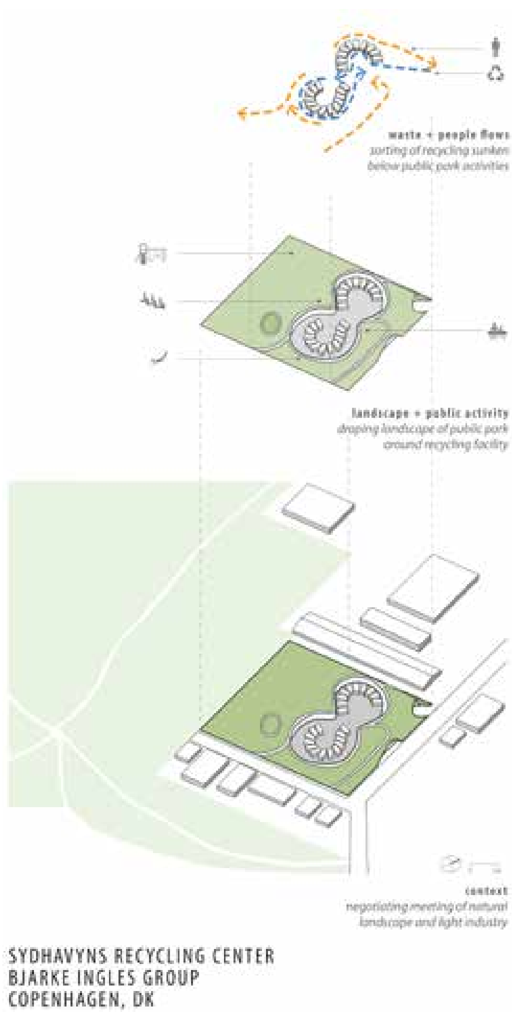
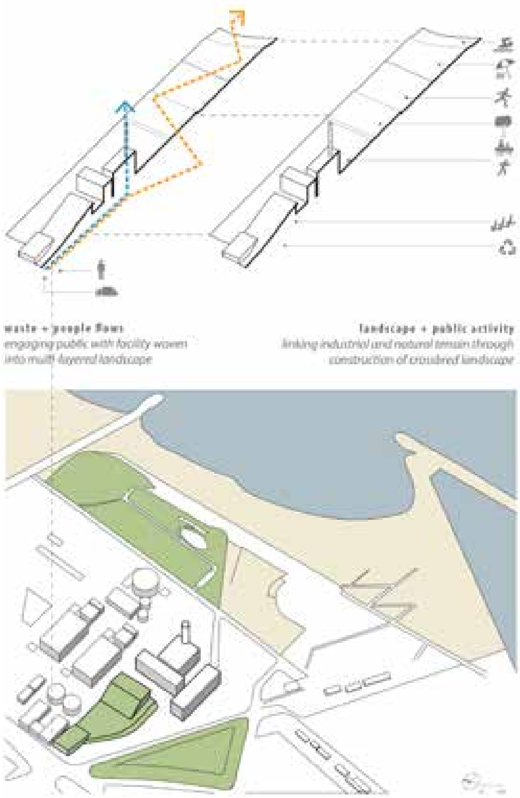
Fig. 5 – Freshkills Park (Image: curtesy of Corner/Field Operation).

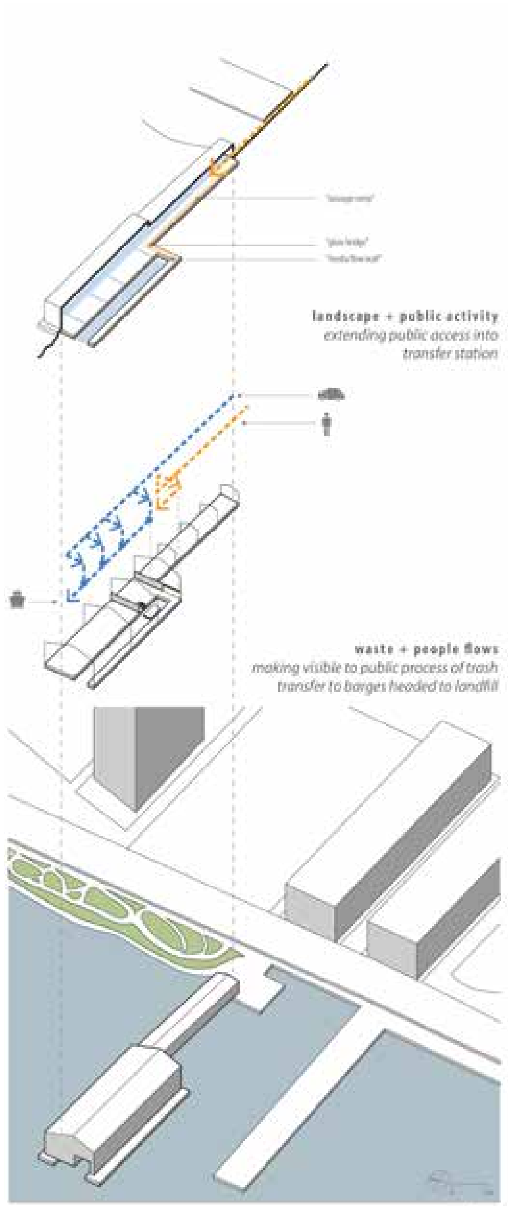






context
constructing multiple intricate experiences of natural components within existing industrial landscape

ECOPARK
ABALOS & HERREROS
BARCELONA, SPAIN



context
enabling residents to experience the "violent theater of dumping"

FLOW CITY
MIERLE UKELES
NEW YORK, NY

Fig. 8 – Diagram of Ecopark (Image: author).
Fig. 9 – Diagram of Flow City (Image: author).

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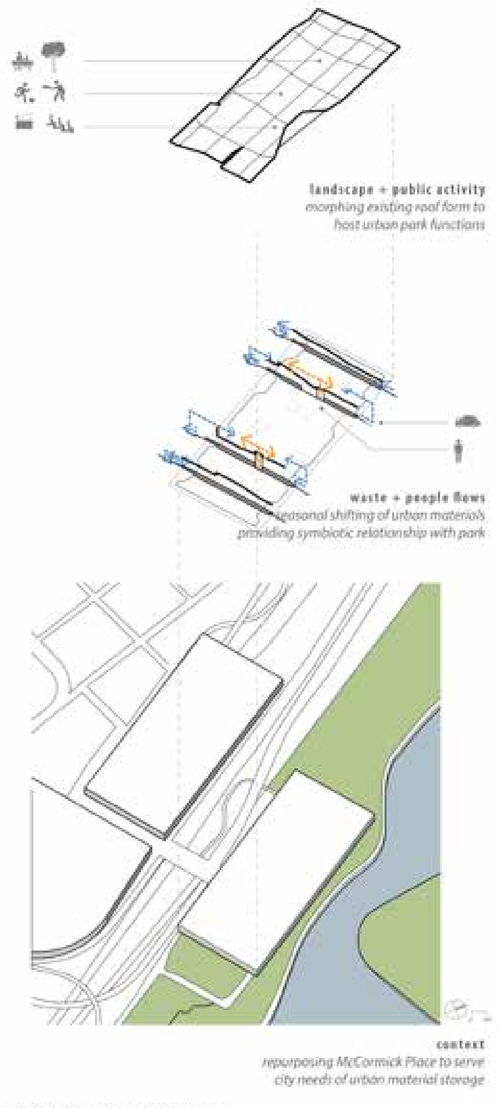
Fig. 10 – Diagram of From Place to Plant (Image: author).



city has imposed on the landscape. The complex is comprised of two buildings and a weigh station pavilion. The two buildings are constructed from a bolted steel structure that can easily be dismantled in the future and enclosed in a recycled polycarbonate. The roof structure is a single pitched green roof that merges with the sloping landscape around it. Not only is the building constructed with recycled materials, but also the entire complex is contrived as a built form that is designed for a lifetime of twenty-five years. After this time, it can be easily dismantled and elements recycled elsewhere. By thinking about the lifespan of the building as part of a larger system, it is merely a piece that is plugged into a larger whole. This elevates the building from pure function to a part of the urban landscape that adds value to its everyday functions.

The landscape projects compiled in this analysis are examples of former landfills that have been given new life. These landscapes of waste can be reclaimed as environments inhabited and used by wildlife and people. While the majority of the building examples were in Europe, a number of these landscape projects are in the United States, where landfills are the prominent means of waste disposal. These designed landscapes are able to foster multiple activities such as recreation, wildlife habitat, and energy production. One of the most prominent examples of a landfill-to-park transformation is the Freshkills Park in Staten Island, New York (Figure 5). Closed in 2001, this landfill was the major recipient of trash from all boroughs of New York and

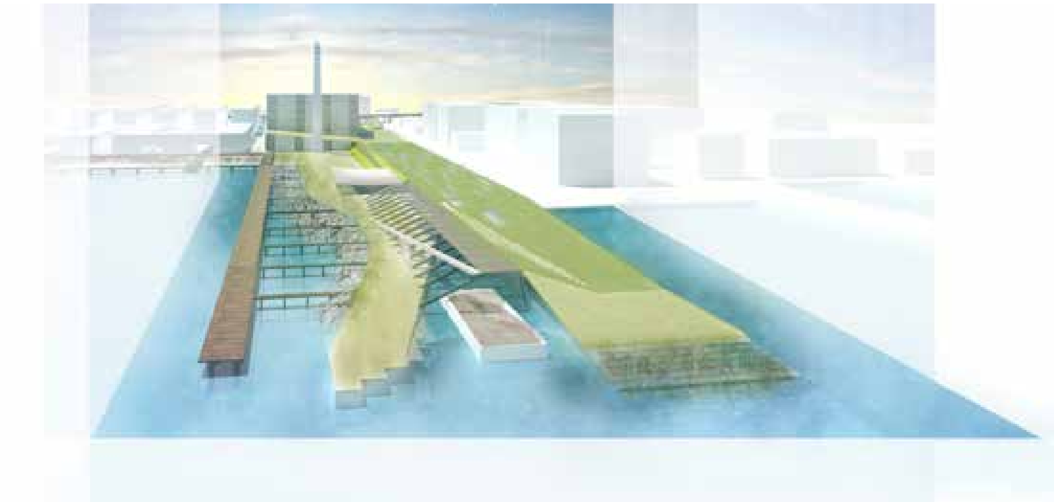


Fig. 11 – Theoretical design proposal of Sunset Park Waste to Energy plant and park (Image: author).

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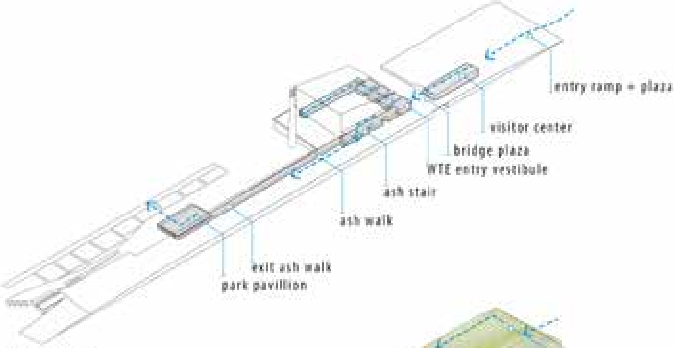
Fig. 12 – Layers of movement: waste, people, and landscape (Image: author).

was the largest landfill in the world. Designed by Corner/ Field Operations, the first phase of the park opened in 2008. Its uses include a variety of public spaces and facilities for recreation, wildlife habitat, energy production, art and culture, and education.

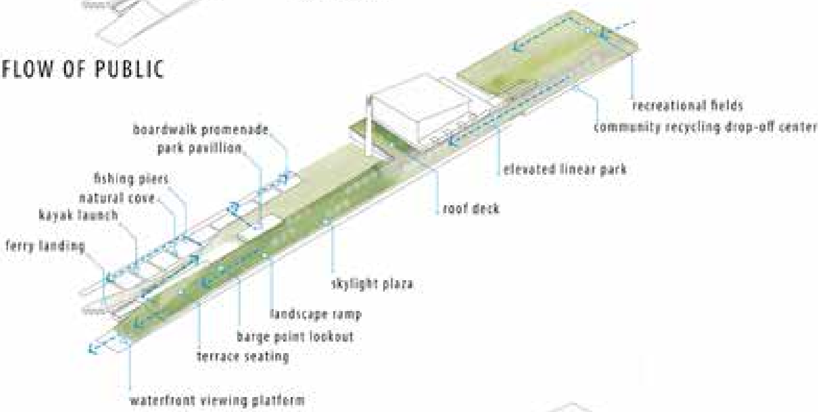
Engaging the public with waste

As mentioned earlier, cities are complex ecosystems with many interwoven systems. As we think about the opportunity to engage waste networks with other urban networks, we can start to look for synergies: places that require us to abandon our binary view of the urban environment: building vs landscape, private vs public; and instead turn to nature where complex systems overlap and any synergy between two improves efficiency. Therefore, in analyzing these waste-oriented projects, the hybrid condition elicits further analysis. Several projects, both conceptual and completed in recent years, allow us see ways in which designers were able to engage the general population in the process of waste management. All of these projects take place in cities: varying from Copenhagen and Barcelona, to New York and Chicago. These are places where urban dwellers can connect in a new way to the waste they are generating and understand the critical link between themselves and this larger system they are an integral part of.

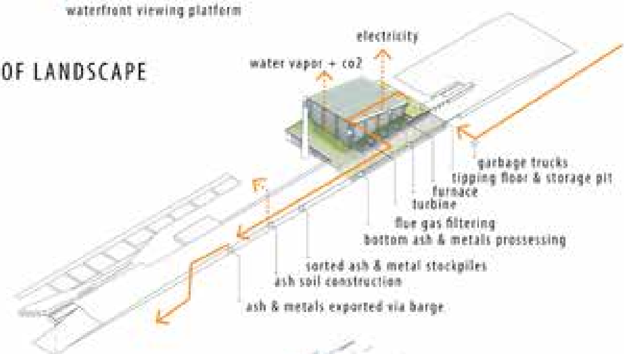
Starting in Europe, we can look to Denmark and Spain, where necessity dictated finding innovative ways to deal with waste. The waste-to-energy plant has less of a negative connotation here than in the United States, and people are quicker to embrace the need for innovative, efficient systems. In Copenhagen, two projects by Bjark Ingles Group show that it is possible to integrate public activity with waste management functions: with both a waste-to-energy plant and a recycling center. The first, Amager Bakke Waste to Energy Plant, open in 2018, combines waste treatment with public amenity to create a hybridized building typology. Figure 6, as well as the accompanying diagram for each of the following projects, shows the layers of the project and how different systems, waste and people, flow through the project. By incorporating a public ski slope into a waste to energy plant, the building is elevated from a typical industrial building to a new typology that at-



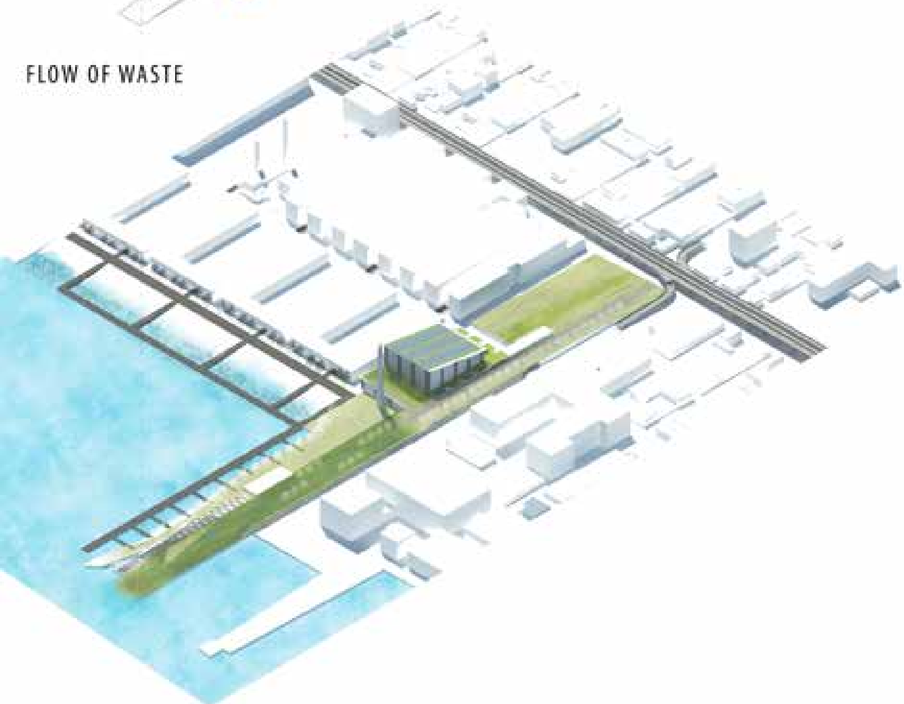
FLOW OF PUBLIC



FLOW OF LANDSCAPE



FLOW OF WASTE



tracts and encourages public interaction with what is typically regarded as negative and 'off-limits'. Located in an industrial area not far from the central historic district of Copenhagen, the building serves as a destination for visitors and locals alike.

Another project by Bjarke Ingles Group that plays with the idea of how industrial functions can be combined with public activity is Sydhavyns Recycling Center, conceptually planned in 2016. It is located in the Sydhavyns district of Copenhagen, southwest of the historic city center. Located near the water within a light industry area, this recycling center imbeds itself into the landscape, connecting with a large park (Figure 7). The project acknowledges that industry and public activity can be interwoven into a coherent space. «As a society, our investment in waste management often ends up as utilitarian facilities of concrete boxes that constitute grey areas on our city maps,» explained BIG in a statement. «What if they could become attractive and lively urban spaces in the neighborhoods they form part of?» Rather than acting as a building separated from its natural context, the building instead tucks itself underneath and within the altered landscape. As stated by BIG, the recycling center is «[...] a way to start thinking of our cities as integrated manmade ecosystems, where we don't distinguish between the front and back of house. But rather orchestrate all aspects of daily life, from consumption to recycling, from infrastructure to education, from the practical to the playful into a single integrated urban landscape of work and play» (Bjark Ingles Group, 2015). This integration between buildings and landscape in the urban environment is an important shift in design thinking. By realizing that all spaces, both buildings and landscapes are constructed entities within the city often combining complex networks of infrastructure, it can be argued that any design needs to address the overlap of architecture and landscape.

By acknowledging that these buildings of industrial use are a necessary and integral part of our cities, they can become part of the fabric of the city. A built project in Barcelona by the architecture firm Abalos & Herreros in 2004, Ecopark does just that: it is an expansion of a waste treatment facility that stiches across layers of urban fabric to tie the recycling facility to a public promenade and beach amenity (Figure 8). Located in the North Eastern area of Barcelona, the design blends programmatic services into the landscape, creating a hillside that acts as a buffer to ease the tension between the extending promenade and the nearby highway. The public plaza weaves between this hillside, a facility building, outdoor facility elements and shifted topographic changes to navigate the public from the edge of the highway along the facility, to the beach. By linking various pieces of the public plaza along both building and landscape elements of the facility, it becomes an integral backdrop to the beach amenity.

These projects, both built and planned, illuminate the possibility of engaging the public through recreational activity with the industrial nature of waste management. We can see that the two do not need to be separated, but can exists in a designed ecosystem together. This innovative design thinking has yet to be fully realized in the United States; most waste management is still dominated by landfilling with some efforts of recycling. The conversation is beginning, however, and some conceptual projects show the potential for this new typology of integrated public-industrial waste facilities.

The first project, Flow City, is a unique project that captures the desire to link the public with the operation of trash movement in New York. This project was constructed as an exhibition along the 59th Street Marine Transfer Station along the Hudson River in 1983. It was completed by artist Mierle Ukeles, who in her manifesto describes her work as «maintenance art» and has been the unsalaried artist-in-residence at the New York City Department of Sanitation since 1977. In the artist's own words: «I call it FLOW CITY because it embodies a multiplicity of flows: from the endless flow of waste material through the common and heroic work of transferring it from land to water and back to land, to the flow of the Hudson River, to the physical flow of the visitors themselves» (Ukeles, 1996, p.201).

This exhibit enables residence to experience the 'violent theater of dumping' in an attempt to bring consciousness to people that their garbage has a life after they throw it away. «The fantasy that many people have about garbage is that it exists outside the realm of time. There's such denial involved» (Ukeles, 1996, p.10). In Flow City, people are led through a sequence of moments that run parallel to the flow of trash as it enters the station and moves into barges that bring the trash to Freshkills Landfill, Figure 9. They first walk through the 'passage ramp', which is a narrow metal grate passage that runs above a floor strewn with trash. Next, they observe the act of trucks unloading trash into barges along the 'glass bridge'. Finally, they end at the 'media flow wall': a wall of screens that show the continued journey of the trash through a series of live feed cameras, as well as images and models of Freshkills Landfill, the garbage's final resting place. While this project is not a design project by an architect, it is extremely pertinent to the conversation of exposing the invisible process of waste management to the general public. This affords the public to make the connection between the trash they put

to the curb for the garbage man to collect, and the aggregate mass of trash produced by everyone in the city, along with the labor required to handle it.
Moving from waste management to the broader logistical needs of a city, is the project From Place to Plant by Lateral Office, which reimagines McCormick Place in Chicago as an opportunity to simultaneously «address and celebrate Chicago's impressive urban logistics while extending the city's project of open space by creating a new urban park experience». Lateral Office (2011). This speculative project repurposes the building as a plant for the management of urban materials such as soil, trees, salt, sand, and snow. Conceptually, the programmatic needs of material storage shift through the seasons, and the urban park located on the roof of the building acts as a receptacle for these materials and repurposes them to suit the needs of the varying public amenities being offered, again shifting throughout the seasons. Waste flows in and out depending on the season and current need of the city and then up to the roof to serve the public in the roof parkscape (Figure 10). The proposal includes transforming the roof through a series of strategic moves: folding, punching, pulling, pushing, and bending. This allows a range of urban experiences that respond to the season, such as a beach during the summer with surplus sand from the winter or sledding parkland during the winter by blowing filtered snow from urban collection. On their way up to the roof, through transparent cores, visitors can catch views of the storage space. This project has a two-fold set of functions. It serves the needs of the city itself by storing and managing urban materials and the citizens of the city by providing a public park. Rather than achieving these two functions completely divorced from each other, which is common practice throughout American cities, Lateral Office has intertwined these functions in a symbiotic relationship in which both functions inform and strengthen each other.
The final speculative project, informed by the research and analysis of the projects proceeding, was completed by the author as final component of a thesis project. It attempts to connect urban and waste ecologies at the scale of the city as well as connect people to the trash they generate in a meaningful way. The proposal creates new avenues for public engagement with waste process-

opposite page
Fig. 13 – Public entry sequence into waste-to-energy center (Image: author).

es through the design of a waste-to-energy plant and public space. This design proposal not only invites the public into the process of waste management but also frames garbage as a resource for the production of public space in order to shift the notion of placing value in in waste infrastructures. This project is situated along the Gowanus Bay in Sunset Park, Brooklyn, New York along a largely underutilized and derelict industrial waterfront, (Figure 11), incorporating architectural and landscape design into one fluid experience. Figure 12 peels apart the layers of the design: guided by the flows through the project: flow of waste, the flow of landscape, and the flow of public. These flows operate in multiple directions and dimensions. The design extends from the edge of the city fabric, seen in Figure 13, down to the water's edge with a design agenda to join the industrial process of a Waste-to-energy facility with public activity that engages with and benefits from the Waste-to-energy plant.

The project actively engages the public with unique aspects of waste processing at key areas along the length of the facility, called out in Figure 14 as the visitor and recycling center, the crane theater, ash walk and skylight plaza, and barge point. Within each one of these areas, the public and trash intersect in a unique way. In carefully crafted locations, the public is able to engage with a stage of waste processing that is a spectacle to behold. People are able to connect with the overwhelmingly large scale at which these facilities operate and better understand the role they play in the cycle of waste.

Towards an integrated urban waste ecology

By examining ways to rethink the relationship between people, cities, and the waste they generate, this research serves to open the conversation of engaging designers in waste processing. This speculative design project along with the research that supports it seeks to act as a catalyst for further discussion about ways to reevaluate the perception, management, and treatment of waste.

All of these projects shine a light on what has historically been a missed opportunity for designers: the ability to design the often neglected and disconnected industrial realm of waste management. As our urban ecosystem grows more complex in a quickly urbanizing world, now is the time to seize the opportunity of engaging and connecting waste and urban ecologies into a system that benefits all facets of the city. We can see through these projects that it is possible to connect public activity with industrial processes and that designers can add introducing cultural, economic, and environmental value in waste infrastructure.

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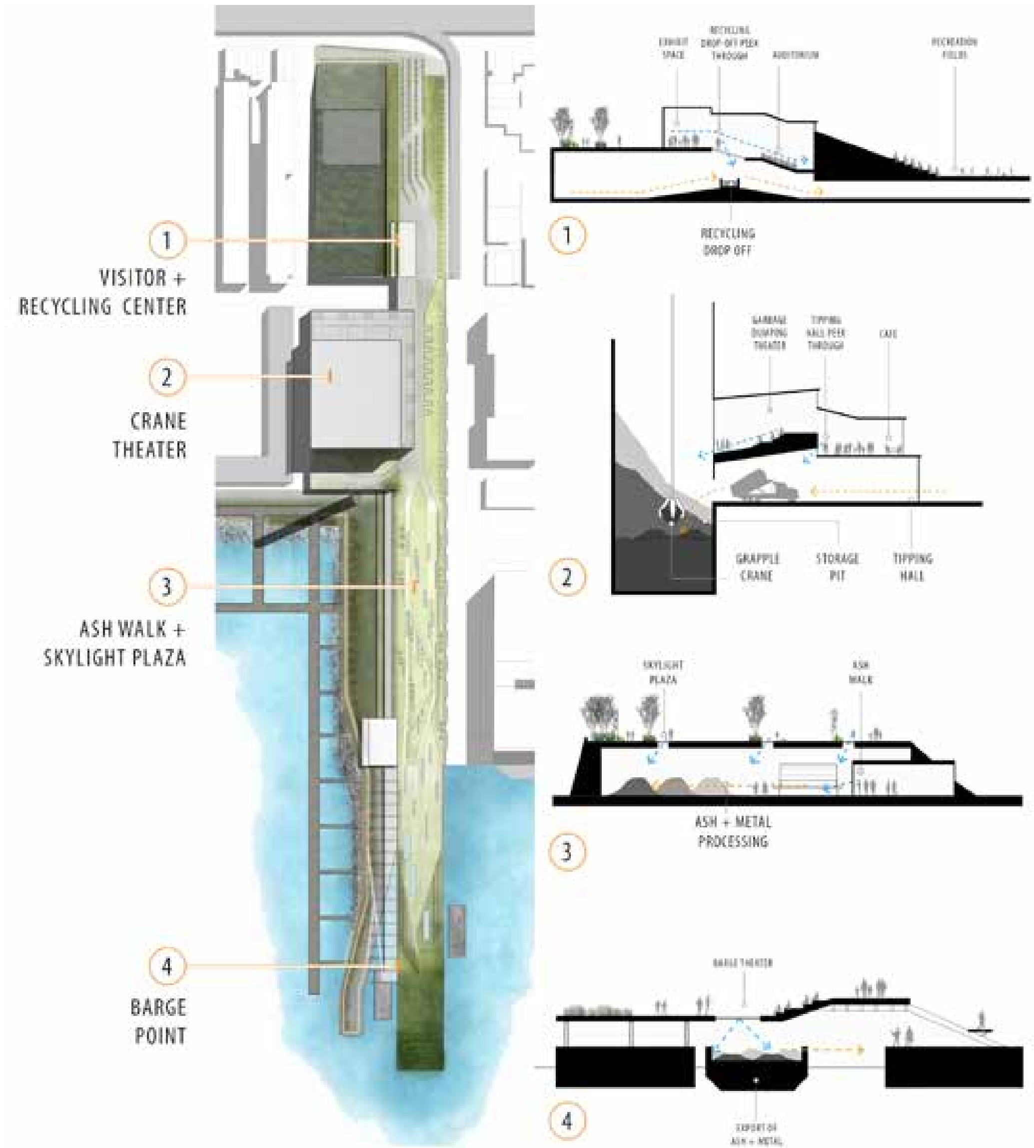

Fig. 14 – Key moments of interaction between people and trash (Image: author).

References

Accuardi Z., Babbitt M., Chen R., Lee E., Mayo T., Rice E., Westby K. 2011, *Waste-to-Energy Design Proposal for Red Hook, Brooklyn*. Earth and Environmental Engineering, Columbia University, unpublished.

Belanger P. 2007, *Landscapes of Disassembly.* «The International Review of Landscape Architecture and Urban Design». n. 60, pp. 88.

Berger A. 2006, *Drosscape: Wasting Land in Urban America,* Princeton Architectural Press, New York.

Bjarke Ingles Group, *Sydhavyns Recycling Center*, <http://www.big.dk/#projects-gbs> (10/15).

Georgoulias A., Kara H., Asensio Villoria L. 2015, *The Missing Link: Architecture and Waste Management*, «Harvard Design Magazine», n. 40. *Well,Well,Well*. <http://www.harvarddesignmagazine.org/issues/40/the-missing-link-architecture-and-waste-management>.

Georgoulias A., Kara H., Asensio Villoria L. 2017, *Architecture and Waste: A (Re)Planned Obsolescence,* Actar Publishers, New York.

Engler M. 2004, *Designing America's Waste Landscapes*, The Johns Hopkins University Press, Baltimore.

Gastil R. 2002, *Beyond the Edge: New York's New Waterfront.* Princeton Architectural Press, New York.

Humes E. 2012, *Garbology: Our Dirty Love Affair with Trash*. Penguin Group (USA) Inc., New York.

Knechtel J. (ed.) 2007, *Trash*. The MIT Press, Cambridge.

Lateral Office 2011, *From Place to Plant.* <http://lateraloffice.com/filter/Work/FROM-PLACE-TO-PLANT-2011> (10/15).

Lynch K. 1990, *Wasting Away,* Sierra Club, San Francisco.

Manfredi M., Weiss M. 2015, *Public Natures: Evolutionary Infrastructures*, Princeton Architectural Press, New York.

Melosi M. 2005, *Garbage in the Cities: Refuse, Reform, and the Environment*, University of Pittsburgh Press, Pittsburgh.

Nagel R. 2013, *Picking Up: On the Streets and Behind the Trucks with the Sanitation Workers of New York City,* Farrar, Straus and Giroux, New York.

Phaidon Atlas, *Recycling Center for Urban Waste* <http://phaidonatlas.com/building/recycling-plant-urban-waste/3299> (10/15).

Ukeles, M.L. 1996, *Flow City*. «Grand Street», n. 57, pp.199–213.

UNStudio, *Waste Disposal Installation*, <https://www.unstudio.com/en/page/3259/waste-disposal-installation> (10/15).

Rehabilitation of the Hiriya Landfill, Tel Aviv

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Abstract
Hiriya, a closed domestic waste landfill, is situated on the wide river plain in the southeast of Tel Aviv. The impressive landmark is part of the future Ariel Sharon Park. It is getting rehabilitated since 2004. Aim is to preserve its captivating silhouette and to develop the landscape of and around the mountain by using construction techniques that take into consideration the waste tip's instability and make use of local materials whilst incorporating the region's traditional land uses and specific climatic conditions. The artificial appearance of the landscape and its origins become a part of a positive experience of the site – a convergence of nature and culture.

Keywords
Landfill Rehabilitation, Stormwater Retention, Resilient Park Landscape, Recycling & Education, Transformation

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The *Hiriya* landfill, possibly the largest waste tip in the Near East, came to be in 1952 on the site of a Palestinian village abandoned in the Arab-Israeli War. It is situated on an agricultural plain in the southeast of Tel Aviv and is encircled by the two rivers *Ayalon* and *Shapirim* (fig. 1). The heap has the impressive dimensions of nearly 1 kilometer, in length, and 87 meters in height, and contains 16 million cubic meters of household waste. The annual river floods wash around the foot of the mesa's steep slopes, adding to the risk of the large and unstable hill's collapse. This would result in pollution of uncontainable environmental proportions. Dangerous leakages of water and gas posed a problem from the onset. The site also became a danger for aircraft flying near *Ben Gurion* Airport as it attracted thousands of sea birds. For these reasons, the *Hiriya* landfill was closed in 1999.

As is often the case, problems seldom come alone. It almost seems fateful that in Israel, of all countries, the long dry season is followed by a short period of winter rains that cause severe flooding to some areas of Tel Aviv, often for several days. During the British Mandate several hundred hectares southeast of the city had already been earmarked for flood retention and plans drawn up for a tunnel to drain rainwater into the sea. Eventually the *Ayalon* River was converted into a large open canal through the centre of the city alongside which railway tracks and the Highway 1 and Highway 20 motorways were aligned. Due to extensive soil sealing and the resultant reduction of water retention capacity within the river catchment area as well as the rapid growth of the city into the retention area, its size became insufficient and flooding became more severe. The canal cannot be enlarged, not least because of the existing transport infrastructure.

The expanding and ever-denser region of Tel Aviv crowds out many recreation spaces and increases the distance to the open landscape. This development can only be compensated through parks being large and robust enough to incorporate safely the divergent interests of recreation-seeking visitors, flood control, nature conservation, politics, science and the arts. Hiriya is only one part of the vast Ariel Sharon Park project. Transforming the waste tip is the symbolic start of constructing a much larger park landscape, which will also have to provide capacity for retaining seven million cubic metres of floodwater from the *Ayalon* River and its tributaries (fig. 2). Despite its internal differentiation, the *Hiriya* landfill appears as a monolith in the new landscape, a spectacular peak and a prominent landmark as seen across the plain (fig. 3).

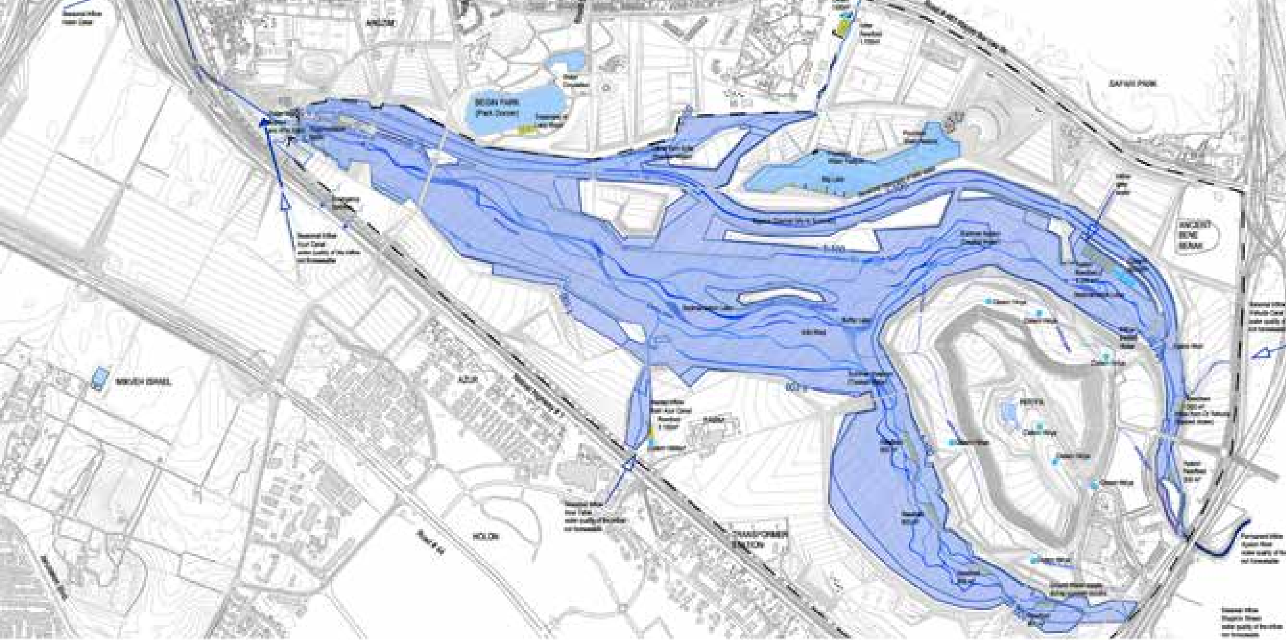
The fascinating appearance of the 'mountain' brought politicians as well as artists to the scene

Fig. 1 – The Hiriya landfill, aerial view 2004 (© Beracha Foundation).

opposite page
Fig. 2 –Centennial floodwater scenario in the future Ariel Sharon Park (© Latz + Partner).
Fig. 3 –Hiriya - a monolith protruding from the Ayalon plain 2004 (© Latz + Partner).
Fig. 4 –Hiriya - from the viewpoint of an artist (© Mischa Ullman).

(fig. 4). In the late 1990s, the *Beracha* Foundation under Martin Weyl worked with artists and international experts to help their search for solutions. They consulted waste disposal and hydraulic engineers, urban planners and landscape architects. In 2004, an international design competition was launched with the brief to develop ideas for rehabilitating the landfill (fig. 5). The objective was to make it a positive landmark and solve technical problems of instability, which, in addition to gas leakages, were the main factors that rendered it unusable. A competition for the 840-hectare site of what was to become *Ariel Sharon Park* followed in 2009 with the aim of turning the flood retention area into a park (fig. 6). The concepts by Latz + Partner convinced both competition juries.

Our main objective is not to hide the technical nature of structures, but to develop a new aesthetic realm of experience around them that is resilient in its cultural context. From a distance, *Hiriya* has the appearance of a 'mystical mountain' amidst the wide plain of the *Ayalon* and *Shapirim* rivers.
Our aim is to preserve its captivating silhouette. The landscape of and around the mountain gets now developed by using construction techniques that take into consideration the waste tip's instability and make use of local materials whilst incorporating the region's traditional land uses and specific climatic conditions. The artificial appearance of the landscape and its origins, not neglected, are a part of a positive experience of the site – a convergence of nature and culture (fig. 7).


BEGIN PARK
(Park Darom)
SAFARI PARK
ANCIENT BENE BERAK
MIKVEH ISRAEL
AZUR
HOLON
TRANSFORMER STATION

Preserving the mountain

The *Ayalon* and *Shapirim* rivers have been realigned more than one hundred meters from the mountain and meander freely through broad 'wadis'. The excavated material plus several millions cubic meters of construction demolition waste is used to build a circular landscape terrace around the foot of the slope in order to stabilize it and so retain *Hiriya's* unique landform. A new tree-covered space has been created for a variety of recreational, play and sports activities. Characteristic agricultural patterns found in the local environment, will be planted on the site, mostly in the form of olive groves and orchards. They require little water, provide shadow, are easy to maintain and perpetuate the traditional historic cultural landscape (fig. 8).

Preserving the waste

The three plateaus of the refuse heap and the oases are sealed with a combination of natural and synthetic materials, and the biogas is safely extracted and utilized. Water is still seeping from the tip and gets collected and treated in separate 'green sedimentation tanks'. A layer of gravel made of recycled construction waste, and clean soil cover the plateaus and the inner slopes of the mountain. A large amount of this material is produced in a recycling plant on the eastern mountain slope where a mas-

Fig. 6 – The Ayalon plain - becoming both a flood retention basin and a spacious park (© Latz + Partner).

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Fig. 5 – Competition plan and five landscape elements - wadi, foot terrace, steep slope, plateau and oasis (© Latz + Partner).

sive sheet pile wall secures the large levelled working platform against pressure from the mountain. The recycling plant is one of *Hiriya's* visitor attractions and is currently being extended by a large RDF waste-to-energy-plant. Coachloads of students, administration workers, politicians and the interested public from all around Israel visit the site to learn the sustainable treatment of waste and how to live with it (fig. 9).

Establishing the vegetation

On the *plateau* and the steep slopes, a drought resistant, mostly low vegetation is prevailing, as it requires little maintenance. Storm water is harvested on the *plateau* and collected in underground reservoirs during the rainy season. (Fig. 10) It is employed to irrigate densely planted areas in dry periods. Much of the vegetation along the freely meandering Ayalon and Shapirim rivers is expected to establish spontaneously.

Exploiting the topography - the oasis

A sheltered depression in the center of the mountain, once the site of a noisy and dusty waste disposal plant, has been transformed into terraced slopes and an open 'spring water landscape' for intensive use. A solid concrete platform in the center, where once large machines stood, is *Hiriya's* only

Fig. 7 – Silhouette of Hiriya with foot terrace and dislocated rivers in the wadi (© Latz + Partner).
Fig. 8 – The different landscape elements in the masterplan 2011 (© Latz + Partner).

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Fig. 9 – Waste products in the visitor center (© Latz + Partner).

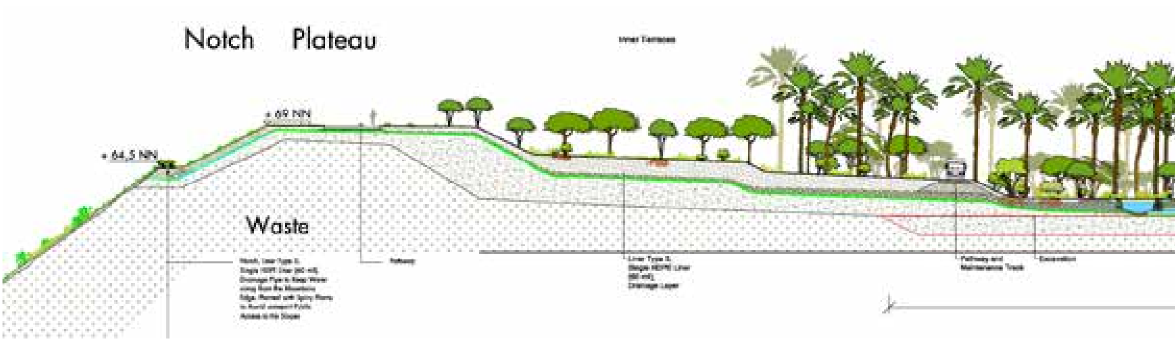

Fig. 10 – Drainage and subterranean reservoirs enable an oasis in the center (© Latz + Partner).

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Fig. 11 – Service facilities built on a concrete platform - the landfill's only stable area (© Latz + Partner).
Fig. 12 – Dry stone walls adapt to the mountain's movement (© Latz + Partner).

stable area. It accommodates central functions in the park and a café/restaurant (fig. 11). Traditional dry stone walls of recycled construction material stabilize the slopes around the valley (fig. 12). The walls are able to adapt to movement in the mountain and provide the best conditions for the type of vegetation that is characteristic of the Mediterranean and for a variety of small-scale spaces. Buried layers of gravel serve as cool storage areas for harvested rainwater that is used to top up small bodies of water throughout the year (fig. 13). The use of communal supply water to get through the dry season is to be kept to a minimum. A lush vegetation of palms and other trees, shrubs, aquatics and flowering plants has been created in the center of the park as a symbol of nature and Mediterranean culture (fig. 14).

Mise-en-scène

After arriving by car, bus or on foot (fig. 15), we first cross the Shapirim and Ayalon 'wadis' (fig.16). We cross the large terraces where, at the foot of the steep mountainside, after construction work is finished families will have picnics and people exercising will enjoy the day (fig. 17). We reach a gently sloping ramp that follows the contours of the terrain and invites us to walk up to the top of the mountain. First, we look across to the recycling plant on our left. Immediately above the working platform and secured by a sheet pile wall, a long promenade allows the recreation area to sit alongside the fascinating activities at the waste recycling plant – the origins of the park. We continue through the terraced valley on the inner mountain slopes until we reach the cool and refreshing oasis where we pause – perhaps to have a drink and to listen to the sounds of the water (fig. 18). Finally, we continue to the *plateau* where we enjoy stunning views of Ariel Sharon Park, the sea and across the green agricultural land towards Jaffa and the dunes of Holon. However, before we get there, we pass a sheltered 'indentation' on the northwestern side of the *plateau*. We sit down under spectacular wooden structures that look like over-dimensioned parasols, and we learn that they adjust to movement in the mountain just like tumbler toys (fig. 19). All the same, it feels safe enough to cast our gaze across the Ariel Sharon Park and towards the white city of Tel Aviv (fig. 20).

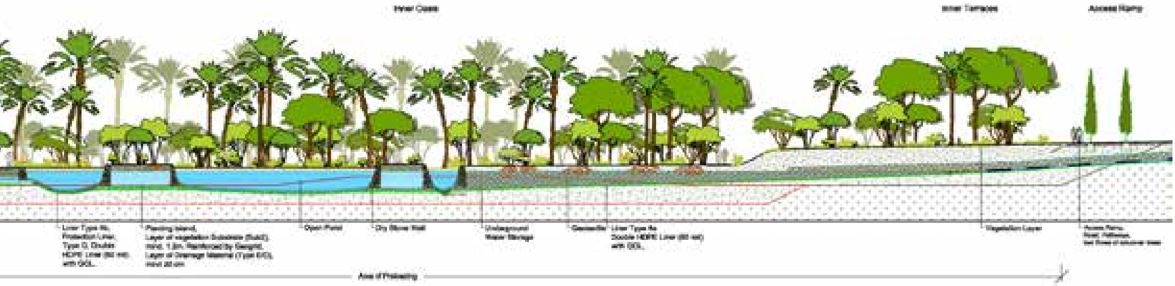
Inner Oasis
Inner Terraces
Access Ramp
Open Pond
Dry Stone Wall
Underground Water Storage
Geotextile
Vegetation Layer

Fig. 13 – The oasis 2014 (© Latz + Partner).
Fig. 14 – The contaminated landfill - transformed into a symbol of nature and mediterranean culture (© Kobi Li).

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Fig. 15 – Future multifunctional groves in Ariel Sharon Park (© Latz + Partner).
Fig. 16 – Image of the Shapirim and Ayalon wadis (© Latz + Partner).

Fig. 19 – Approaching the Belvedere and its shady umbrellas (© Ariel Sharon Park Company).
Fig. 20 – Visitors admiring Tel Aviv's skyline (© Latz + Partner).

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Fig. 17 – Image of agricultural patterns on the foot terrace (© Latz + Partner).
Fig. 18 – Crossing Hiriya's oasis (© Latz + Partner).

A recovered landfill in the construction of a metropolis: Valdemingomez Forest Park, over time

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Abstract

The project for the recovery and transformation of the Valdemingomez landfill in Madrid required the application of complex environmental engineering processes, as well as new architectural strategies. Today, it is a place which can be incorporated, with full guarantees, into the city structure, as long as it is viewed as a 'monumental' public space. It is recovered ground which is capable of becoming a new, free metropolitan space that can respond to the current and future needs of society, especially if it remains as such over time. The architectural project which was undertaken involved the proposal of new strategies for creating an area which will be open, flexible and dynamic throughout time, in a search for equilibrium between city and nature.

The Valdemingomez landfill constitutes an example of a proposed model of continuity between the forest and the surrounding area; a pseudo botanical garden with indigenous species seeking integration into the Parque Regional del Sureste (Southeast Regional Park). It was transformed into a free, public area with pedestrian paths and bicycle lanes, along with woods and wetlands which have helped to create small, localized ecosystems. Within it, one can observe the life of both nature and the city.

Keywords

Landfill, Recovery, Landscape, Territory Planning, Community

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Contextualization

The analysis of the recovery and transformation of the Valdemingomez waste landfill permits to study the development in the treatment and management of waste caused by the rapid growth in population that the city of Madrid has experienced since the second half of the 20th century. The amount and composition of the waste deposited in the landfill have changed substantially in a few decades, and as a result and at the same time, in the last third of the century the implement of a spatial-temporal plan with this purpose will begin. A new conscience too.

The first urban waste landfill of the 20th century in Madrid, opened in 1950, was called *La China*, located in the south and next to the Manzanares River. The unstoppable growth of the city in the second half of the century, forces to close down the landfill and move it to marginal lands outside the city. As a result, the Valdemingomez landfill materializes.

The city of Madrid fails to locate landfills in places distant enough from the center, so that they do not disrupt the health of its inhabitants avoiding, at the same time, long itineraries not to make the service more expensive.

The Valdemingomez landfill, Madrid. 1978-2000

The entry of the seventies in the 20th century was marked, in relation to the municipality of Madrid, by an increasing cycle of waste production that put the necessity to enlarge the capacity of landfills.

In 1972, *Fomento de Obras y Construcciones*, S.A. (FOCSA), the successful bidder company of the competition organized by the Madrid City Council to renew the collection for the central area of the capital, includes the temporary transfer to the municipality of certain lands located in Madrid, in the area called Valdemingomez, at kilometer 14 of the III National Highway (Madrid-Valencia), and at a distance of 3 kilometers from it and 15 kilometers from the city center. It is the southeastern limit of the municipality of Madrid and the limit of the Vallecas District.

These are gypsiferous, arid and deteriorated lands. Their little or non-existent landscape or agricultural value, their distance from the city (on the boundary of the municipal area) and the topography were the reasons for which they were chosen as the future landfill for Madrid.

The Valdemingomez landfill area was inaugurated in 1978, and formed the access gateway and connection point between the city (fig. 1) and one of the largest metropolitan projects of the Community of Madrid: the Southeast Regional Park, a pocket of protected land on which the city was irreversibly encroaching and which will eventually be incorporated into its infrastructure.

Fig. 1 – Madrid, aerial photograph. Relationship between the Valdemingomez landfill site and the city. (Photo: GoogleEarth 2014).

In its 22 years of activity (fig. 2), the Valdemingomez landfill accumulated more than 21 million tons of waste. This rose to a maximum height of 652m above sea level (Ayuntamiento de Madrid, 2003, p.10), around 40 meters higher than its original level and that of the surrounding terrain. The record year for waste deposition was in 1991, when 1,301,336 metric tons were dumped there, the equivalent of 98.6% of the refuse generated in Madrid for that year. This percentage shows that, at the time, only a small amount of waste was sent for recovery or composting. The everyday use of the landfill was planned according to techniques which had been in use in Europe for years, especially in England. This planned system consisted of three stages: shredding of the waste in a plant; transport to the discharge platform, known as a landfill; and finally, the spreading and compacting of the waste (fig. 3). Every two days, this process was supplemented by the spreading of various layers of inert material of a thickness of about 20cm. These layers served to prevent the presence of rodents and bad odors, to avoid the dispersion of material by wind and to prevent fires.

Valdemingomez quickly became the nucleus around which successive environmental infrastructures began to grow: Madrid's most important plants for the treatment and elimination of solid urban waste, which now form the so-called *Parque Tecnológico de Valdemingomez* (Valdemingomez Technological Park – fig. 4).

In 1993, an important event occurred in the history of the Valdemingomez landfill: the renewal of the waste collection contract for the Peripheral Sector of the capital, a contract which was awarded to FOCSA in 1968. The offer submitted by this company included, as an improvement, the definitive assignment of the ownership of the land to Madrid Council. From that point forward, the Valdemingomez

Fig. 2 – Trucks unloading waste into the Valdemingomez landfill, Madrid. (Photo: Madrid Council, in the 90s of the 20th century).
Fig. 3 – Valdemingomez landfill, before the recovery. Formation process, aerial photographs: 1980-1985-1995-1999. (Photo: Madrid Council).

landfill became a land which was owned in full by the city, or in other words, a public place. In 1995, the first research took place into the potential harvesting of biogas from the landfill, to harness its energy. The end of the landfill's useful life was in sight and therefore the Council started to look for alternative uses, ones which were more suited to the new demands of current environmental legislation.
On March 2nd of 2000, the Valdemingomez landfill closed its doors for good, after a 22 year existence.

Landscape recovery and transformation. 2000-2003

The project for the landscape recovery and transformation of the Valdemingomez landfill involved, from a technical standpoint, four basic operations: the sealing of the entire surface; the installation of a degassing network to extract the biogas accumulated within the mass; the construction of a power station which uses said gas to produce electricity; and lastly, the transformation of the surface into more than 110 hectares of Forest Park (fig. 5). A waste research center was built alongside said area, the *Centro Tecnológico Medioambiental* (Environmental Technological Center, using the recovery and transformation of the aforementioned waste

VALDEMINGÓMEZ TECHNOLOGICAL PARK

1. Valdemingómez Forest Park, degassing and forest surface maintenance
2. Environmental Technological Center
3. Bicycle paths
4. Wetlands and bird-watching refuges
5. Meadow areas
6. Biogas energy recovery
7. Biogas purification and concentration
8. Classification and separation of recyclable materials, energy recovery
9. Classification and separation of recyclable materials, composting, processing of plastics, incineration of dead animals
10. Maintenance of the sealant layer of the inert waste landfill
11. Biomethanation
12. Classification and separation of recyclable materials and composting
13. New landfill with cells

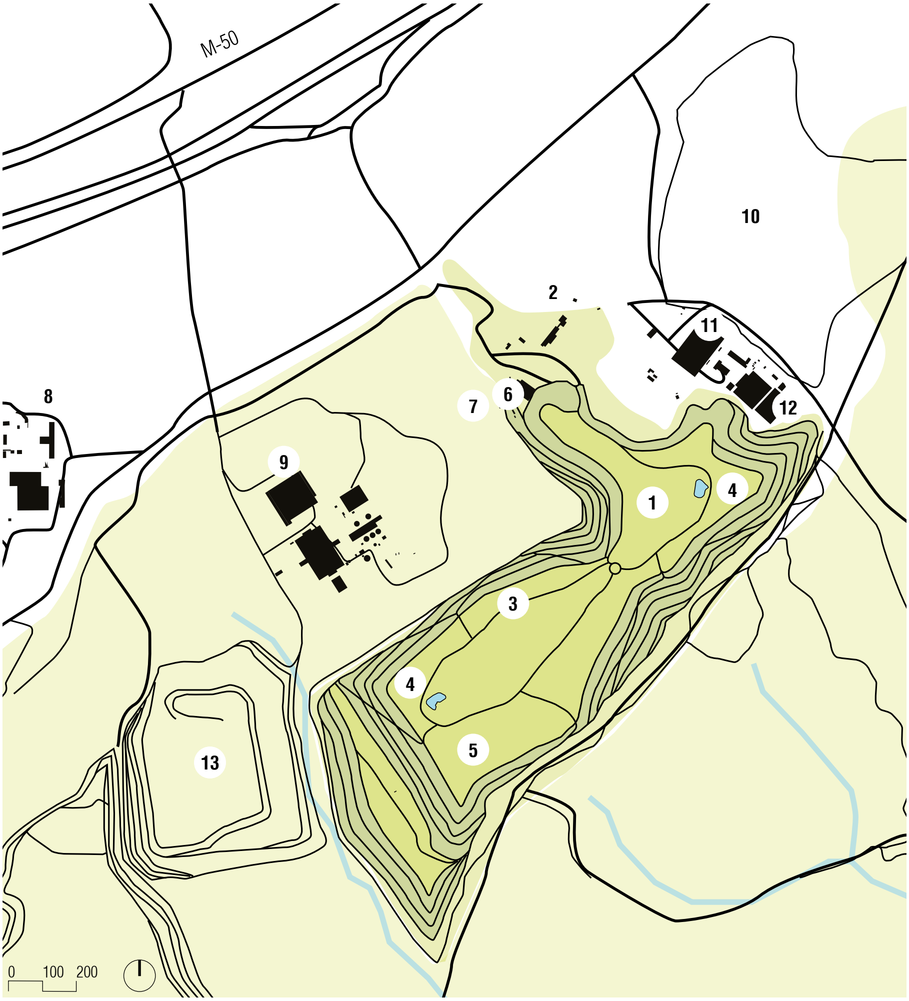

Fig. 5 – Valdemingomez Forest Park, aerial photograph. (Photo: Madrid City Council 2003).

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Fig. 4 – Valdemingomez Technological Park. (Photo: Israel Alba 2015).

shredding plant which was built in Valdemingomez. The project includes environmental monitoring of the landfill for a period of over 30 years.

After 22 years of uninterrupted delivery of solid urban waste, there were two fundamental objectives for the Valdemingomez landfill. The first was to ensure the general confinement of the mass of waste deposited on the site, particularly the methane gas produced by the decomposition of organic material. The second objective was to provide adequate support for the installation of the structures designed for the degassing and subsequent revegetation.

To achieve this, a succession of layers of different materials was spread over the surface and one of the most significant of these layers was a double sheet of polyethylene: impermeable to the gases from the interior and to water from the exterior. The most suitable solution was applied to each zone of the landfill, based on the most advanced technical and environmental criteria of the time, in order to produce the maximum safety and stability in the mass of waste. The covering layer was supplemented by rainwater drainage systems which prevent water from accumulating on the landfill surface, anti-leachate systems[1] which avoid contamination, and supervision and surveillance systems throughout the entire landfill.

A multi-layer coverage system was employed and it was formed of the following basic components: 1. A layer for the leveling of the landfill surface; 2. A gas drainage layer; 3. An impermeable layer; 4. A layer for the drainage of rainwater from percolation; 5. An upper layer of soil and support for vegetation. The formulation of each of the layers individually and as a whole was adapted to two types of surface: sloped areas and the crowning area or plateau (fig. 6).

To protect the topsoil against the effects of water erosion on the sloped surfaces, the plan was to use a synthetic sealant and therefore an anti-erosion mesh of jute fiber was installed. A large quantity of bushes were then planted and lastly, the entire slope was hydro-seeded to create a carpet of vegetation which would protect the surface from any initial rainfall as well as giving it a natural look right from the beginning, integrating it into the surrounding landscape.

Neither jute mesh nor hydro-seeding were used on the plateau, although a universal sealant was applied. The operations were instead limited to the planting of trees, bushes and seeds. These activities were supplemented by the construction of two areas of water measuring 1500m^2 each and these served as small areas of wetland around which two bird-watching refuges were built.

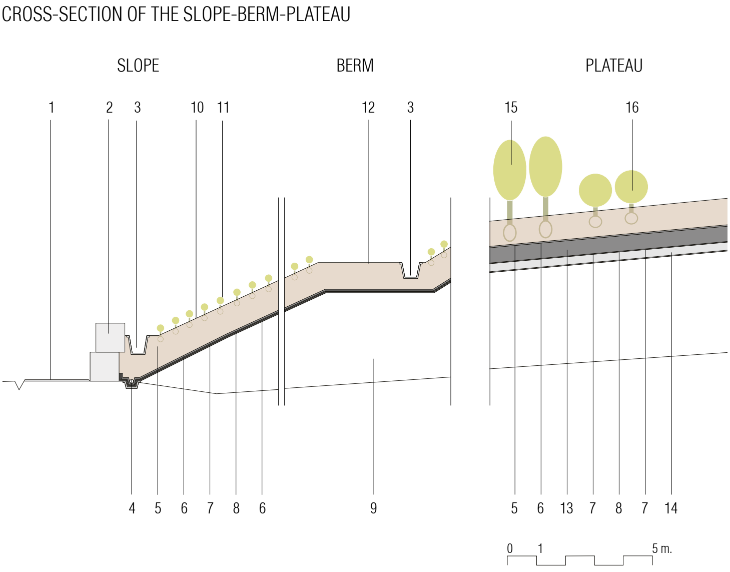
The main component of the biogas inside the mass of waste is methane and its expulsion to the exteri-



or would have negative repercussions on the environment, seeing as said gas is an active generator of the greenhouse effect. Therefore, a network of 280 gas collection wells covering the entire landfill surface was constructed (with each well having an area of influence of about 25m and a depth of 20m) along with 42.5km of transport pipes which take the gas to one of the 10 Regulation and Measurement Stations (RMS) with 14 entry points each, prior to its arrival at the waste-to-energy facilities.

One of the main objectives of the landscape transformation consisted of returning the area to as natural a state as possible and therefore it was vital to carry out a suitable planning of the activities. This required, in turn, a profound knowledge of the components of the existing ecosystem and its behavior, particularly its natural development. It was very important to cover the landfill with topsoil and to instigate the primary colonization by the pioneer plants, which, by contributing to the formation of the soil with their organic material, prepared the medium to sustain more advanced species. In this way, an inert medium such as a landfill was able to be transformed, via the development of a biologically productive soil, into a complete and self-sustaining ecosystem. All the possible plant formations in the area were taken into consideration and the recommendations of the Master Plan for the Southeast Regional Park were followed. The planted plants form an arboretum that is truly representative of the vegetation of the Community of Madrid and they were provided with an automatic irrigation system which uses water obtained from the nearby *Estación Regeneradora de Aguas Residuales Sur* (Southern Waste Water Regeneration Station). Due to the large size of the former landfill, it was deemed necessary to divide the surface to be vegetated into zones (fig. 7). The two basic factors which characterize said zones are their slope and their orientation. Orientation only affects the sloped areas (fig. 8) and these are divided into shaded slopes and sunny slopes. The shaded slopes are more at risk from freezing, they undergo less evapotranspiration and therefore the planted vegetation is less xerophilous than in the sunny areas. In the latter were planted species which require greater humidity: maples and Portuguese oaks. The south-facing slopes are more similar to the typical terrain of the Regional Park. On the plateau (fig. 9), the choice was made to plant natural-looking woodland, very similar to that of the nearby (indigenous) areas, using species such as Portuguese oaks, olive trees, pine trees, almond trees, holm oaks and cork oaks.

The plan was to establish small colonies which would grow over time, expanding and becoming more complex, responding to local conditions, and this has indeed occurred (fig. 10).



1. Environmental inspection road
2. Gabion used as a contention wall
3. Runoff water drainage ditch
4. Ø200 Grooved pipe for collection of rainwater from percolation
5. Min. 1m soil
6. Synthetic Geodren
7. Polypropylene geotextile
8. Polyethylene sheet
9. Mass of waste
10. Jute mesh
11. Kermes oaks
12. Protection berm
13. Drainage layer of 0.50m of gravel
14. 0.25m gas drainage layer
15. Portuguese oaks, Pyrenean oaks, holm oaks...
16. Riparian vegetation

Fig. 8 – Valdemingómez Forest Park, aerial photograph (source: Madrid Council).
Fig. 9 – Cross-section of the slope-berm-crowning plateau of the Valdemingómez Forest Park (photo: Israel Alba).

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Fig. 6 – Former Valdemingómez waste treatment plant, before the recovery, interior view. Source: Israel Alba (2000).
Fig. 7 – Valdemingómez Environmental Technological Center (information, publication and education), after the recovery, interior view (photo: Eduardo Sánchez).

Integration and use of the transformed landfill. 2003-2030

The project was developed by a multi-disciplinary team (engineers, biologists and architects) and its starting point was the planting of the landfill surface with species of trees typical of the area, so as to integrate it into the Southeast Regional Park, converting it into a new, green lung of the city. A series of public facilities were added to the recovery project after the reforestation: trails, paths, a bike lane connected to the rest of the city (fig. 11), small woods, picnic areas and two wetland lagoons with areas for observing both the newly developed ecosystems and the city, into which this new area will soon be incorporated. The public-use spaces will assuredly be redefined after the 30 years needed for environmental monitoring.

In the spring of 2003, the landfill, having been transformed into a great Forest Park of almost 110 hectares and with dimensions similar to those of *El Retiro* Park in the center of Madrid, began its life as a free area of leisure and enjoyment, with guided visits, courses, conferences and exhibitions organized in the Environmental Technological Centre. This center, used as a welcoming element and the connection point between the city and the Forest Park, has become the most 'public' representation of the recovery process and it has in some ways become the icon or symbol of the project.

As frequently occurs, the content of projects reflects desires which in practice are materialized quite differently and, as previously mentioned, time is a key factor in the complete recovery and transformation of these areas. As yet, it is still not possi-

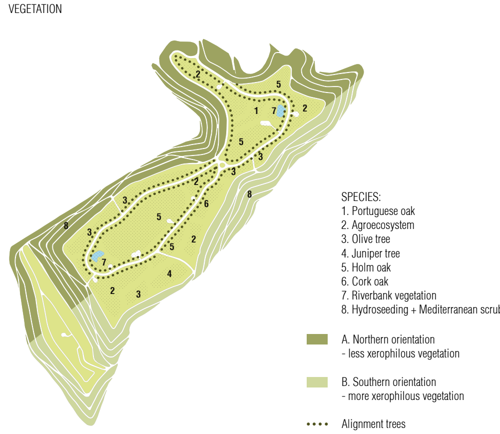

Fig. 10 – Slope with an anti-erosion mesh of jute fiber in the Valdemingómez Forest Park, after the recovery (source: Madrid Council).
Fig. 11 – Vegetation layer, organization of surfaces based on orientation and slope (source: Israel Alba).

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Fig. 12 – Valdemingómez Forest park, topography and vegetation of the slopes (photo: Miguel de Guzmán).

ble to open the park to the public for a free and continuous use of the space, mainly due to the fact that the extraction process for the biogas stored in the landfill causes constant subsidence in the terrain (fig. 12). In some cases this can be dangerous, seeing as it can cause the possible release of methane gas and because instantaneous subsidence can sometimes exceed two meters. For this reason it will be partially closed until the surface has stabilized, once all the biogas has been extracted. The situation also occurred in the Fresh Kills landfill of New York and in *El Garraf* of Barcelona. This may lead us to think that methods and processes other than the current ones should be used, seeing as it will take more time to make the land suitable for park use, due to having to wait for the degassing process to conclude, than it took for the landfill to be formed by the daily dumping of thousands of tons of waste. New strategies must be devised, ones which allow more immediate and different uses, even if they are merely partial, thus making more sense of these interventions, both in the short and medium term.
The strategies used in Valdemingomez bring it closer to the new models of free, metropolitan areas; making visible what was once hidden and forming a relationship between the metropolis and the surrounding land, via a recovered and transformed landscape which is based on a natural topography brought about by an artificial process. Thus, the Valdemingomez Forest Park supposes new type of public space that combines the derivation of energy from accumulated waste and continuity between the landscape and the immediate surroundings, with its connection to the Southeast Regional Park. Valdemingomez witnessed the construction of a top quality, free, metropolitan space (fig. 13) for citizens' leisure and enjoyment, although at present, visits are limited to guided tours so as to guarantee that the landfill surface is not overloaded, which might cause additional subsidence or accelerate the processes which have to occur in a controlled manner. The plan is for the park to be opened to the public in 2030. This however, has not stopped the planted tree species from taking root and nor has it stopped the wetlands from accommodating small ecosystems which are integrated into the natural

cycle of their environment. The use of water is not just an aesthetic artifice, it is a response to new environmental problems and it has led to the creation of new, water-based ecosystems (fig. 14).

Today, the work carried out in Valdemingomez could be seen as a possible way of approaching the construction process of an area, using artificial processes (the accumulation of refuse) to create natural topography for new metropolitan uses. This is a deeper and more evolved approach, based on the vision provided by the North American artist Robert Smithson in the second half of the 20th century, with the starting point being his entropic landscapes and his definition of the 'monumental vacancies' of Passaic, New Jersey. However, it could also be linked more contemporarily to the *terra fluxus*[2] of the landscape architect James Corner. But this project, which is not just an aesthetic matter, has also made it clear that traditional architectural instruments by themselves are incapable of fully resolving situations such as that in Valdemingomez (fig. 15).

The recovery of this space provides us with a new, continuous artificial landscape system, formed of layers in which the incorporation of energy-producing systems is merged with other, infrastructural el-

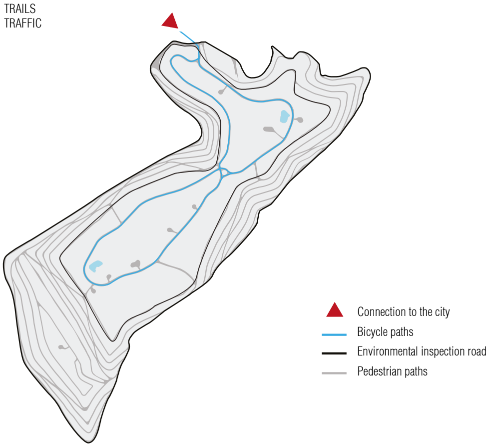

Fig. 13 – Valdemingómez Forest Park, woods on the plateau. Growth of the landscape over time (photo: Miguel de Guzmán).
Fig. 14 – Valdemingómez Forest Park, small initial colonies (photo: Miguel de Guzmán).
Fig. 15 – Layer of trails and paths (photo: Israel Alba).
Fig. 17 – Former Valdemingómez waste treatment plant, before the recovery, exterior view (photo: Israel Alba).

Fig. 16 – Valdemingómez Environmental Technological Centre, after the recovery, exterior view (photo: Eduardo Sánchez).

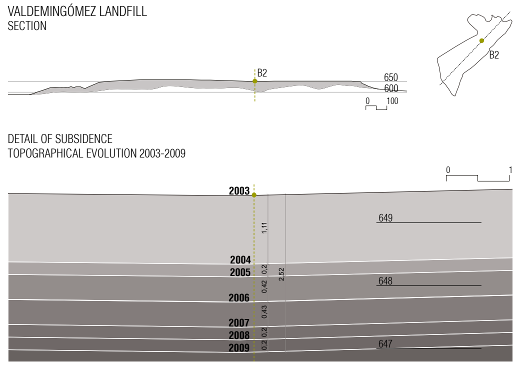

Fig. 18 – Valdemingómez landfill, detail of subsidence, topographical evolution 2003-2009 (source: Madrid Council).

ements as well as with architectural transformation itself and the time-dependent growth of a landscape. It is a contemporary landscape model.

Unlike other waste landfills which existed in Madrid in the 20th century, Valdemingomez, having been transformed into a great Forest Park, avoided becoming a dark memory of the city's past. Instead, it is part of the city's present and, above all, part of its optimistic future. It is a sign that a new declaration can be written regarding man's conscience, his attitude towards the landscape and his relationship with the physical world.

As the architects Iñaki Ábalos and Juan Herreros affirmed when they referred to Madrid, the project for the recovery and transformation of the former Valdemingomez landfill has allowed us to verify that: «The periphery is no longer a far away and picturesque ideal which might charm us with its aesthetics, rather it is a real laboratory used for experimentation with universal ideas» (Ábalos I., Herreros, J., 2000, p.25).

Conclusions: from continuity to utility

This project is not a picturesque work which follows that well-trodden path in the search for a capricious, eccentric landscape, nor is it a spontaneous inspirer of feelings, nor is it an example of *Landart*[3]. This is because it is not a pure mix of architecture and landscape. Instead, it garners influences from the course marked out by both disciplines. We are in a new age; we face new problems which demand the use of new technology in addition to the application of the cultural heritage which has preceded us.

We must also acknowledge the technical difficulties which arise in the handling of enormous piles of garbage, within which millions of aerobic and anaerobic bacteria work ceaselessly and sequentially in biological processes, decomposing all organic waste and producing gases such as methane, carbon dioxide and nitrogen. The elimination of this methane involves various subsidiary objectives such as eliminating foul odors, preventing the formation of pockets of flammable gas, avoiding the gas's contribution to the greenhouse effect and harvesting it for energy.

Its existence obliges the use of new gas confinement techniques and these must be combined with those developed for combating the loss of the mass's internal volume and with those used in the formation of a topsoil layer at the surface. The creation of this topsoil layer was a new technological challenge be-

Fig. 19 – Valdemingómez Forest Park, biogas extraction well next to wetlands (photo: Israel Alba).
Fig. 20 – Relationship between the Valdemingómez Forest Park and the Southeast Regional Park, in the background (photo: Israel Alba).
Fig. 21 – Valdemingómez Forest Park and Madrid. The city rises over the new free space. Meadow area and lookout point (photo: Miguel de Guzmán).
Fig. 22 – Lagoon or wetlands of the Valdemingómez Forest Park, where one can see the established flora and fauna. Growth of the landscape over time (photo: Miguel de Guzmán).

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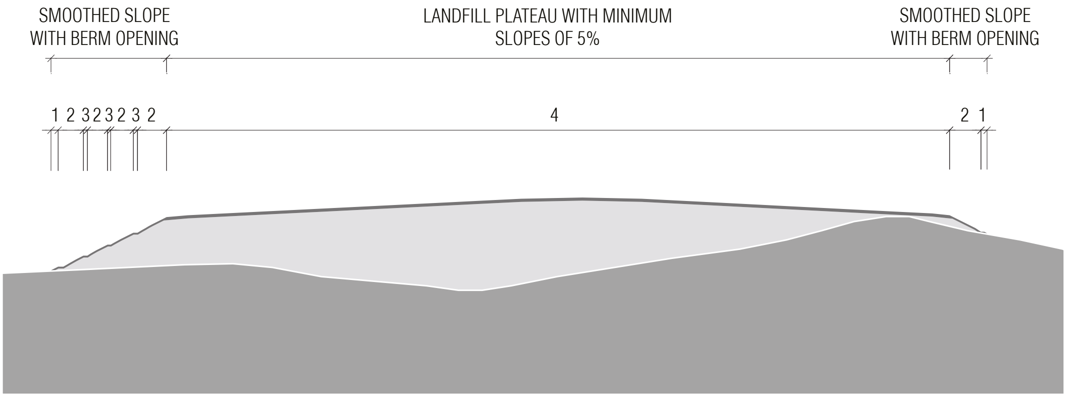
Fig. 23 – Footprint and topography of the Valdemingómez Forest Park, shown with the soil plan (photo: Israel Alba).

VALDEMINGÓMEZ LANDFILL
Cross section. E. 1/5.000



1. Environmental inspection road
2. Slope
3. Protection berm
4. Plateau

cause topsoil is a component which acquires its morphology and properties after a long, slow period of evolution. Our new environmental sensitivity has introduced and improved our perception of the role of soil, whose structure, which is not constant over time, is fortified by farming, repeated tilling and the use of irrigation. When, as is the case here, the soil is newly created, its formation can be accelerated with induced changes. Biologically active soil supports life and continues to evolve from the moment of its formation and this occurs via processes affected by biological, climatic, geological and topographical influences. Despite the crucial role it plays in the recovery of landfills, the actual perception of the role of soil has generally played second fiddle to other components of the project and the traditional techniques applied in agriculture were trusted for the most part.
The soil and vegetation formation processes, the gas collection and conversion systems, and the evolution of the employed techniques led us to introduce time as a fundamental variable in landfill recovery projects, seeing as they have become 'living' projects.
The introduction of the time variable and the need to apply techniques from other disciplines, instead of being a limitation in an architectural transformation project, should serve as stimuli to the acceptance of new proposals and new challenges. This is the only way by which we can advance the discipline - working at the fringes, at the limits. In Spain, as in most countries, politics is key in these types of operations, but the interests (time) and visions of the agents involved do not always coincide. Landfills are immense natural topographical areas produced by artificial processes, watchtowers from which to discern a new horizon, a new world, a new future in which it will be possible to reverse our acts of deterioration.
By assigning a new value to waste, the recovery and transformation of a landfill provides a new topography which is capable of being useful and productive for contemporary society, for leisure or for agriculture, revealing itself as a free space of the new city.
The chronological analysis of this project makes it primarily clear that the expansion of the metropolis has literally engulfed the first landfills from the second half of the last century and incorporated them into the urban infrastructure (fig. 16). It also

Fig. 24 – Valdemingómez Forest Park, aerial photograph, slopes and vegetation (photo: Miguel de Guzmán).

makes it obvious that there has been a clear evolution, within a short period of time, in the unfurling of a new outlook on these spaces and in architects' attitudes towards the project; they are now more sensitive to the physical and natural world. We are on our way to a new paradigm. The recovery and transformation of the Valdemingomez landfill has given us a chance to verify that every common space has now become understood as a landscape and, as such, an object of interest and the focus of attention of the architect. Landscape has lost its disinclination to change and has grown into a subject that allows many transformations and one which can harbor new, metropolitan uses.

The operation which was carried out was artificial but it seeks naturalness and the attainment of another level of evolution in its relationship with the medium and in its ability to support a new, free space (fig. 17). The recovery of this space, via forestation concepts, involves thought and planning, first about the soil and then about the plants, calculating the time required to develop them. Only after the process has progressed sufficiently should the construction of the rest begin. In the words of Claude Guinaudeau, we should: «Plant today, build tomorrow» (Batlle, 2007, p.69). In this way, we incorporate the value of time into the project and in the construction of public spaces in the metropolis, giving vegetation the chance to develop properly in a soil which is kept 'alive' and in a state of constant evolution. As noted by James Corner, we should aspire to build landscapes which are more active not only in biological terms (productivity) but also in ecological terms (usefulness): «And if we were to understand

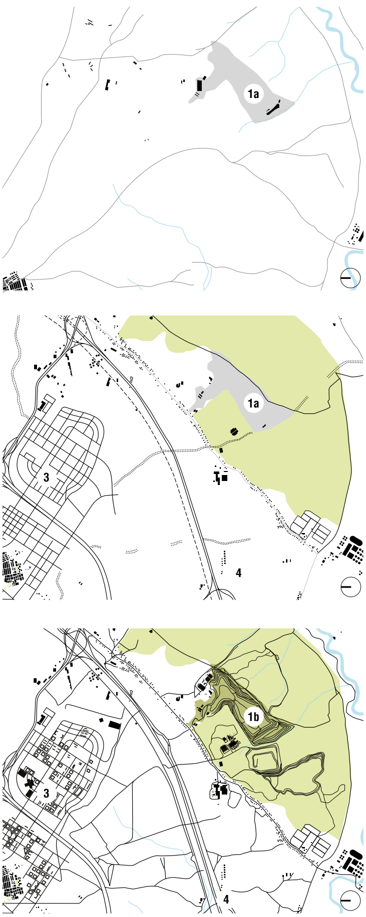
Fig. 25 – Valdemingómez Forest Park, aerial photograph, pedestrian and bicycle trails and meadow areas on the plateau. Construction of a new place (photo: Miguel de Guzmán).

this desire for a more active landscape, not only in biological terms but also in terms of programming, culture, imagination and experience […] we could finally escape from the limitations of naturalism and scenography» (Corner, 2007, p.158).

Having analyzed the results of the completed works and their evolution through time, we should ask ourselves the same question that was posed by Marc Treib: «Should a project which is based on an ecological concept look natural? And if so, why?» (Treib, 2007, p.159).

In contemporary projects, it is vital to incorporate the idea of change over time, unpredictable and programmatic indeterminacy. Only by doing this will we manage to design the landscape and establish links with the natural environment, with the understanding that, as the same author affirms: «Landscapes grow and die. Change is inherent in all living systems and, in turn, it becomes a key element in landscaping, unlike that which occurs in architecture. Projects rarely address growth or change» (Treib, 2007, p. 161).

According to the work carried out by the multi-disciplinary agency IaN+, formed by Carmelo Baglivo and Luca Galofaro, we are now witnessing a new definition of the term 'ecology' and this should be adapted to the work of the architect. To do this, they have defined the term 'new ecology' as the idea of urban ecology linked to time and to the relations which develop in the territory. In this way, architecture assumes a fundamental role by being an integral part of the project process which orientates the evolution of the territory. At the same time, it contributes to the renovation of traditional urban planning, incorporating variables and concepts which suggest



1a. Valdemingómez landfill (closed 2000)
1b. Valdemingómez Forest Park (opening 2003)
2. Historical city Vallecas
3. New developments
4. Infrastructures

Fig. 28 – Integration into the new landscape of the energy extraction systems for the biogas accumulated in the landfill (photo: Miguel de Guzmán).
Fig. 29 – New plan of the biologically active soil of the Valdemingómez Forest Park (photo: Israel Alba).

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Fig. 26 – Valdemingómez Forest Park, aerial photograph, slopes and plateau (photo: Miguel de Guzmán).
Fig. 27 – Relationship between the Valdemingómez landfill and Madrid: 1978-2000-2013. The maps show the urban growth in the surrounding area. After its first years of use as a decentralized landfill, it has become a free space close to the expanding city (photo: Israel Alba).

subtler interrelations between human settlements, nature and urban components.
This is to confirm that contemporary architecture meets equally and at the same time architecture and landscape, addresses the matter of time or, what is the same, the matter of life. Life cycles incorporated to the architectural project cannot separate from the matter of time, as it indeed happens in the construction of the city. Life span, with its inevitable change associated to itself, is another variable in the architectural project.
If globalization implies the anonymity of a city and its disassociation from physical reality, then new, free metropolitan spaces can actually return to that city part of its identity (fig. 18) and specificity. This

Fig. 31 – Valdemingómez Forest Park, aerial photograph, pedestrian and bicycle trails alongside wetlands and meadow areas (photo: Miguel de Guzmán).
Fig. 32 – Valdemingómez Forest Park. Source (photo: Israel Alba).
Fig. 33 – Valdemingómez Forest Park, aerial photograph, pedestrian and bicycle trails alongside wetlands and meadow areas (photo: Miguel de Guzmán).

is especially so when the spaces are the fruit of the recovery of landfills and when they are very close to unique places (from a landscape and environmental standpoint) such as the Southeast Regional Park of Madrid.

In any case, this project's relevance stems from its attainment of the three main objectives that this type of intervention required: resolving a complex technical problem, producing a new, free public space and constructing a new landscape via the creation of soil and the manipulation of the topography. It could be affirmed that it is not a full recovery *per se*, because the natural state which was lost can never be recovered. Rather, it is a 'reinvention' whose value lies in changing the attitude of man towards landscapes and areas of deterioration.

This project has confirmed that the limits have been diffused and that we are operating on a metropolitan scale in the territory. It has confirmed that we are mindful about everything and that everything requires mindfulness, both the city and the landscape; that is if the two are not already one and the same. We need and inhabit the planet as a whole, not only the cities, and therefore this case reveals a clear and rapid evolution. It also reflects the commitment of contemporary architects, of man and of our society to the addressing of the problem of waste generation and the contamination of our environment.

It is, in any case, a positive example of the recovery and transformation of a landfill and it imbues us with an optimistic spirit, one that is full of challenges and possibilities, and with a new ecological conscience which is moving us towards a new paradigm. And even though there is still much to do, we must believe in a possible future that can be better.

To paraphrase the Spanish philosopher José Luis Pardo, we could say that waste was never so useful[4].

«Every territory is unique, thus creating the need to 'recycle', to scratch away once more (but with the greatest possible care) at the old text which man has recorded on that irreplaceable material which is the terrain, in order to leave a new text which responds to current needs before it, in turn, is erased» (Marot, 2007).

Fig. 34 – Wetlands in the Valdemingómez Forest Park, a new ecosystem. Growth of the landscape over time (photo: Israel Alba).

Endnotes

[1] A leachate is any liquid that, in the course of passing through matter, extracts soluble or suspended solids or any other component of the material through which it has passed.

[2] The landscape, more than the buildings, is the generating force behind a metropolis and therefore it is appropriate to make it the central aspect of urbanism.

[3] A term used to define the artistic movement which came about in the United States in the second half of the 20th century and which uses the landscape as the base for an artistic intervention in which the work of art and the landscape are inseparably joined.

[4] Alluding to his essay *Nunca fue tan hermosa la basura (Waste was never so beautiful)*.

References

VV.AA. 2002, *El Complejo Medioambiental de Valdemingómez,* Área de Medio Ambiente del Ayuntamiento de Madrid, Madrid.

VV.AA. 2003, *Parque Forestal de Valdemingómez. Rehabilitación de un vertedero de residuos urbanos*, Área de Medio Ambiente del Ayuntamiento de Madrid, Madrid.

Ábalos I., Herreros, J. 2000, *Reciclando Madrid*, Editorial Actar, Barcelona.

Ayuntamiento de Madrid, Área de Medio Ambiente 2003, *Parque Forestal de Valdemingómez. Rehabilitación de un vertedero de residuos urbanos*, Madrid, p. 10.

Batlle E. 2011, *El jardín de la metrópoli. Del paisaje romántico al espacio libre para una ciudad sostenible*, Colección Land&Scape Series, Editorial Gustavo Gili, Barcelona, p.69.

Bélanger P. 2009, *Landscape as infrastructure*, «Landscape Journal», vol. 28 n. 1.

Colafranceschi D. 2007, *Landscape+100 palabras para habitarlo*, Editorial Gustavo Gili, Colección Land&Scape Series, Barcelona.

Corner J. 2007, *Proceso*, in D. Colafranceschi (eds.) *Landscape+100 palabras para habitarlo*, Editorial Gustavo Gili, Barcelona, p. 158.

Corner J. 2009, *Terra fluxus*. in *Naturaleza y artificio. El ideal pintoresco en la arquitectura y el paisajismo contemporáneos*, Ed. Ábalos I., Compendios de Arquitectura Contemporánea, Editorial Gustavo Gili, Barcelona. pp. 133-147.

Galí-izard T. 2005, *Los mismos paisajes. Ideas e interpretaciones*, Editorial Gustavo Gili, Barcelona.

Marot S. 2003, *Sub-urbanism and the art of memory*, Architectural Association, London.

Marot S. 2007, *Metafora*, in D. Colafranceschi (eds.) *Landscape+100 palabras para habitarlo*, Editorial Gustavo Gili, Barcelona, p. 127.

Ocaña robles L. 2003, *Los residuos sólidos urbanos de la ciudad de* Madrid, Área de Medio Ambiente del Ayuntamiento de Madrid, Madrid.

Pardo J.L. 2010, *Nunca fue tan hermosa la basura. Artículos y ensayos*, Editorial Galaxia Gutenberg, Barcelona.

Smithson R. 1967, *A tour of the monuments of Passaic, New Jersey,* «Artforum-International Magazine», vol. 6, n. 4. pp. 48-51.

Treib M. 2007, *Proyecto*. in D. Colafranceschi (eds.) *Landscape+100 palabras para habitarlo*, Editorial Gustavo Gili, Barcelona, pp. 159; 161.

Wasteland rehabilitation in rural landscape: a project in the Verona plain

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Abstract

This contribution presents a design exploration for the rehabilitation of a dumpsite in the municipality of Isola Rizza, Verona (Italy). In the Verona plain, a former district of brick production left in its wake a cluster of water basins and wastelands that are today distinctive of the landscape and object of a territorial dispute among landowners, public administrations, and the local community. A project for the rehabilitation of one of those wastelands, converted into a dumpsite, has been recently developed. It considers the idea of re-organizing the circulation of waste materials and soil involved in the remediation to implement a public park. Although the project has been facing the little consideration given by local regulations to integrated design, it clearly shows the capacity of systemic design to tackle rehabilitation challenges while offering potential spaces integrated with the local ecological and slow mobility networks.

Keywords

Dumpsite Rehabilitation, Integrated Design Project, Wetlands, Verona Plain

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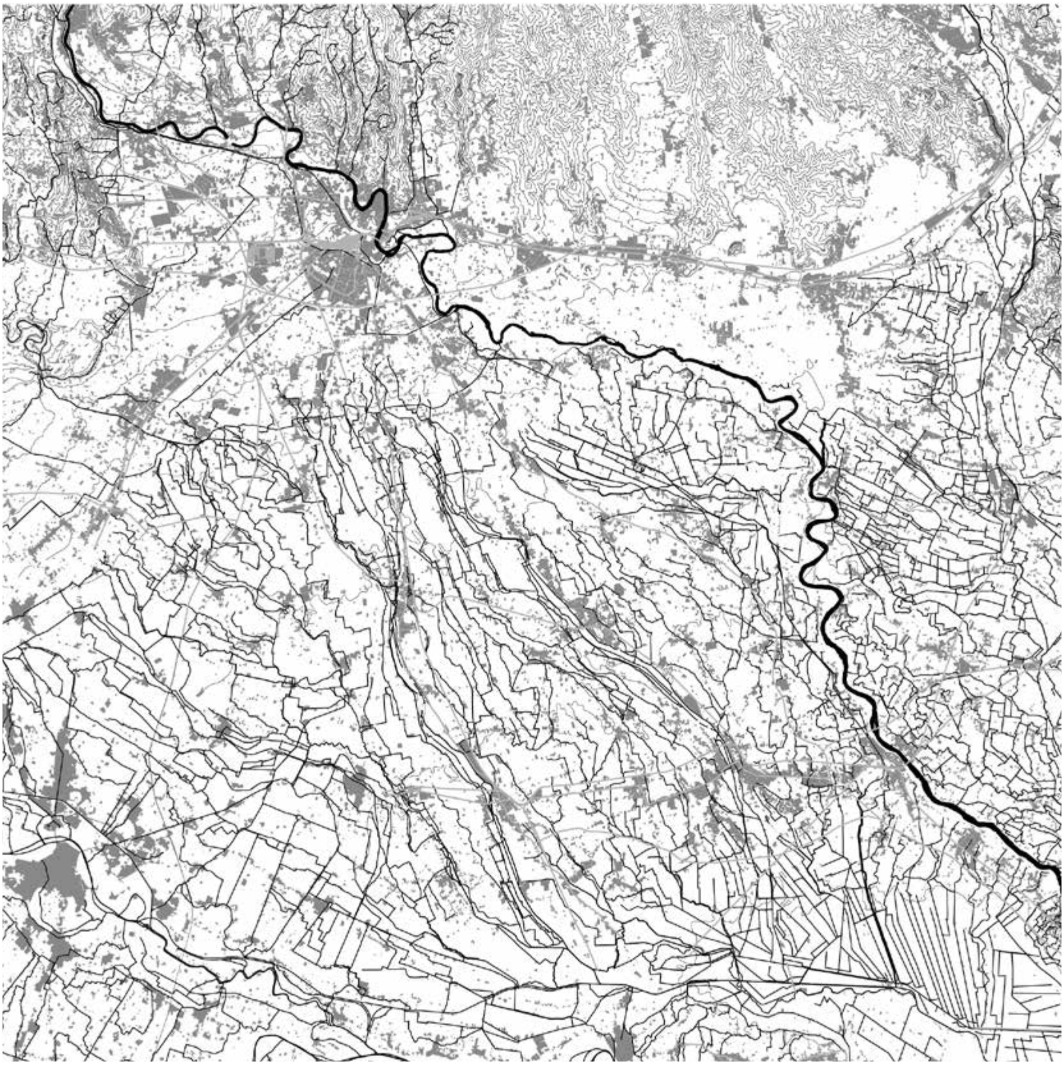
Introduction

In ancient times, a vast system of wetlands was stretching over the low plain south of Verona (North East of Italy) along the borders between the Veneto and Lombardy regions. These wetlands originated in the depression between the Po and Adige rivers – two of Italy's mayor watercourses –occupying more than 30,000 hectares of surface (Mastini, 2013). At that time, the Verona low lands were replenished by the flooding of the two rivers and by a number of springs that flowed into formerly carved riverbeds and rambled into marshy grounds (fig. 1).

These extended wet areas looked like a large expanse of reeds, wet meadows, shallow lakes, and scattered hygrophilous woods of poplars and willows, offering the "spectacle of one of the most extensive backcountry marshes in Italy", at the foot of the Alps (Mastini, 2013). Later on, different cycles of land reclamation occurred: initiated by the Romans, continued by the Venetian Republic, they were concluded by the Italian State in the 1950s. Through the regimentation of the watercourses and the realization of new canals, locks and bridges, the territory was progressively dried up. The post-war economic boom which took place in Northern Italy happened here a little later. Also for this reason, urbanization is less dispersed than in other parts of the so-called Megalopoli Padana, an extended tapestry of settlements that stretches all along the Po river basin from Turin to Venice (Turri, 2000). Instead, the Verona low lands appear as a depressed, mainly rural area where industrial and agricultural activities cluster around specialized districts of small and medium enterprises.

During the post-war economic growth, in the upper part of the former Verona's wet landscape, a few dozens of kilometres from the city of Verona – where the Adige river bends towards South – a district flourished around a proto industrial production of construction bricks. Before hydraulic works of dykes and diversions prevented river overflows, the water used to spill over this low-lying area releasing deposits of fine clay. Given this resource, many brick furnaces established over the time in the area. Most furnaces arose beside pits where the clay was extracted removing the shallowest layers of soil. Many clay pits, on average of two meters deep, spread over the landscape at the expense of agriculture. Later on, between 1950 and 1970, the mining activity underwent a significant development. Thanks to modern technologies that allowed digging deeper – up to six meters – and controlling water infiltration during digging operations, the landscape of clay pits further expanded. Due to the deep mining and the high water table, the reclaimed landscape started to get its former wet character back. The mining ac-



tivity advanced at such a pace that, in the sole small municipality of Ronco all'Adige – 6.000 inhabitants, the clay pits have covered up to half of the total municipal surface (fig. 2) (Veneto Progetti, 2009).
The temporal succession of dry and wet conditions sounds remarkable for the history of this apparently ordinary landscape (see Latitude Platform, 2015). However, the soil exploitation talks only for the most visible part of the recent socio-natural transformations occurred in the area. Before the 1980s, the mining activity had very little laws and regulations and it was common practice to use the exhausted open pits as dumpsites for unsorted waste materials. This occurred to many pits in the Verona plain. Official information about the use of exhausted open pits as dumpsites is not available, yet there is a common agreement about the dissemination of this practice as well as a diffuse apprehension about the risk related to it. The exhausted pits have become the receptacle of hazardous materials, which endanger the quality of the underground waters.

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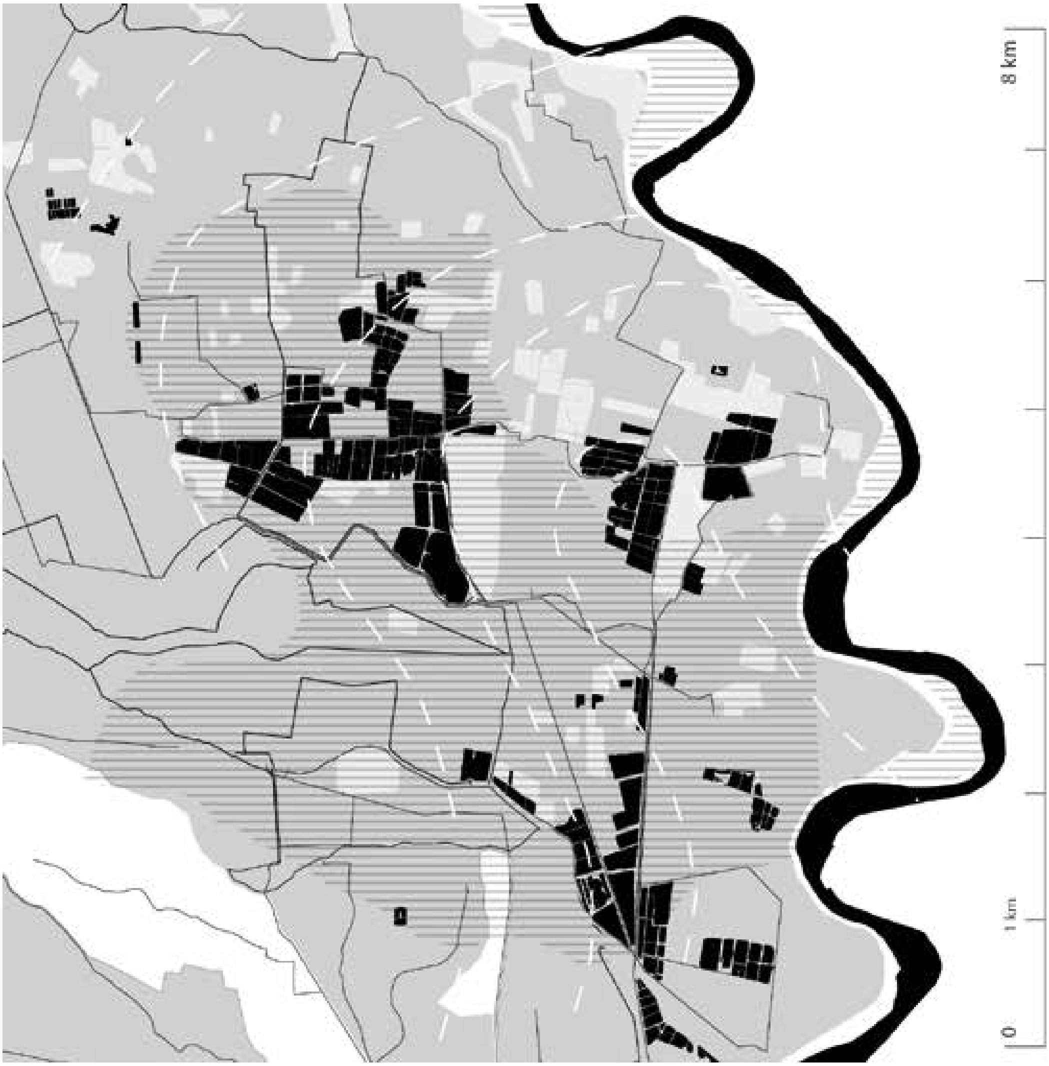
Fig. 1 – The Verona plain in the Po Valley. Hydrography is in black, built up areas are in grey. The Adige River crosses the plain from the mountain foothills in the North to the drainage channels on South passing by the city of Verona.

Today, in the Verona plain, brick production has declined. Due to the crisis of the regional real estate market, and the introduction of stricter laws and concessions for the mining activity, the brick industry has known a strong recession and the local mining activity has almost disappeared. As a result, some of the former pits have been partially filled to be returned to agriculture or to be replanted with poplar trees. However, the great part of the abandoned clay pits continues to rule the landscape in the form of many water expanses. They have an indissoluble presence in the contemporary landscape of the area and in the life and memory of the local community. A certain number has been converted into fish farms or ponds for sport fishing. However, all over, animals and plants have repopulated with a great biodiversity typical of the transitional zones between water and terrestrial environments. This wet condition recalls the original local landscape characterized by marshes and hygrophilous woods. The former pits have medium slope banks, sometimes covered with thick vegetation hedgerows, other times with well-maintained lawn and tree rows (fig. 3). The ensemble of wet areas extending for 500 ha over the municipalities of Ronco all'Adige, Roverchiara and Isola Rizza is a unique resource for the region. Because of its rich biodiversity, some of the wetlands are enlisted among the regional natural areas worth of conservation (Provincia di Verona, 1994).

It is known that, nowadays, European and Regional programs and directives recognize the ecological importance that these habitats have for many plant and animal species, whose biological cycle is related to water. They are resting areas for migratory birds. They have a role in regulating floods events. They contribute to the natural treatment of water. They are also meaningful with respect to the long history of human activities and interplay with the landscape, and are thus a landmark of the local identity. For all these reasons, landscape reclamation programs are high in the political agenda. Besides the celebration of these wetlands as regional biodiversity hotspots, an integrated process of reclamation has to be worked out in order to tackle the pollution issue caused by their past exploitation as dumpsites.

Regional constraints and opportunities

Within the framework of a comprehensive regional vision, the former clay pits of Ronco all'Adige, Roverchiara and Isola Rizza could become the asset for an integrated landscape and environmental management. Other studies by the authors (see for instance Ranzato, 2011) have already investigated possible scenarios of rehabilitation of the former clay pits within integrated territorial strategies. On



the one hand, the former clay pits can play a fundamental role for the regulation of the local water cycle. They can provide an important volume to stock water and regulate seasonal excess, shortage, and water quality. The area surrounding the former pits of Ronco all'Adige, Roverchiara and Isola Rizza is periodically facing flood risk and, due to the high water demand by agriculture during dry summer periods, water shortage. At present, these opportunities have not been fully taken into account by local regulations.

By contrast, the clay pits have also negative implications on the water cycle. With the withdrawal of the top clay soil layer, the mining activity has altered the groundwater table so that it flows under pressure few meters below the ground surface and which today re-emerges in the open clay pits. In addition, fish farms require a constant water temperature and circulation, which is provided by extracting groundwater with steady temperatures from deeper aquifers. The water is then discharged, both by gravity and through pumps, into the surface wa-

Fig. 3 – The former clay pits of Ronco all'Adige, Roverchiara, and Isola Rizza. (Photo: Basilio Rodella Bams Photo, Consorzio di Bonifica Veronese).

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Fig. 2 – The former clay pits of Ronco all'Adige, Roverchiara, and Isola Rizza. Surface water and the pits filled with water, in black; the filled up pits, in light gray; a section of the catchment, in dark gray; the floodable areas, horizontal dark grey lines pattern; groundwater levels, white dotted lines. Source: Regione Veneto. Elaboration by the authors.

ter network. As a result, the aquifer is largely exposed to the activities taking place on surface, engendering the risk to increase the percolation of fertilizers and others pollutants into the ground. Aquifer's contamination is a serious issue for the local community, whose drinking water supply depends on groundwater. Periodically, due to the presence of nitrates in the supply network, the municipalities in the province of Verona are forced, at the request of the Regional water board, to enact ordinances that prohibit the use of the public water (Albi, 2014). In order to preserve the quality and availability of potable water, integrated long-term measures that do not weight on the scarce public finances are needed. On the other hand, the clay pits can be revitalized to foster a greater number of interactions between the natural environment and the local community. Feeding the imaginary of its inhabitants is key, as it is stimulating local associations of environmentalists, and grassroots' engagement in local activities and development. An example in this respect is offered by the experience of a group of nature photographers, which have shown how, in the span of 10 years, and through appropriate measures like graduating water levels to create a variety of wet areas, an abandoned clay pit can trigger processes able to regenerate a strong ecological complexity. Indeed, the area has become the nesting place for many birds' species and rare amphibians have reappeared (Mastini, 2013).

The former clay pits could therefore compensate water stress and increase landscape quality and biodiversity through an ecologically sound and low cost design. Softening the slopes' profile of the water expanses, for instance, would greatly benefit the biodiversity. It would increase the transitional surface

zone and enhance the roots filtering capacity of the wooded hedgerows. Although the former clay pits represent a great opportunity for the area, their private ownership regime makes it still difficult to imagine an integrated development. For some time, local municipalities have advanced different proposals to return the quarries to the community through public-private partnership.

The vision for the Polandro, Isola Rizza

The project for the rehabilitation of the Bastiello quarry, in the municipality of Isola Rizza, provides an interesting example of public-private partnerships developed around a former clay pit that is now a wasteland. The Bastiello quarry belongs to a private land of 40.000 m^2 located not far from the urban centre of Isola Rizza, in the Polandro area (approx. 1 km). During the 1980s, this former clay pit has been heavily exploited as dumpsite (fig. 4). Nowadays, it appears as a barren wasteland, which hides the underground environmental damage. In 1992, the site has been sequestered and since then is pending for remediation. In 2009, the quarry has been included in a priority list of sites to be reclaimed by the province of Verona (Simone et al., 2014, R02.1). Recently, a local private waste management company interested in enlarging its business offered to recover the site without any cost for the local administration, leaving the area in public hands once finished with the reclamation. According to the proposal, the excavated waste would have to be allocated in a municipality's landfill nearby, the expansion of which is still pending approval. In order to transform it in a new public green area, the ground would have to be filled with gravel and topsoil from certified excavation sites as well as with the uncontaminated soil eventually found on site (Simone et al., 2014, R02.1). A concern arose about the fact that the future public green area would come to exist in a rural environment, mainly surrounded by agricultural fields. It was hence thought to carefully measure the intervention scope with respect to the needs of the possible future users.

In order to frame the project within a wider planning strategy, the Water Board *Consorzio di Bonifica Veronese* (responsible for the surface water management in the catchment of the Verona plain) took over the initiative to propose a possible integration of the project with other ongoing local initiatives. The water board was interested in the implementation of a system of touristic paths, which would enhance the existing pedestrian and cycling mobility along the rivers' embankments and the rural dirt roads.

Within this framework, the design practice Latitude Platform has been appointed to develop, in collab-

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Fig. 4 – The Bastiello dumpsite is located in the 'Parco del Polandro', a public park ideally part of a larger vision for the valorization of ancient hydraulic buildings (Gangaion and Botte Vecchia) and the regional slow-mobility and touristic tracks along rural roads and the Adige river. (Photo: Latitude Platform, 2014).

oration with the Water Board and the local municipality, some design reflections for the area. The proposal take into account the presence, in the immediate vicinity, of two ancient buildings of hydraulic regimentation, one of which has been recently renovated and that will open, eventually, as an 'Ecomuseum' displaying the history of the local landscape. It considered the unique value of the surrounding agricultural landscape that, although threatened by environmental degradation and fragmentation, is still characterized by open large extension favouring broad panoramic views, and the amenities already present in the Polandro area that could be thought as a one-thing with the new park. Concerning the last point, it appeared relevant that another clay pit previously recovered in the area today functions as an artificial water pound dedicated to sport fishing and is managed as a semi-private space by a local association. Beyond this recreational angling, a private wood patch towards the close by urban settlement of Isola Rizza has been repopulated with a variety of tree species and it is made available by the owner for educational and recreational purposes.

The strategy designed by Latitude mainly advantages on the earthworks. The operation of excavation is at the centre of the conception of the park. The core idea is to introduce an exception into the predominant horizontality of the plain landscape. Just in front of the shallow depression resulting from the waste removal, a raised counterpart arises on the opposite side, shaped to build a privileged point of view towards the surrounding landscape. The cleaning up of the site with the digging up of waste on the one side, the carryover of new topsoil and the realization of the park on the other, are conceived as a single intervention also in order to reduce the general operational costs. Depression and relief would stand as signs of this very last excavation process. After extraction and cleaning up of the waste, the hollow of the former clay pit is meant to be only partially covered in order for the ground level to be just above the water table (approx. 3 m deep). Most of the good soil will be deposited on one side of the area to form the relief. The new rise makes the order of magnitude of an excavation process readable, while in the surrounding abandoned pits the water hides the excavation depth. The realization of an 'observatory' at the top of a large and slightly vegetated slope responds to the need of experiencing the whole surrounding landscape. Rather than enclosing the area with visual barriers made of tree masses or fences, the site would be open to the landscape. The strong visual relationship is revived also by the entering path connecting the site to the main road and from there to the urban centre. The slow mobility network would extend to the other important natural and historical spots of the surroundings. The new park is designed to be flexible and open to a variety of uses served by two fixed elements: a projecting roof in the lower part, almost hidden at the level of the campaign, and an equipped platform in the highest point (fig. 5,6,7).

Conclusions

In a large part of the Verona plain where land reclamation had largely shaped the landscape, wetlands have returned as legacy of the mining activity. The post-natural ecologies generated in the former clay pits are now recognized as integrated part of today's landscape: into these wastelands, new natural cycles are taking place; they are considered important ecological carrying structures and ecosystem service providers; not only academics and professionals, but also citizens and local associations acknowledge their value and struggle for their conservation.

The design project conducted by Latitude for the rehabilitation of the Bastiello quarry, one of this former clay pits, reveals the systemic character of design – versus narrow, technical understandings of the area. The proposal advantages on the inner qualities of the clay pits landscape and places the intervention within a wider natural and recreational regional network. In the project, the elements surrounding the site, like the nearby wood-patch and the rural landscape of the Polandro area, are visual cornerstones around which the accessibility to the site is re-shaped. Technical issues and landscape features are combined in order for the space to offer a multiplicity of functions. For a rural landscape facing struggling economy, multiplying the opportunities related to a project is deemed more than an option.

The proposal for the rehabilitation of the Bastiello quarry, however, also highlights that, unlike a mere technical intervention, a design project could also upset arrangements and assumptions underlying the initial proposal. While expanding synergies, the design process brings out potentials and win-win combinations that conflict with rigid private-public agreements and dictates of current praxis. In the agreement between the private company appointed for the dumpsite rehabilitation and the municipality, waste materials are brought to a sanitary landfill located in a nearby municipality and owned by the same company. Instead, 'costly' quality soil is brought to the site in order to fill the 'new' hollow. In the region, this is praxis in dumpsite remediation. Notwithstanding, the design project considers the opportunity of partially preserving the wet character of the area which will appear after remediation. Accordingly, the area whose imprint corresponds to the former clay pit would be only partially

Fig. 5 – The vision for the Polandro: an open park made of a large and soft slope visually and spatially connected to the surroundings areas, axonometric view. (Photo: Latitude Platform, 2014).
Fig. 6 – The vision for the Polandro: longitudinal section. (Photo: Latitude Platform, 2014).
Fig. 7 – The vision for the Polandro: the landscape observatory. The image illustrates the idea at the core of the project proposal: the exception of a privileged, single elevated point in front of a vast horizontal landscape (Photo: Latitude Platform, 2014).

filled in order for the ground to just exceed the level of the water table.

The proposal also foresees that most of the soil originally intended to fill the remediated pit is instead located just on the side to form an observation point. Ultimately, the design process could have gone even further, especially if local legal procedures were more flexible. The rise envisioned in the project could have been designed considering the re-use of the non-dangerous waste of the dumpsite itself. In other words, a more consistent hypothesis could have been considered, that is sorting the waste extracted, securing it by isolating the non-dangerous waste, covering the top soil with a water-tight foil, and placing the non-dangerous waste for rising the observation point. Projects like the *Volgermeerpolder* in Holland (Vista Architects), the *Vall d'en Joan* in Spain (Battle and Roig), or the Freshkills Park in the US (Field Operations) have shown how it is possible to secure environmentally damaged sites such as former sanitary landfills while including new park-like uses on the same site. Actually, during the process, the design considered the possibility for a shorter cycle of material reuse. However, the option was difficult to practice because it would have asked for further studies and, in short, it would have altered the established private-public agreement. This shows how design could bring solutions that go beyond and challenge current practice but systemic ideas could result useless if the institutional arrangement is rigid and/or design comes late in the process.

The design vision for the Polandro has however found the interest of the local administration and was used as a strong point during a past election campaign (2014). Besides the willingness of the local municipality and the positive reception of its citizens, the project was stuck in the bureaucratic machine. Therewith, soon after a strong criticism aroused around the real sustainability of the entire process. Some local politicians and citizens' committees have pointed out that the disposal of 13,000 cubic meters of non-dangerous waste – out of the overall estimated 25,000 cubic meters which will be extracted from the dump site – was used by the private company to obtain the permit needed to extend their own landfill located in the nearby municipality. Critics also contested that the company's landfill expansion was explicitly required in order for the private company to raise the bill for carrying out the remediation of the Bastiello quarry (Simone et al., 2014, R03.1). In a time where the new regional waste plan excludes the opening of new landfills, the entire operation has been strongly criticized as a ploy of the private company to extend its activity and business (Vesentini, 2014). Paradoxically, the missed opportunities highlighted by the design project, that is the possibility of re-using onsite the non-dangerous waste extracted from the dumpsite in order to build the rise, would have allowed overcoming the local criticism. This shows that design could play a crucial role if it was understood as a proactive tool rather than a mere act of plotting.

References

Albi L. 2014, *Rassegna dei casi di inquinamento nelle acque sia superficiali che profonde a Verona e Provincia*, paper presented at the conference "Lo stato delle acque in provincia di Verona", 01.02.2014, Verona, unpublished.

Latitude Platform 2015, *Landscape Traces and Stories*, Research report for the Consorzio di Bonifica Veronese, Verona, unpublished.

Mastini B. 2013, *Le zone umide nel veronese tra passato e presente*, in Atti e Memorie dell'Accademia di Agricoltura Scienze e Lettere di Verona, Verona.

Provincia di Verona, 1994, *L'ambiente naturale*, Agenda 21 - Rapporto sullo Stato dell'Ambiente, Verona.

Ranzato M. 2011, *Integrated water design for a decentralized urban landscape*, Ph.D. thesis, University of Trento.

Simone P., Angeloni A., Condorelli M., 2014, M. R02.1 - *Progetto Definitivo di Bonifica, Progetto Definitivo per l'Ampliamento dell'Impianto di Smaltimento D1 per Rifiuti non Pericolosi in Località Ca' Bianca in Comune di Zevio (VR) e Progetto di Bonifica Cava Bastiello in Comune di Isola Rizza (VR)*, INERTECO S.r.l.

Simone, P., Angeloni A., Condorelli M., 2014, M. R03.1 - *Progetto Definitivo, Progetto Definitivo per l'Ampliamento dell'Impianto di Smaltimento D1 per Rifiuti non Pericolosi in Località Ca' Bianca in Comune di Zevio (VR) e Progetto di Bonifica Cava Bastiello in Comune di Isola Rizza (VR)*, INERTECO S.r.l.

Turri E. 2000, *La Megalopoli Padana*, Marsilio Editore, Venezia.

Veneto Progetti, 2009, *V.A.S. Rapporto ambientale, Rapporto sul Quadro Conoscitivo*, in «Piano di Assetto del territorio, Comune di Ronco all'Adige».

Vesentini G. 2014, *Ampliamento in vista per la discarica Cà Bianca?*, Zevio Bene Comune, August <https://sites.google.com/a/zeviobenecomune.org/zeviobenecomune/comunicati-stampa/ampliamentoinvistaperladiscaricacabianca> (08/15).

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Afteruse of Landfills
Methodological approach, project requisites and relationship with the surrounding area

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Abstract
Sanitary landfills still today represent one of the most widely applied methods of waste management. However, the characteristics of this type of plant represent a particular challenge for the environment due to the potential release of pollutants, for the surrounding area as the plant may affect local organization and functions, and for the landscape as both the size and the morphology of a landfill may establish new relationships with the landscape.
In the case of older landfills, reclamation measures are frequently required, although these can be undertaken to enable co-existence with modern waste disposal operations based on an integrated system of waste management, and should be included by land-use urban planning as a place of mutual interest to the community.
The more modern types of landfill designed based on criteria relating to waste technologies and management developed to reduce the impact produced on the environment and the local area, may provide an opportunity to intervene with large-scale projects and thus restore spaces for community use and even provide a benefit. Based on these premises, it would be particularly interesting to focus on the possibility of future reclamation of the landfills under construction at the design stage by applying an approach that takes into account future use from a technical and, economical perspective from the outset.

Keywords
Afteruse, Waste, Landscape, Territory Planning, Community

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General aspects and state-of-the-art

Municipal solid waste management is consistently linked to a strong interrelationship between technology, the environment, the terrain and society. In the past, although in the presence of a dearth of disposal technologies, this interrelationship was concealed by the small scale of interventions, the low population density, the scarce mobility of the population and by a limited (at times absent) environmental awareness. Subsequent economic and demographic growth has raised the visibility of land use and environmental issues deriving from waste management. Means of transport, technology and the Internet have all promoted an increased mobility and enhanced the possibility of a widespread contact throughout a region.

The locality no longer provides residual spaces to be used for the purpose of waste disposal but dictates how waste management systems should be comprised as part of an overall land use plan linking the diverse areas of the local area in a process ultimately identifying the intended use of the areas within the context of an organised community. Accordingly, the disposal of waste evolves from an inexpert into a process and tool intended to foster new forms of land use. The planning activity underpinning the management and realization of a waste disposal facility should represent a contribution to local territorial planning. This way the waste facility would be fully integrated with other urban structures (intended as the locations on which the attention of the community is focused), rather than being seen merely as the consequence of exclusions and concealments or limitations dictated by a state of emergency. Moreover, planning and design should strive towards obtaining consent at the time of decision-making, and in no case later than siting of the works. The consensus should never be considered in retrospective mode, especially in the presence of an organised opposition carried out by the populations concerned.

In terms of quality of the local terrain, it is no longer a sustainable practice to earmark extensive areas to be occupied by landfill, although the importance placed on this issue may vary according to the reference context concerned. In some countries, land reclamation is a firmly established condition aimed at guaranteeing quality of life under threat from an uncontrolled industrial development and population growth necessitating use of the land in question and avoidance of misuse (fig. 1). In this regard, a landfill represents a potential value in line with the context in which it is located. The functional reclamation of the Hong Kong landfills (Sai Tso Wan, Jordan Valley, Shuen Wan, etc.) is a concrete example. The latter landfills, all sited on areas of virgin land,

Fig. 1 – Garbage piles up at a temporary garbage dump in the eastern suburb of Beirut (photo: Joseph Eid).

were identified as valuable land to be used in creating leisure facilities and green spaces that were inevitably lacking throughout the territory.

When envisaged, the functional reclamation of the majority of landfills consists mainly in the siting of revegetation works on the final cover with the aim of mitigating impact, although these works are frequently limited to a mere restyling that rarely leads to an effective functional reuse of the area.

However, numerous cases of functional reclamation of old landfills have been described worldwide, attesting the real possibility of undertaking works for the good of the community. Thanks to a cultural approach that tends to view this type of work favourably, and due to a general lack of space, old landfills in Spain, Japan and China (for example) are frequently used for the purpose of creating urban green spaces with leisure and sport facilities.

Options resulting in a renewed use of areas are required to undergo a decisional/design process aimed at assessing the most appropriate final choice in terms of land reclamation, impact on the landscape, environmental sustainability and community consensus. These options are considerably limited by the fact that landfills are conceived to represent the final solution for a specific area, with reclamation not being taken into account during the important design stage. The limitations to be addressed during this process are linked mainly to management of the waste volumes concerned. Indeed, aboveground waste void space is developed to allow the deposition of as much waste as possible, resulting in the formation of masses that significantly limit re-use options. Old landfills, initially developed with a specific intended use, although not strictly viewed as pollutants, constitute a potential 'polluting' presence on the area that frequently deface the landscape and functionality of the area (for example the typical tronco-pyramidal shape, etc.).

After use of landfills: 3 potential scenarios of intervention

When considering the reuse of an existing landfill or hypothesising the functional use of a landfill yet to be constructed, the main features to bear in mind are: environmental conditions, technologies used to

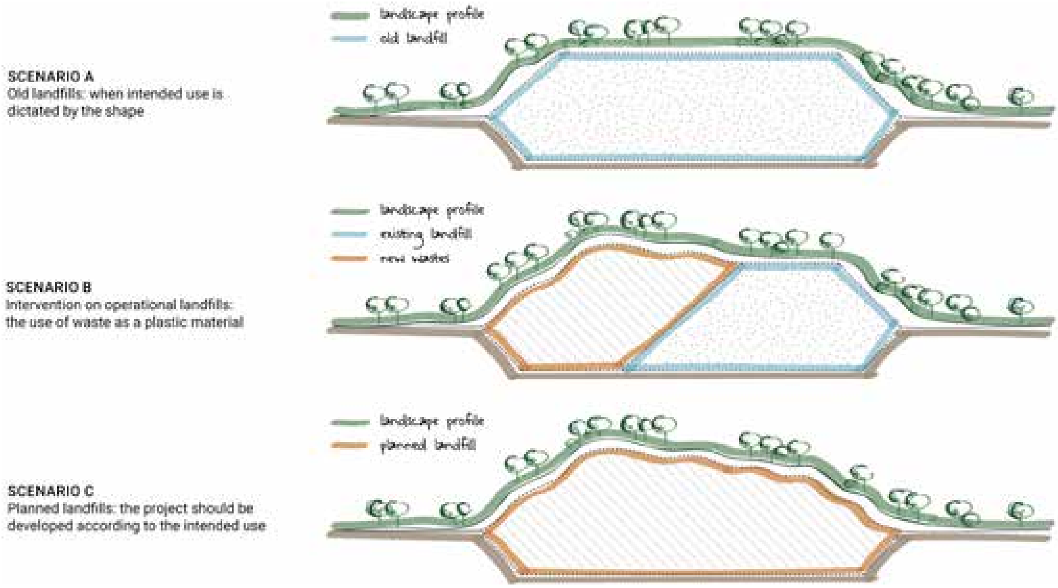


Fig. 2 – Scenarios of intervention (graphics: Studio Arcoplan).

mitigate impact, the impact on land use and infrastructure exerted by the facility within the context in which it has been sited, and landscaping in view of the value of transformation elicited on the existing landscape by siting of the landfill on the area.
Functional reuse of a landfill may be envisaged in a series of different situations as follows:

- A Existing landfills requiring works of environmental reclamation or recovery
- B Existing modern landfills either undergoing construction or operational (or in which extension works are required)
- C Landfills still to be designed (details relating to siting, waste volumes to be deposited, etc. may not be known).

According to these situations there are three different scenarios (fig. 2).

Scenario A | Old landfills: when intended use is dictated by the shape

Reclamation of an old landfill is characterised from the outset by a predominantly negative view of the intervention: to reclaim; i.e. to undertake the recovery of an environmentally compromised situation and re-establish links with the surrounding area. From a morphological viewpoint, old landfills were invariably constructed without any consideration for the landscape or urban planning, with the sole constraint of complying with the height limits defined by the competent Authorities at the time of authorisation. In an attempt to maximise the capacity of the facility, landfills were frequently developed without paying due attention to above ground waste volumes, thus resulting in the formation of improbable-shaped masses that interrupted the natural lines of the landscape. A recurrent skyline was represented by a troncopyramidal formation that, although designed according to laws enforced at the time (in terms of maximum height, slopes, etc.) left an invasive and permanent anthropic mark on the landscape. The resulting land conformation significantly limited the choice of intervention, with the pre-existing landfill constituting a highly visible element with which the restoration project would be required to interact.
A good functional rehabilitation project carried out

Fig. 3 – The El Garraf Massif, Barcelona. Project for a community park on the Val d'en Joan landfill drawn up by the architects Enric Battle and Joan Roig (source: Batlle I Roig Arquitectes archives).

as illustrated in figure 2 (scenario A) should therefore assign an appropriate role to the pre-existing landfill, without attempting to mitigate or conceal it, but rather seeing it as a means of interpreting the entire project, continuing to testify the previous life of the site.

A relevant example to clarify this concept is provided by the restoration of the Hiriya landfill in Tel Aviv, an impressive 60m high 'mountain' of waste distributed over an area of more than 450.000 m^2. The landfill restoration project, drawn up by Latz + Partner in 2004, provided for transformation of the area into one of the largest urban parks in the world, thus changing the aspect and features of the 'mountain' of waste from a negative element of the landscape into a symbol of ecological renovation. The volume of the old landfill stands at the centre of the project like a large evocative totem, in clear view of visitors in all corners of the park. Taking into account the pre-existing facility, the transformation of the Hiriya landfill was designed as a sort of enormous theme park focussing on waste recycling and evolved into an innovative centre for research on recycling technologies that also hosts educational activities.

Generally, a functional restoration and landscaping project will need to address the issue of the complex management of a landfill during the post-filling stage. It will need to take into account the presence of the visible impact of some infrastructure (i.e. leachate drainage and/or treatment plants, biogas extraction plants, etc.), of subsidence and settling of the waste, of the existing slopes and topography in general, of water management and layering of the final cover. All these elements, if not assessed previously with a view to final recovery, will further limit any possible form of reuse.

The landscaping and agronomic management of the site should be carefully investigated during the planning stage. The area should be planted in order to enhance a correct balance between surface run-off, infiltration and evapotranspiration, thus promoting a correct control of infiltration water.

Indigenous trees and shrubs are to be preferred, having roots which are suited to the substrate and leafy coverage to enhance run-off and evapotranspiration. Herbaceous species should be fast stabilizing, hardy and with a low degree of flammability.

In the scenario A, possible outcomes are represent-

Fig. 4 – The El Garraf Massif, Barcelona. Project for a community park on the Val d'en Joan landfill drawn up by the architects Enric Battle and Joan Roig (source: Batlle I Roig Arquitectes archives).

ed by nature parks or green spaces with leisure facilities (theme parks, motocross tracks, cycle paths, golf courses, model plane fields and sport and leisure facilities in general). Other more complex and structural constructions are hard to achieve.

It is however possible to achieve a good outcome in the functional reclamation and landscaping of old landfills denoted by high quality architectural features, as attested by a wide series of projects undertaken throughout the world.

Reclamation of the Barcelona landfill situated in the *Val d'en Joan* in the natural Garraf Park, is still today deemed a reference project of excellence for this type of intervention. The project for restoration of the landfill was drawn up by the Spanish architects Enric Batllé and Joan Roig, and in one sole intervention was aimed at achieving three major aspects: solving a complex technical problem, creating a new community area and providing a new landscape (fig. 3-4).

The complex technical issues deriving from the closure and final covering of the landfill underpinned the rationale behind the working hypothesis. This consist in the organization of the stepped consolidation terraces, the containment banks and road access marked the geometry of the landfill and determined the placing of the pipelines required by the gas treatment plant to generate electricity, for the drainage system and the transfer of leachate.

The third objective, the development of a new landscape, came with the desire to merge the old landfill with the Natural Garraf Park. Naturally, the morphology of the site today has greatly changed if compared to the original one. However, the Garraf Park comprises cultivated valleys that have been modified by means of agricultural techniques (fig. 5) purpose-adapted to the local geography using systems of terraces, drainage and cultivation in order to meet the technical requirements of closure and final covering of the landfill.

The outcome saw the construction of eleven stepped terraces planted with native drought-tolerant species compatible with integration of the landscape. Moreover, an irrigation system was set up throughout the area. An underground drainage system was devised to separate the pollutant liquids and recirculate the water to irrigate the park. The landfill also provided biogas used in the produc-

Fig. 5 – Project for a community park on the Val d'en Joan landfill: constructive and vegetation systems, inherited from traditional agriculture (source: Batlle I Roig Arquitectes archives).
Fig. 6 – Project for a community park on the Val d'en Joan landfill: detail of plant walls, built of non-degradable products of the old landfill (source: Batlle I Roig Arquitectes archives).

tion of electricity. Some wastes left on the top of the landfill in large steel cages to remind visitors the origin of the site (fig. 6).

The architect Israel Alba who curated the transformation of the *Valdemingómez* landfill in Madrid adopted a similar strategy. The project for the recovery and transformation of the *Valdemingómez* landfill required the application of complex environmental engineering processes, as well as new landscape architectural strategies. Today, this place can be incorporated, with full guarantees, into the city structure, as long as it is seen as a monumental public space. It is recovered ground capable of becoming a new, free, metropolitan space that can answer the current and future needs of society, especially if it remains as such over time.

The landscape architectural project undertaken involved the proposal of new strategies to create an area that would remain open, flexible and dynamic throughout time, in search for equilibrium between city and nature. The *Valdemingómez* landfill proposes a model of continuity between the forest and the surrounding area, as a pseudo-botanical garden with indigenous species seeking integration into the *Parque Regional del Sureste* (Southeast Regional Park). Now it has been transformed into a free, public area with pedestrian paths and bicycle lanes, along with woods and wetlands, which have helped to create small, localized ecosystems. The life of both nature and city can be observed within.

The project for the general reclamation of the old 'Fresh Kills' landfill in New York, designed by James Corner Field Operations, is one of the most widely known. Firstly, as it is the largest existing landfill worldwide. Since the closure of the landfill in 2001, the value and significance of this urban site of more than 890 hectares have changed considerably. This artificial landscape located to the east of Staten Island is today as an extraordinary resource for the fast growing population of New York with its pressing need for green spaces. Only 45% of the Fresh Kills site has actually been used as a landfill. The remaining area features the extensive swamps that have characterized the New York archipelago since its origin. The wide variety of natural environments forms a habitat for numerous indigenous and migratory animal species. The aim of the project was transforming Fresh Kills into a twenty first century urban park whilst maintaining both the large dimensions and the essential underlying character of the area (fig. 7). The buildings and the activities are all confined to specific areas, thus leaving the rest of the site as open and natural as possible.

The project will be completed over a thirty-year period, with the first challenging ten-year stage comprising work on the northern and southern sections

Fig. 7 – Aerial view of Fresh Kills Park.

of the park (fig. 8). The implementation strategy is based on a series of flexible and incremental steps aimed at ensuring a balanced execution of works to close the landfill, start up the site management processes and transform the area into a public park.

Scenario B | Intervention on operational landfills: the use of waste as a plastic material

Reclamation works performed on a landfill will have a far greater chance of success when studied and developed during the stage of active management of the landfill (during the construction stage, during waste deposition or at the time of a potential extension). Indeed, employing new wastes as a plastic material, whose shape can be moulded, extends the pool of potential uses assigned to the project and provides greater freedom in reinventing the final configuration of the area (fig. 2 - scenario B). In addition, it facilitate important budgetary savings in terms of material employed to modify the structure of the site.

By intervening during the operational phase rather than the post-management phase, not only enhances the possibility of modelling the banking of new wastes in line with the project design (fig. 9), but also enables operations aimed at the functional recovery and landscaping of the area that start when the landfill is still operational (e.g. in the previously established closed sectors). In other words, in scenario B the intervention entails an immediate functional use of the areas with a progressive involvement of other sectors.

The main difficulties encountered in the planning and design are due to the coexistence of the ongoing operations of waste deposition and remediation of the landscape, thus requiring careful planning throughout. The establishing of a timeline representing the chronological development of the project is fundamental, and should scan the different operations in line with the state of waste deposition in the landfill sectors (fig. 10) according to a series of future short, medium and long-term scenarios developed over a period of no less than 30 years.

The distribution of vegetation should be imple-

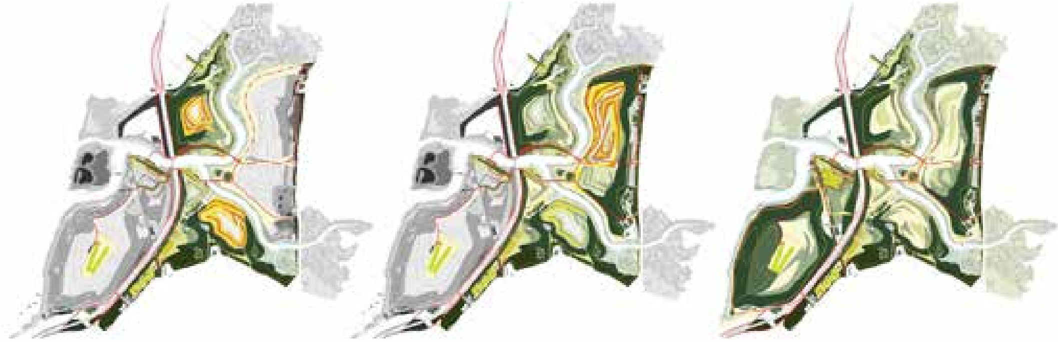


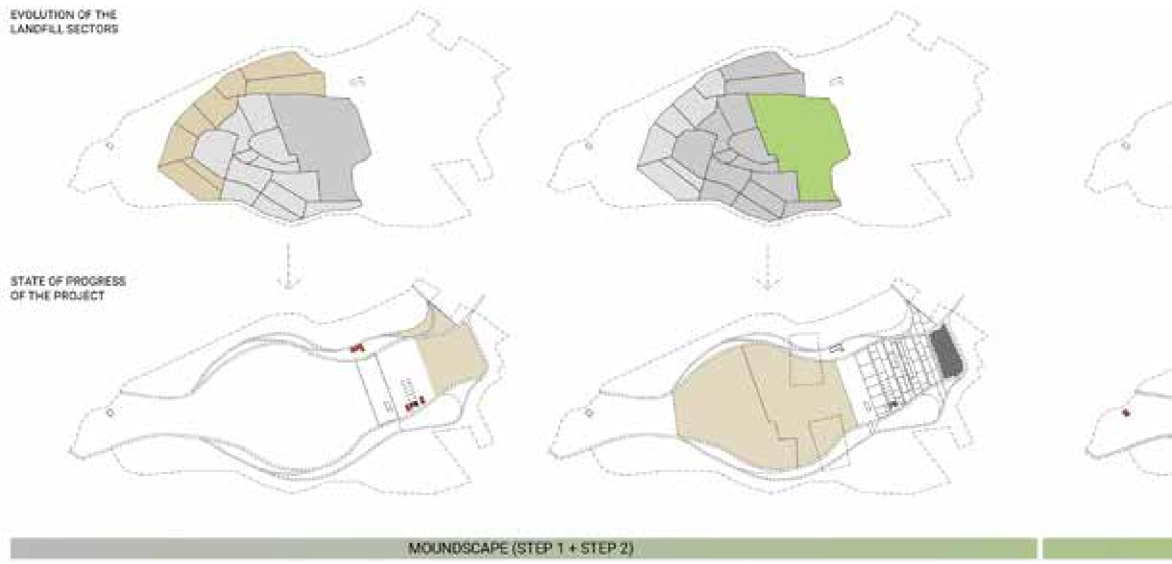
Fig. 8 – Chronological evolution of the landscaping of the Fresh Kills landfill, New York.

Fig. 9 – Cross section of a landfill. The wastes used as a plastic material to shape the land (graphics: Studio Arcoplan).

mented in full compliance with the original existing landscape and should be completed taking into account not only the technical aspects described above, but also the functional reclamation of the area to be achieved once waste placement operations have terminated and the relative sectors have been covered. Plant distribution throughout the area therefore should be envisaged in synergy with the operations and functions provided for by the function reclamation project (fig. 11).
Furthermore, undertaking works at this stage enables the planning of operations that are more complex. It also foresees a marked local involvement, thus promoting a widespread positive impact. Accordingly, a project for valorisation of an area should be developed in line with the specific aim of creating important synergies with the locally present manufacturing and entrepreneurial concerns.

Scenario C | Planned landfills: the project should be developed according to the intended use

When designing a project on the basis not solely of the designated use of the site as a landfill, but rather in view of the ultimate use established, since the beginning of the project waste contribute to shape and model the final morphology of the landscape. From the outset, therefore the structure of the project depend on the final use of the area. In line with the parameters established by the project, the deposited wastes may be used today as a plastic material to shape the area for tomorrow (fig. 2 - scenario C).
Establish operational synergies between the location, the form and the volume of waste to be banked, the architectural materials and language of the buildings destined to house the facilities, together with all other features of the project, will enable a dual function. A first temporary function associated with operations of disposal and treatment of the waste, and a second more permanent aspect linked to the future intended use determined during the stage of landfill design (fig. 12).
The planning and design phase for a new landfill therefore provides all the necessary conditions to



envisage a coherent contextual change in line with the needs of the locality.

The construction of a new landfill according to a project aligned with the surrounding landscape and urban spaces is dependent on a fully integrated project strategy and a multidisciplinary approach that can only be achieved by relying on a team of designers with competence in numerous sectors (environmental engineering, geology, agronomy, landscape architecture).

The abovementioned principles are however deemed extremely innovative when compared with common practice as they dictate a change in the terms of the project: we are no longer the designers of mere landfills, but rather of community spaces.

In order to make provisions for the project as a whole, the planning of the intended future use of the area should be articulated on the basis of the three subsequent levels of in-depth technical analysis provided for by current law, i.e. a preliminary design, a definitive project and an executive project. The study should imply detailed analysis to provide for a detailed budgetary control from the outset. This will allow to accrue sufficient sums during the operational phase of the landfill to effectively finance the carrying out of all works.

These important concepts, which should drive the planning and design of new landfills and shift the focus of the designer, unfortunately often fail to be taken into account.

Methodological approach

Generally speaking, designing a final solution for the area and studying the morphology and configuration the site will possess once waste deposition will be completed, implies an inherent need to identify the relationship that the new development will establish with the surrounding natural and cultural landscape, thus determining the success of future relationships. Therefore, in order to define the relationship of the facility with the local context the forms assumed by the environment, the history of the area, the locations, the presence of places of interest throughout the area, should all be examined in detail. The same happens to define what functions it may fulfil and - in case of designing e.g. a park - what species of plants should be used to cover it. At the same time, it is to envisage the use of

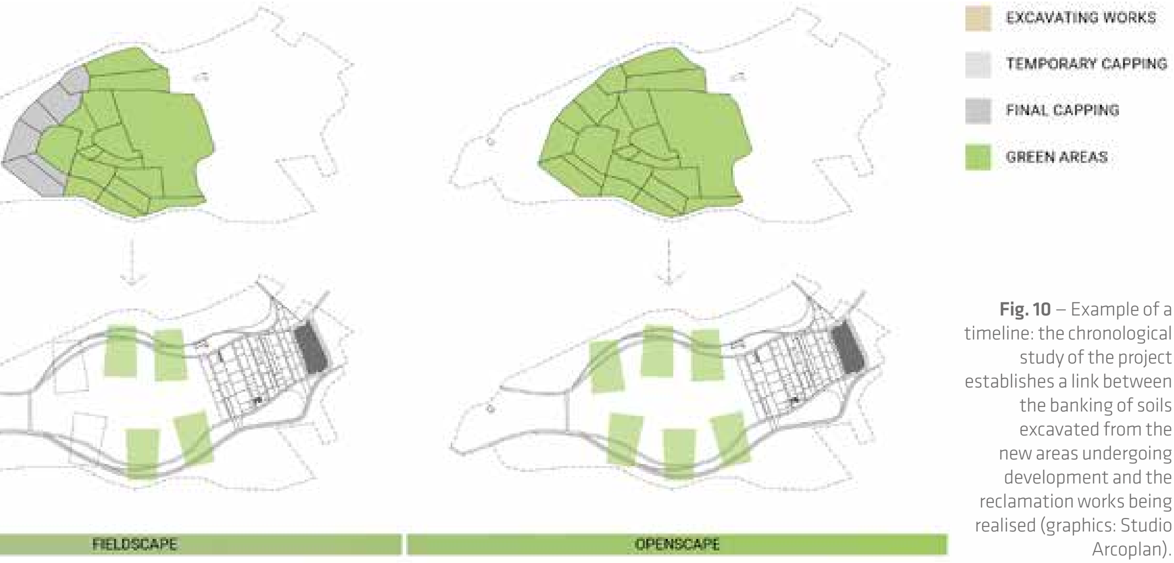


Fig. 10 – Example of a timeline: the chronological study of the project establishes a link between the banking of soils excavated from the new areas undergoing development and the reclamation works being realised (graphics: Studio Arcoplan).

the waste mass as a 'plastic' element (an architectural term for rich, three-dimensional or sculptural presence of an architectural element or building) for the reconstruction of a coherent and redeveloped landscape.

The following paragraphs focus mainly on landscaping, integration into the surrounding area and public perception.

Assessment of the surrounding area

In line with the most elementary principles of land use planning, the assessment of the surrounding area undeniably represents the most important step to be undertaken prior to drawing up of the project and irrespective of the type of intervention to be carried out (scenarios A, B, and C).

As for any other type of area, the re-naturalization of a landfill, whether it be in existence or still at the design stage, is largely linked to an understanding of the area and the territorial structures present in order to enhance the integration of the area and the establishment of necessary bonds with the pre-existing urban and natural structures.

The complexity of the landscape and the wealth of elements characterising the area should be carefully analysed in the light of the predominant factors. Once the main objectives of the project have been established, the methodological process should include an accurate assessment of the territory as detailed below:

1. Analysis of the landscape and terrain

Assessment of the terrain and land use are fundamental to analyse the predominant features of the concerned area. In particular, a detailed analysis of the agricultural context and the dominant environmental factors is mandatory in identifying the lines structuring the new landform design and establishing the specific land use of the restored site.

This type of analysis consists in the identification of the environmental components that will be involved in the project. The environmental system is thus split into elementary components. In the same way, as in routine land use planning, this type of analysis is conducted by means of overlay mapping of the natural system in which the major components (elevations, waterways, etc.) have been broken down.

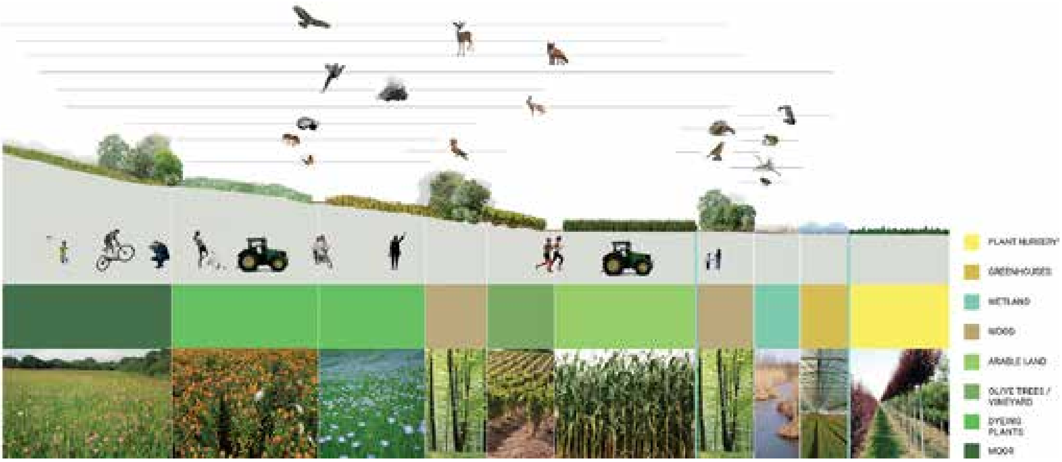


Fig. 11 – Example of landscape design based on the intended use provided for in the general project (graphics: Studio Arcoplan).

2. Analysis of the residential | infrastructural system
This assessment possibly represents the most important stage of the preliminary analyses and is fundamental in ascertaining the size of the catchment area of potential users, also in view of the vicinity/distance from the main towns and cities that will need to be taken into account. A thorough knowledge of the history of the area and of the existing facilities is mandatory to identify a potential lack of infrastructures and determine future relationships.

3. Analysis of the productive system
The existence and articulation of resources (underpinning the specific local characteristics) should be highlighted: identification of the latter will contribute towards revealing the magnitude of the environmental values and pinpointing of those areas displaying signs of incompatibility with potential transformation works. Subsequently, any existing restrictions should be examined.
Analysis of prevalent activities: this should be carried out to assess the possible links to the project and to identify potential involvement of the local manufacturing industry (fig. 13).

Project requisites
Downstream of the outcomes of the preliminary territorial analysis, the planning and design should be developed to foster a harmonious insertion of the intervention in the local context, in respect of the morphology of the surrounding landscape by recreating the essential forms and lines of the spatial continuity. To reuse a landfill, the project should restore the terrain to its natural vocation, moreover providing a benefit and meeting the requirements of the local community by bridging a potential gap in the lack of infrastructures. It should furthermore provide a series of educational, social, cultural and leisure facilities to attract potential users.
Moreover, the design concept should promote a positive outcome and economies of scale, bearing in mind the economic feasibility of the transformation, and should strive towards creating an 'exportable model' to become a reference project in similar contexts.
The success of a project will depend largely on the consensus received from the local community who will benefit from the presence of a quality-controlled environment, from local manufacturers and consumers. Two possible involvement processes are illustrated in figure 14. In the approach 'En-

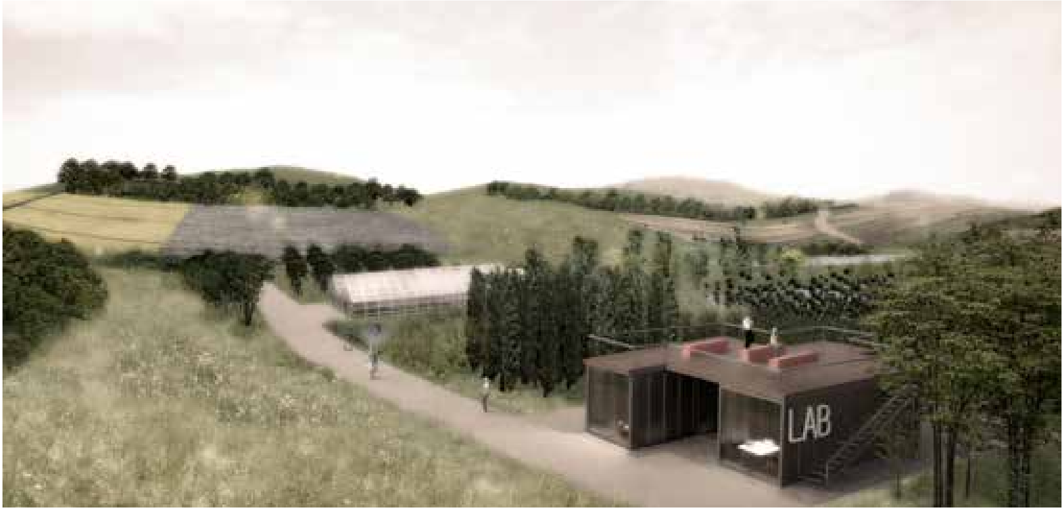


Fig. 12 – Aerial view of the future use of a landfill site (graphics: Studio Arcoplan).

Fig. 13 – The project and potential involvement of the local manufacturing industry. The figure shows, in a matrix format, the relationship between the design choices and the productive system, associating the different products obtained from the exploitation of designed surfaces and the local prevalent activities.

gage-Design-Deliver', some key representatives of the wider community are brought in at the very start to discuss and agree the scope of the project and the involvement process with the technical team. This takes longer than the start in the old model. The team, the core group and many others then engage in the process 'Decide Together'. Then, instead of having to announce the proposals to an unsuspecting public, not only (most of) the public will be already aware but some will have contributed directly to those proposals. Instead of objecting they will often support, even 'champion' what many by now consider 'their' project. However, some defending is always still needed.

Conclusions

A sanitary landfill, intended as the last link in a circular economy, should be conceived as an endeavour that is developed throughout the duration of the operational phase. Completion of construction will only

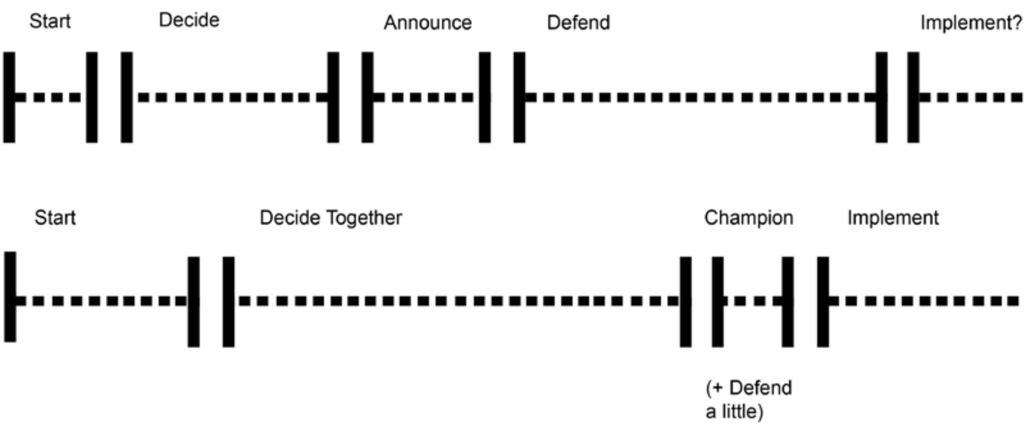


Fig. 14 – Involvement processes: diagram 1 - Decide-Announce-Defend (common process) - diagram 2 - Engage-Design-Deliver (recommended approach) (source: Jeff Bishop Studio).

be achieved once the global project has been terminated. Accordingly, the operational phase of a landfill should be seen as an extension of the building.

In a circular economy perspective, landfills occupy an unavoidable rather than a disputable position and should be seen as a necessary facility in the same way as all other services a community relies on. Indeed, it is the overwhelming need for landfills to legitimize construction of the same and likewise justifies the need to ensure they remain near the community they serve.

An environmentally sustainable landfill should assume programmatic significance through a planned intervention that contributes towards the overall design of the locality and meets the requirements of the two life phases of the landfill itself: the operational phase (temporary use as a landfill) and post-operational phase (final use created on the basis of the deposited wastes). Therefore, a precise time horizon and specific technical regulations should be established in line with the final intended use of the site as determined in the initial project.

Municipal waste sanitary landfills should therefore be seen as an integral part of local area planning with a functional rather than a disposable intended use. It should no longer be construed merely in the light of its intended use, but as a process heralding the development of a new form of intended use.

References

Alba I. 2015, *A recovered landfill in the construction of a metropolis: Valdemingómez forest park, over time*, in Proceedings International Workshop on Waste Architecture, CISA publisher, Padova.

Artuso A., Cossu E. 2012, *Environmental reclamation of the Campodarsego (PD) controlled waste landfill,* in Urban Mining. A global cycle approach to resource recovery from solid waste, edited by R. Cossu, V.Salieri, V. Bisinella, CISA publisher, Padova, pp. 408-414.

Artuso A., Cossu E. (in stampa), *Afteruse of landfills: Methodological approach, project requisites and relationship with the territory*, in *Sustainable waste landfilling: Concepts, processes, technologies*, edited by Cossu R., Stegmann R., Elsevier publisher, Amsterdam.

Bishop J. 2015, *Working with communities: Faster, cheaper, better!*, in Proceedings International Workshop on Waste Architecture, CISA publisher, Padova.

Cosgrove D. 1990, *Social Formation and Symbolic Landscape*, Croom Helm Ltd, UK.

Cossu R. 1998, *Problematiche della chiusura e post-chiusura delle discariche controllate*, in Atti Convegno Nazionale Chiusura e post-chiusura delle discariche controllate, CISA Editore, Cagliari.

De Poli M., Incerti G. 2014, *Atlante dei paesaggi riciclati*, Skira editore, Milano.

Di Fidio M. 1998, *Per una pianificazione locale orientata ecologicamente*, «Inquinamento», n. 6.

Comitato Tecnico Discariche 1997, *Linee guida per le discariche controllate di rifiuti solidi urbani*, Cisa Editore, Cagliari.

Landscape Architecture Europe 2006, *Fieldwork*, Birkhauser LAE Foundation.

Maciocco G. 1991, *La pianificazione ambientale del paesaggio*, Franco Angeli, Milano.

Maciocco G., Sanna G., Serreli S. 2011, *The urban potential of external territories*, Franco Angeli, Milano.

McLeod V. 2008, *Detail in contemporary landscape architecture*, Laurence King Publishing Ltd, UK.

Mezzacane D. 1995, *The profession of architect of golf courses*, «Gli impianti per il golf», n. 3.

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SECONDA SERIE

Rethinking the Spaces of Waste Management Infrastructure: towards integrated urban strategies to avoid urban solid waste in contemporary city

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Abstract

This paper examines the issue of solid waste management in urban contexts, by an architectural perspective. In light of the emerging waste crisis, this paper proposes to redesign and gradually reintroduce waste management facilities in the urban tissue. The capacity to learn from trash can help to design a new generation of facilities, aiming to recover suburban areas and to re-establish a lost ecological balance.
The paper underlines the need to radically reconsider the spatial articulation and the organizational structure of the current waste management infrastructure, through an integrated approach aiming to define a decentralized and distributed urban model. Finally, the paper explores heuristic potentials for architectural design, identifying hybrid figures and finding key actions to intervene in the contemporary city, inspired by the notion of 'unblackboxing'.

Keywords

Architecture, Waste Management, Urban Metabolism, Strategic Design, Unblackboxing

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Introduction

Today production and consumption of goods are the most extensive than any time in human history. Waste generation, both domestic and industrial, continues to increase worldwide in tandem with growth in consumption. Urbanization trends (in 2050 there will be about 9 billion inhabitants, of which 80% will live in cities) and the dynamics of the still widespread capitalist consumerism, threatens the environmental carrying capacity.

The issue of waste comes from the unsustainability of a development model that alters environmental and social balances. If current trends continue, the world may see a five-fold increase in waste generation by the year 2025. There is a need to develop an integrated approach in order to promote a sustainable solid waste management in the frame of a circular urban metabolism. Since the spread of notions of circular economy and urban metabolism, the need to consider waste as a resource it is today increasingly common in different fields and disciplines.

How to bring back the bulky presence of waste within the design of public space, city and territory? Looking at the urban agglomeration through the conceptual filter of urban metabolism, it appears as a body swollen and flooded by the many wastes that have become unmanageable (Marvin and Medd, 2010).

If matter that is in a temporary state of uselessness and loss of value (waste), brings back usage value (resource), is therefore necessary to develop an architectural and urban imagery that integrates their cycle with society, its rhythms and rituals, and with ecological cycles.

The aim of this reflection is to examine the issue of solid waste management by an architectural perspective. Historically, flows of resources have always had a spatial and aesthetic consideration, producing new urban imaginaries: aqueducts, mills, fountains, power plants, even railway stations constitute an architectural heritage of public interest, considered as integral part of urban and territorial morphology.

An Operative Hypothesis

History provides examples of how the relationship between waste and urban agglomeration has been rephrased over time, thanks to a continuous activity of repair and maintenance (Graham & Thrift, 2007). Often the topographies we observe and believe to be ‘natural’ have been determined by artificial processes (Alba Ramis, 2015), resulting from human activity. Most evident cases are former landfills, such as the historic trace of *Monte dei Cocci* in Rome or the more recent grass-covered Georgswerder Energy Hill in the Wilhelmsburg district of Hamburg.

The capacity to learn from trash can help to design a new generation of facilities and spaces, aiming to recover suburban areas and to re-establish a lost ecological balance.

Current environmental policy is generally founded on the principles of the 'waste management hierarchy', aimed to improve the selective collection and make it more efficient through the application of the proximity and self-sufficiency principles.

Prevention is the hierarchically superior goal in waste management strategy, according to the inverted pyramid scheme. It is followed by preparation for reuse, recycling, recovery of various kinds, and finally disposal. Each stage corresponds to physical spaces to be designed and integrated within the existing fabric, including different activities (selecting, compacting, vending, transporting, composting, disassembling, fixing, upcycling, disposing) and various additional equipment (vehicle parking spaces, temporary storage warehouses, spaces for the promotion of reuse and upcycling, repair centres and creative recycling laboratories, spaces to house compaction or composting units).

The combination of the activities previously mentioned delineates new locational geographies, which tend to be spatially organized according to fundamental principles:

- Convergence: defined as a strategy pointing to one side to catalyse existing flows, hybridizing them together with functions and spaces, and on the other to establish points of contact between the life of the building, the urban waste cycle and a more efficient use of existing infrastructures.
- Synergy: establishing a network of simultane-

Fig. 2 – Top view of the Issean plant. Below, the unloading deck on the river Seine. Source: Syctom.

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Fig. 1 –The top view of the former landfill close to the city centre. Credits: IBA Hamburg GmbH.

ous and reciprocal relations between systems;
- Intermodality: incorporating multiple modes of transportation in order to capitalize advantages and to determine impacts.
- Hybridization: primary functions are connected to a system of relations and complementary functions that will activate metabolic cycles.
- Adaptivity: each configuration founds its own balance dealing with the typology of urban tissue, public spaces networks, infrastructures.

It is clear how these needs and goals set up parameters for a new inter-scalar infrastructure, both physical and social, adaptive in relation to the contexts and to the specific functions required.
In light of the emerging waste issue, here is proposed to redesign and gradually reintroduce waste management facilities in the urban tissue, through an interscalar, incremental and adaptive approach, based on different phases that correspond to different times and scales of intervention.
The incremental model proposes a period of choices based on the constant search for a balance between the actors involved from time to time in decisions that will no longer be called upon to respect their actions with a rigid design ex ante, but they will also compete to its very definition. Each partial result accomplished in one phase becomes the starting point for the subsequent phase. Defining new spaces for waste management requires three phases of intervention, taking as a reference the Cityforming® Protocol (Carta & Lino, 2015), a planning protocol aimed to reactivate the metabolism of an area.
The first step involves micro-interventions and ur-


01
park

Fig. 5 – View of the rooftop garden. Source: Maag Recycling.

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Fig. 3 – Street view of the recycling and sorting centre at Porte de Pantin (Paris), DATA Architectes, 2016. (Image © DATA Architectes).
Fig. 4 – Main front view of the Maag Recycling Centre (Winterthur, Switzerland), OOS Architects, 2004. Source: Maag Recycling.

ban ecology tactics supported by the use of various mobile devices for waste collection and citizen awareness. Services and processes triggered have a connection role, intervening on the public space and at a social level.

Subsequently, a second intermediate step is envisaged, characterized by a series of permanent interventions. These are architectural additions to the urban fabric for the grafting of multifunctional equipment as the first outposts of the chain to start reducing waste streams and disassembling and recovery phases. Collection and reuse centres are the spaces that at this scale play a key role. Within the second step also increases the accessibility of the area. The third step carries out the completion of the chain at the urban scale through the realization of buildings-hubs at the municipal scale or supra, in which a number of further uses and flows converge.

Hardware and Software: a Proposal for a Strategic Framework

An effective strategy for waste reduction resides in the adoption of integrated scenarios, in which a design capacity expressed in a plural and collective way (Manzini, 2015) determines the testing of models for localized urban ecologies at different scales. In order to achieve the ambitious goal of a circular society, as indicated by the European Union, it's required a strategic framework that stands for a dual design action, operating simultaneously on the 'urban hardware' (buildings, infrastructures, systems) and on the 'urban software' (tactics, protocols, processes).

The inherent link between waste production and human activities leads to consider the relevance of new forms of social performativity, active citizenship and prosumership (Timmeren, 2015). It is not for sure that increasing separate collection will guarantee lower levels of consumption and waste production. There is a real risk that efficiency could be understood as a factor that legitimates a further increase of consumption. Furthermore recycling make disposables new naturalized commodities instead of foregrounding waste redesign or reduction (MacBride 2011).

A broader degree of citizens must to be involved in waste management practices, as remarked in the latest report 'World Cities 2016' (UN-Habitat 2016). Among the five key principles to guide the urban development, citizens' empowerment is indicated. According to that, the second action foresees to intervene on the urban software.

In the so-called Anthropocene's era, the reduction of the waste stream cannot only depend from neither technological innovation nor industrial efficiency, but it has required a rethinking of the relations with things and waste, calling for a less pas-

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Fig. 6 – Top view of Ecoparque (Granada, Spain), Gonzalo Arias Recalde architect, 2002. Source: Gonzalo Arias Recalde architect.

sive human agency (Bonneuil & Fressoz, 2016) to be involved through civic engagement.

Program and Aesthetic: an On-Going Metamorphosis

Waste facilities are increasingly facing a spatial and aesthetic metamorphosis, allowing to say that waste management spaces and facilities, starting to be simple technical rooms, are invested by a process of transformation. This transformation sees them taking on the role of real places for meeting, exchange, access to knowledge and finally, where new forms of experience are developed, good civic practices are involved, and finally new forms of economy can emerge.

In this perspective, these facilities should also to be characterized by functional hybridization and spatial quality, to be aesthetically recognizable and to be conceived not as mere storage spaces, but as productive and generative places, such as laboratories or factories, where a continuous transformation of matter and data can be driven by research and innovation.

Some case studies are presented below. The selection underlines strategic, locational, programmatic and aesthetic values.

Isseane: a circular factory

At Issy les Moulineaux, the Paris Metropolitan Waste Agency Syctom, decided in 2008 to replace the previous incineration plant with a new one, housing a sorting centre and a valorisation unit. It is also a productive hub for a widespread district heating network. Waste transport on barge and urban proximity allow reducing polluting emissions, vehicular traffic and transportation costs.

Aesthetically speaking, the dynamic wooden façade makes the plant looks like an office building or a shopping mall. The integration with the context is achieved thanks also to the invisible chimney encapsulated in the 2/3 grounded building. This allows reducing noise and airing pollution. Isseane activates synergies with the river, promotes a culture of environmental sustainability and energy efficiency by opening its spaces to educational initiatives.

Infrastructural intersections: the network of dechetterie in Paris

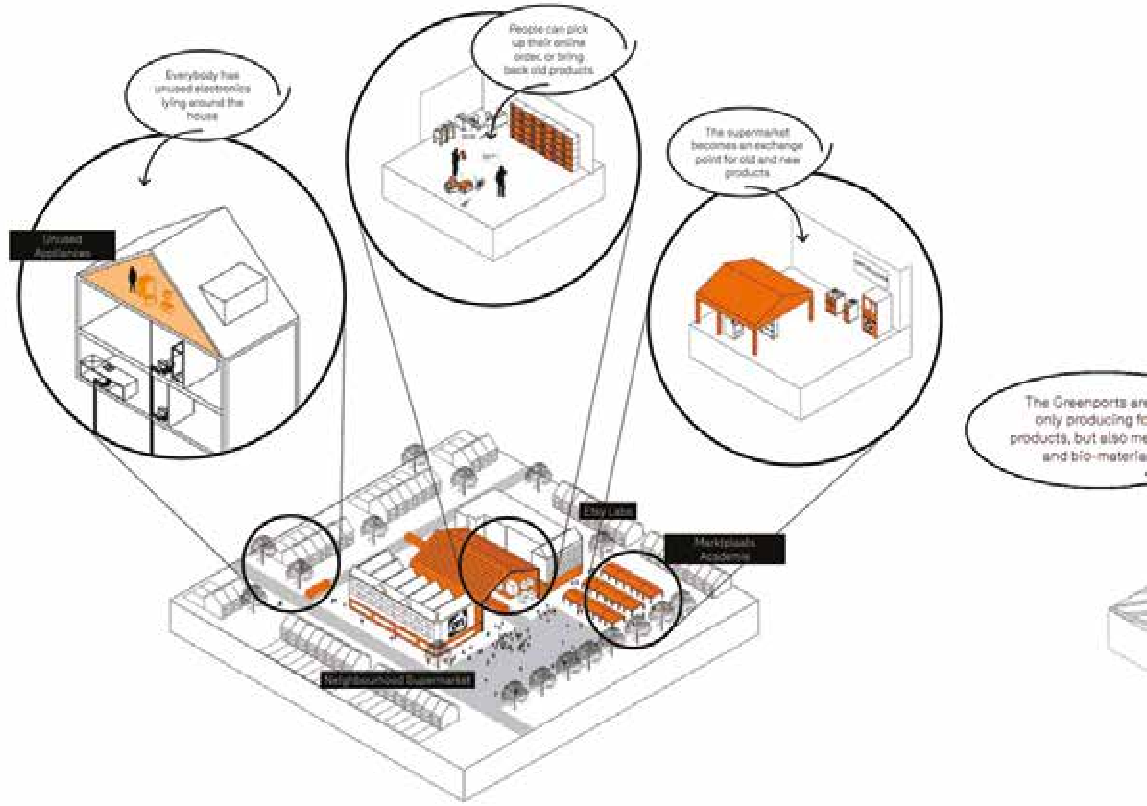
Paris is redefining its relationship with suburban areas beyond the Peripherique. A series of civic-amenity called CVAE (*Centre de valorisation et d'apport des encombrants*) are provided, where collect bulky waste, WEEE, green and garden waste, hazardous wastes as well as paper, cardboard, plastic, metal and glass.

Many sorting centres are located along the infrastructure, filling the voids under the overpass. Particularly relevant is the recycling and sorting centre at *Porte de Pantin*, built in a former traffic roundabout. An elegant white curtain made of staggered white brickwork, alternating with glass bricks, identifies the sorting centre. Aesthetic value accompanies locational advantages, given by the presence of the *Parc de la Villete*, the *Cité de la Musique* and, most recently, the *Philharmonie*.
It is noted how interstitial spaces transformed into a collection centre turns from forgotten space into a place of collective recognition: the overpass becomes the covering of a new metropolitan public space.

A recycling garden in Winterthur
The German word *hof* means court, courtyard. This inspired the Recy-hof project in Winterthur (Switzerland), a waste collection centre conceived by Mr. Werner Maag as a welcoming place for temporarily useless objects and materials. Designed by the OOS Open Operative System, in collaboration with landscape designers Stefan Rotzler and Matthias Krebs, the building fits in a strategic location, in a hinged area between the residential area and the industrial area of the city, with a high Degree of accessibility, and close to the railway line.
The building represents a convergence node that includes a collection centre, a lab, offices and services. Spaces and equipment for compacting and treating waste are placed on the other side of the parking lot. The green surface-rooftop put together a parking area and a community garden made by recyclables.

A multitasking ramp
In 2003, the architect Gonzalo Arias Recalde realized Ecoparque, a waste collection centre in Granada. The building is located at the edge of a production area and shares the access to the lot with a fuel station. For this reason, different flows are intercepted, ensuring proximity and synergies between different activities. Below the ramp there are three blocks hosting a seminar room and temporary deposits. Finally a third vertical block is located nearby the entrance, to host offices and services. Afterwards the functional program has also included an employment centre.
As an artificial landscape trail, Ecoparque is a porous and crossable border that separates vehicle trails and leaves open views of the surrounding landscape.

Towards a Distributed and Decentralized Model
Looking at fragility and inefficiency shown by current waste management infrastructures, the shift from a model based on few concentrated mac-



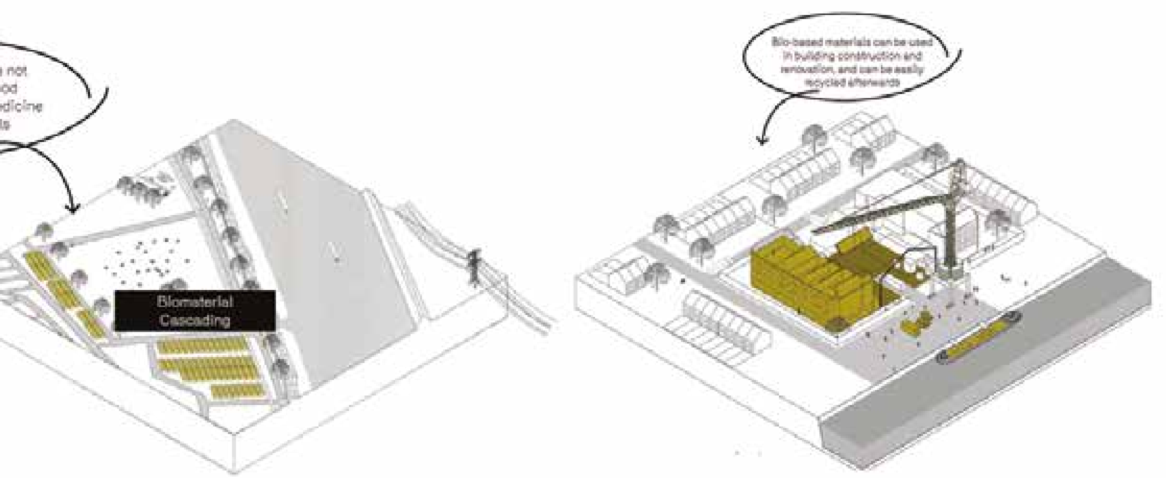
ro-plants, to a distributed and decentralized one, made by small-medium size facilities, represents a real trend reversal that will enable cities and territories to exit from an emergency condition, to finally get to an ordinary state (Mamì, 2014). From a linear model that meant opacity, distance between consumption and production, analytical separation and infinite circulation, we are approaching a new phase based on transparency, proximity, coexistence, systemic integration and circularity.

What kind of urban facilities do we imagine for this scenario? To this question tried to answer the vision *Urban Metabolism: sustainable development of Rotterdam* presented in 2014 at the Biennale of Architecture, *Urban by Nature,* in Rotterdam. The proposal, co-ordinated by Fabric together with a multidisciplinary team, presents a systematic approach and outlines different intervention strategies starting from the identification of nine streams (goods / goods, people, waste, animals and plants, energy, food, water, land and sand, air). The four design proposals converge on the common goal of optimizing metabolic flows. The strategy adopted on Rotterdam declines according to an adaptive logic, resulting into a multitude of medium/small-scale interventions on the medium small scale that are the points of activation or switching of the metabolic flows.

In a distributed and decentralized system, the role of these physical intermediate nodes related to waste management becomes meaningful in order to embed and to steer flows. These new glocal areas of 'friction' stimulate a civic attitude to change.

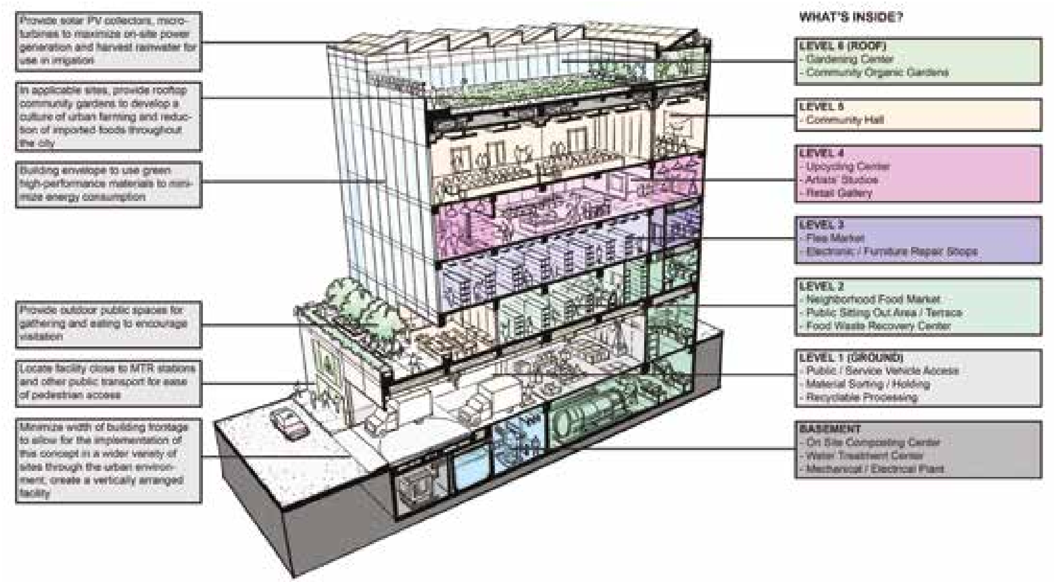
The challenge that contemporary design faces is to apply the principles of proximity, self-sufficiency

Fig. 7 – Circular utility facilities for Rotterdam (2014). Proposal by FABRIC. Source: Urban metabolism: sustainable development of Rotterdam, IABR, Rotterdam, 2014, pp. 85, 90.



and environmental sustainability, combining them with improved living conditions and daily habits. The relations between these principles are well expressed by the prototype for a neighbourhood community hub proposed by Sepia Design for the city of Honk Kong. It is a multi-story building combining together recycling, community, leisure and educational activities. According to the scheme, an onsite composting centre and a waste treatment centre are located in the basement, in order to ensure odour and noise prevention. At the ground level, vehicles can access to a material sorting and processing area. Three upper floors host flea&food markets (with a food waste recovery centre) and repair & upcycling laboratories next to a retail gallery. A level providing multi-purpose function room for community meetings, educational events and exhibitions foregoes the rooftop. Depending on site conditions, on the roof can be produced food, within the community organic garden, and generated on-site energy with photovoltaic solar panels.

Mapping urban intersection points of flows (humans and non-human) helps to identify new spatial conditions and locational patterns to build a distributed infrastructure of small/medium sized waste facilities. Mid-size facilities are, in this design strategy, elements able to produce new urbanity, along with a wide range of functions. What are the conventional points of connection between various urban systems where a design strategy can promote a more circular metabolism? The strategy proposes to redefine the spatial organization of waste infrastructure through identifying three urban systems: infrastructures; knowledge networks; production and commerce.


Provide solar PV collectors, micro-turbines to maximize on-site power generation and harvest rainwater for use in irrigation
In applicable sites, provide rooftop community gardens to develop a culture of urban farming and reduction of imported foods throughout the city
Building envelope to use green high-performance materials to minimize energy consumption
Provide outdoor public spaces for gathering and eating to encourage visitation
Locate facility close to MTR stations and other public transport for ease of pedestrian access
Minimize width of building frontage to allow for the implementation of this concept in a wider variety of sites through the urban environment; create a vertically arranged facility
WHAT'S INSIDE?
LEVEL 6 (ROOF)
- Gardening Center
- Community Organic Gardens
LEVEL 5
- Community Hall
LEVEL 4
- Upcycling Center
- Artists' Studios
- Retail Gallery
LEVEL 3
- Flea Market
- Electronic / Furniture Repair Shops
LEVEL 2
- Neighborhood Food Market
- Public Sitting Out Area / Terrace
- Food Waste Recovery Center
LEVEL 1 (GROUND)
- Public / Service Vehicle Access
- Material Sorting / Holding
- Recyclable Processing
BASEMENT
- On Site Composting Center
- Water Treatment Center
- Mechanical / Electrical Plant

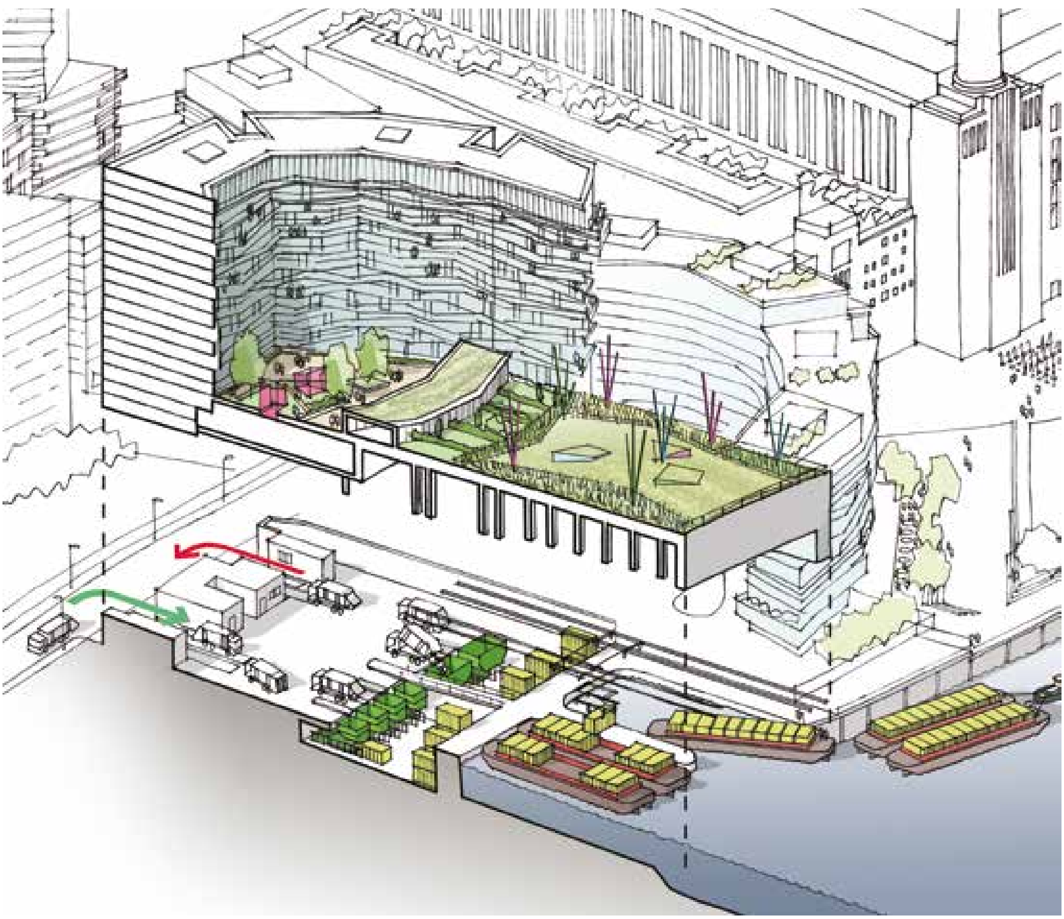


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Fig. 8 – Prototype for a Neighbourhood Recycling Centre in Honk Kong. Source: Sepia Design.
Fig. 9 – The Cringle Dock's waste transfer station along the river Thames, London. Project by arch. Rafael Vinoly, 2015. Source: www-wrwa.gov.uk.

Infrastructures

A decentralized model underlies the need to think of convergence and *infrastructural ecology* as key principles to draw possible synergies between various systems. Here infrastructures include mobility, transportation and logistics. Since the 19th century, architects are looking to find possible interconnections between infrastructural systems, as in the case of Rue de Future for the city of Paris, proposed by Eugen Henard.

Interpreting proximity in physical terms involves the treatment of waste at reduced distances from the production site, favouring the reduction of polluting impacts and minimizing the criticalities of car traffic resulting from transport activities.

Private transportation and logistics are rapidly changing, under the pressure of ecological goals and technological innovations. It is necessary to consider how the vehicular transport of waste, and the consequent production of CO_2, is one of the factors with the most negative impact. In most of the case studies shown, facilities are often located next to railways, despite having different sizes and programs. If we think that many cities are adopting urban railways for the transportation of goods and waste in the city centre, it is clear that new design possibilities need to be tested in this direction.

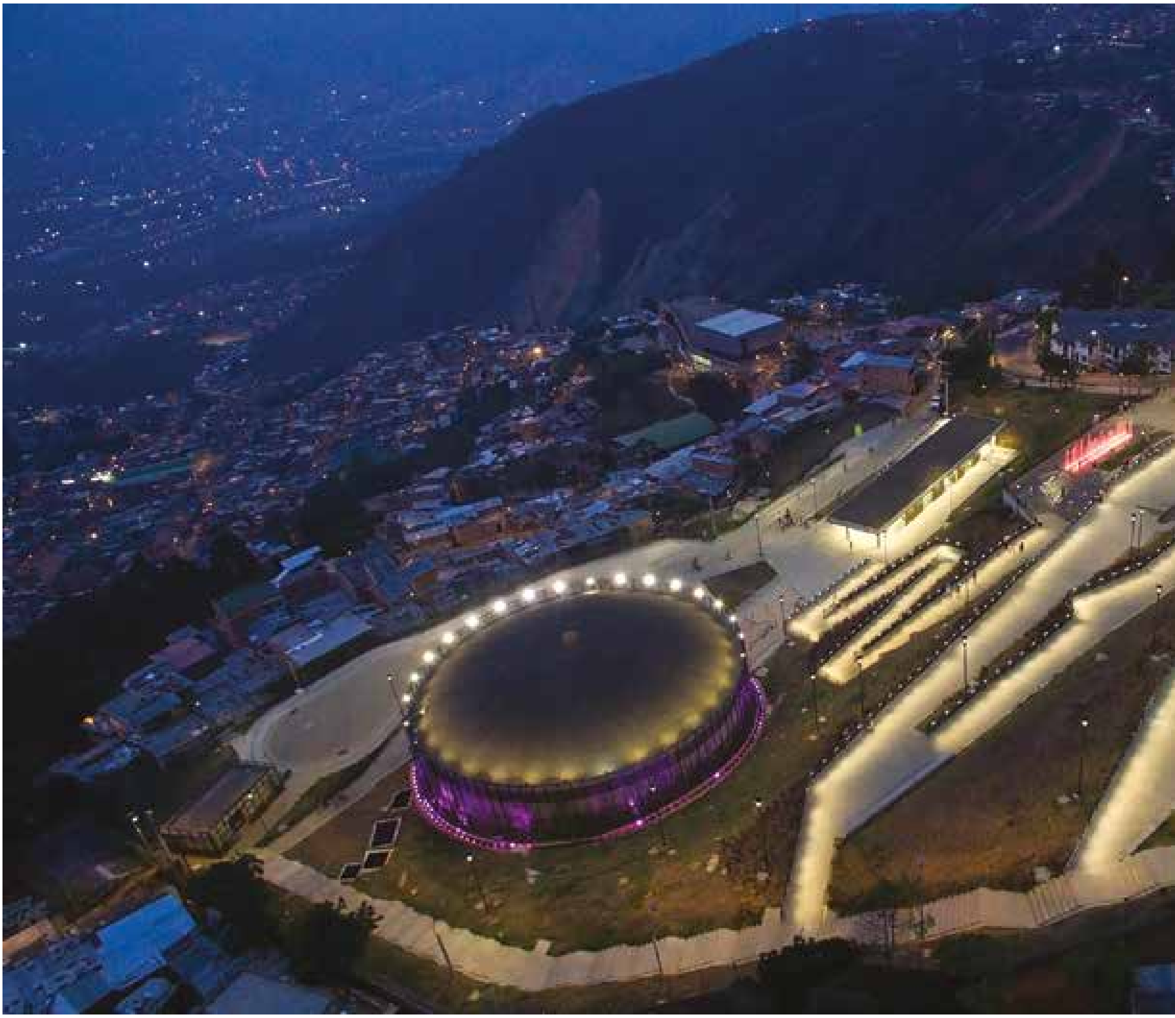
Secondly, strategic connections are found with car mobility, particularly with the network of fuel stations. This typology is also typologically similar to sorting centre, and this factor can constitute an advantage in terms of design. Who writes proposed a strategy for the suburban area of south Rome, developing an incremental strategy in which waste facilities regenerated existing drosscapes nearby the fuel stations (Massaro, 2016). Good examples of connections can be found with rivers, as for Isseane in Paris or the upcoming Cringle Dock in London.

Knowledge networks

Education and public awareness are one of the main pillars in the prevention strategy. It's necessary to map public and private spaces for education and knowledge, from schools to community hub, from civic centre's creativity and innovation laboratories. These spaces can catalyse good practices and micro-scale interventions, especially in the first phase of the strategy. In order to legitimate waste management spaces as social and civic places, it has required a functional mix including education and cultural activities. Therefore will find place conference and seminar rooms, offices and services.

Production and commerce

Tourism, industry and logistics represent the areas of greatest entropy rate that need interventions



(Acebillo, 2013). Markets, supermarkets and commercial districts are convergence nodes where developed local synergies and close metabolic loops. Locating everyday places as 'producer' spaces leads to waste management being regarded as a system similar to the proximity economy and solidarity networks. Moreover, going to the market citizens can simultaneously confer waste and buy new goods, and thanks to reverse vending services, they shift attitude from users to active prosumers.
The evolution of territorial chains, along with the rapid diffusion of innovation spaces and digital manufacturing laboratories (see FabLab and MakersSpace), is an incentive factor for reviewing the symbolic and functional status of collecting centres and transfer stations. By leveraging on hybridization, digitization and service delivery, they can be considered part of a wider ecosystem.

Unblackboxing: an Architectural Agenda for Waste

Waste management model is easily associable with a 'black box' model: the composition of flows is not known exactly and the behaviour of the man-

Fig. 10 – Top view of an UVA project (Medellin), 2015. Predominant are pedestrian paths and the use of artificial lighting, Source: www.epm.com.co

agement system remains unclear (Graham & Thrift 2007). In the so-called 'era of transparency' of Orwellian memory, the notion of 'unblackboxing' aims to subvert the black box logic of dumb and mono-functional facilities (Graham 2010). The term is borrowed from science and sociology and here has a double meaning. Firstly, it has an operational and aesthetic value for design purposes in order to reveal and make visible management and treatment processes; improve accessibility by creating new connections, services and public spaces; avoid marginalization by opening up boundaries. In this frame the design actions to apply are intended both for the renovation of existing buildings or for new interventions.

Secondly, from a civic, social and relational standpoint, unblackboxing is understood as a political act (Domínguez Rubio & Fogué 2015) aiming to suggest an integrated approach, which means creating enabling conditions to foster multiple processes of self-organisation, civic engagement and prosumership. These categories are systemically applied in the UVA - *Unidades de Vida Articulada* (Articulated Life Units) project series, activated since 2012 in the metropolis area of Medellin (Colombia). The program provides multiple interventions aimed for space reclamation near the water treatment plants and the municipal water reservoirs. Four main aspects link all the different projects. The first is the creation of paths that engage the existing artefacts, by connecting adaptively different points of the city, at different rates. Then the creation of new multifunctional public spaces and the insertion of functions in accordance with the specific needs of the various contexts in which they are located. The second is the reinterpretation of boundaries and fences defined by tanks, in order to foster social inclusion; the third is the lighting design used as a changing layer that makes water tanks as urban attractions recognizable from long distances and finally, the building of a shared imaginary through participatory processes with locals and stakeholders.

Conclusions

In the intermediate spaces identified by the mapping, there happens a conflict between an industrial model and a civic approach to the issue of waste. There a transition takes place. Architecture is called to define new hybrid models and to find new urban coexistences, enabling relations and changing cultural patterns previously considered incompatible.
The proposed scenario shifts the terms of the discourse from the building as a solution to an operational strategy that identifies the fields of intervention, where flows and vectors are the elements that regulate the joint and the use of urban space. The intention to operate in terms of fields and flows is guided by the precise intent to reconnect interrupted ties, reactivating cycles, reduce inefficiencies and generate new values. A focus on waste as a driver for urban changes introduces in the architecture discipline significant innovation aspects, whose singularity emerges to the different design scales. Starting from territorial level, where infrastructure and facilities affect the value of the landscape, to urban settlements scale, where the redevelopment of abandoned or marginal areas can help to regenerate physically and socially some urban fields, until the scale of the building, where communal areas can be reconfigured to welcome new devices for the daily waste collection.
The current reflection outlines how crucial is to provide a combinations of activities and functions, in order to avoid marginalization and failure of waste management infrastructure. Its architectural and social legitimation comes across the assimilation of waste utility facilities to any other kind of public facilities.

References

Aa.Vv. 2014, *Urban Metabolism: sustainable development of Rotterdam*, Mediacenter, Rotterdam.

Acebillo J. 2013, *A new urban metabolism: Barcelona / Lugano*, Actar, New York.

Alba Ramis I. 2015, *Los paisajes del desecho: reactivación de los lugares del deterioro*, PhD dissertation, Universidad Politecnica de Madrid, Escuela Tecnica Superior de Arquitectura.

Bonneuil C., Fressoz J.B. 2016, *The shock of the Anthropocene: the Earth, history and us*, Versobooks.

Carta M., Lino B., 2015, *Urban hyper-metabolism*, Aracne, Roma.

Domínguez Rubio and Fogué U. 2015, *Unfolding the political capacities of design*. In *What is cosmopolitical design? Design, nature and the built environment,* ed. A. Yaneva, A. Zaera-Polo, Ashgate, pp. 143-160.

Graham S. Thrift N., 2007, *Out of order: understanding repair and maintenance*, «Theory Culture Society», 24 (3):1-25, Sage Publications, London, pp. 1-25.

Graham S. 2010, *Disruptive cities: when infrastructure fails*, Routledge, New York.

Lindner C. Meissner M., 2016, *Global garbage: urban imaginaries of waste, excess, and abandonment*, Routledge, New York.

MacBride S. 2011, *Recycling reconsidered. The present failure and future promise of environmental action in the United States*, MIT Press, Cambridge.

Mamì A. 2014, *Circular processes for a new urban metabolysm: the role of municipal solid waste in the sustainable requalification*, «Techne: Journal of Technology for Architecture and Environment», 08, Firenze University Press, pp. 171-180.

Manzini E. 2015, *Design when everybody design*, MIT Press, Cambridge.

Marvin S., Medd W. 2010, *Clogged cities: sclerotic infrastructures*, in *Disruptive cities: when infrastructure fails*, ed. S. Graham, Routledge, New York, pp. 85-96.

Massaro S., 2016, *La raccolta dei rifiuti solidi urbani nella città dispersa*, in *Drosscape: progetti di trasformazione nel territorio dal mare a Roma, ed. R.* Secchi, M. Alecci, A. Bruschi, P. Guarini, Aracne, Roma. pp. 287-295.

Timmeren A. van, 2014, *The concept of Urban Metabolism (UM)*, TU Delft. <https://urbanmetabolism.weblog.tudelft.nl/files/2016/07/05a_UrbanMetabolism_VanTimmeren.pdf> (10/16).

Miflin C., Spertus J., Miller B., Grace C. (eds) 2017, *Zero waste design guidelines. Design Strategies and Case Studies for a Zero-Waste City,* The Center for Architecture <http://www.zerowastedesign.org/wp-content/uploads/2017/10/ZeroWasteDesignGuidelines2017_Web.pdf> (04/18).

UN-Habitat 2016, World Cities Report. <http://wcr.unhabitat.org/main-report/> (12/16).

Reclamation and architectural requalification of an old landfill using in situ aeration, phytotreatment of leachate and energy crops

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Abstract
The requalification of a landfill provides an opportunity to undertake qualified territorial reorganization work in which the procedures applied in plant management and redevelopment of the environment may constitute a key factor in effective rezoning of the area. The available options geared towards renewing the functional status of the area undergo a decision process to assess the most appropriate end use in terms of territorial reorganization, impact on the landscape, environmental sustainability and public consensus.
However, landfill redevelopment projects carried out to date have only given marginal consideration to the above aspects. In Italy, there is a tendency to intervene with projects that merely envisage landscaping of the areas concerned, and rarely take into account functional reuse of the site. In other countries, thanks to a vastly diverse cultural approach, greater emphasis is placed on these aspects, and old landfills are frequently transformed into public parks featuring leisure and sports facilities. The present project focussed on requalification of an old landfill, designed and developed by Studio Arcoplan in conjunction with the Universities of Padova and Brescia, fits into this context and envisages a series of innovative features. In particular, the project aims to adopt an integrated approach to aspects relating to landscaping, the environment and energy, in order to develop an extensive park with a prevailing theme of renewable energy.

Keywords
Afteruse, Waste, Landscape, Phytoremediation, Community, Park

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Site characteristics and aims of the project

The old landfill, situated in the proximity of a residential area in northern Italy, extends over an area of 10 hectares with a maximum height of approximately 15 metres from the ground and contains more than one million tons of landfilled wastes. The landfill, which stopped accepting waste in 1992, is currently in the post-management stage, and is characterized by a virtually constant production of leachate, still of concern because of the high treatment costs.

The numerous zones of stagnant water in the concave areas created through land subsidence and inefficacy of rainwater drainage systems result in a constant infiltration of water inside the landfill body, worsening the already critical situation of leachate management. The area currently occupied by the landfill appears as a fenced off and well maintained green hill with a scarce number of trees lacking any functional status (fig. 1).

The project therefore was designed on the basis of the following aims:

- to regulate the quantity and quality of leachate; the landfill will be capped with a soil and clay cover to limit water infiltration and, consequently, leachate production;
- to reduce the pollutant potential of the accumulated material; the *in situ* aeration of the waste mass will be introduced to improve biological stability and decrease the risk of pollution;
- to ensure environmental sustainability of the landfill; *in situ* aeration will provide an end quality of the stabilised mass in equilibrium with the environment;
- to produce renewable energy and render the site energetically self-sufficient; photovoltaic panels will be installed on the landfill and oleaginous plant species for biodiesel production will be cultivated;
- to reduce the production of greenhouse gases; *in situ* aeration oxidises organic substances and prevents biogas production (60% CH_4, 40% CO_2) and the use of solar energy reduces the production of CO_2;
- to treat leachate on site with a low energy demand plant; a phytoremediation plant will be set up using oleaginous crops cultivated;
- to create new functions on the closed landfill and provide added value for the territory; a Park featuring cycle tracks, foot paths and recreational lakes will be established using the aforementioned crops and structural plants on the slopes;
- to limit the quantity of water used to irrigate green areas and moisten the waste mass by means of recirculation of rainwater and water accumulation in lakes.

Project works

The project provides for redevelopment of the old landfill area and reshaping of the landfill body, planting of phytoremediation meadows for leachate treatment, in situ aeration fed by a photovoltaic plant to accelerate and complete waste stabilization, and in completion by establishing an extensive park (fig. 2).

The project envisages the carrying out of the following works.

Landfill stabilisation by in situ aeration. In the scenario of treatments available for use in regulating waste biological degradation processes, in situ aeration is an internationally acknowledged and applied technique. This system provides for the introduction of low-pressure air, concomitant removal of process gases and drainage of leachate present in the landfill (fig. 3).

The circulation of air inside the landfill promotes the onset of aerobic biodegradation of organic substances, accelerating the stabilization and settlement of waste, and drastically reducing the production of methane and other odorous substances, thus improving the quality of the leachate produced, and substantially lowering the environmental impact and post-management costs of the landfill.

These forms of intervention impinge directly on the source of the uncontrolled emissions of biogas and leachate, guaranteeing a definitive reclamation of the site and preventing the onset of further environmental issues in the future, years after the completion of works.

The plant will operate thanks to the energy produced by the photovoltaic panels situated on the top of the landfill, left side.

Landfill reshaping and landscaping. The landfill will

Fig. 2 – Sketch plan project (graphics: Studio Arcoplan).

Fig. 3 – Plan of the in situ aeration plant (graphics: Studio Arcoplan).

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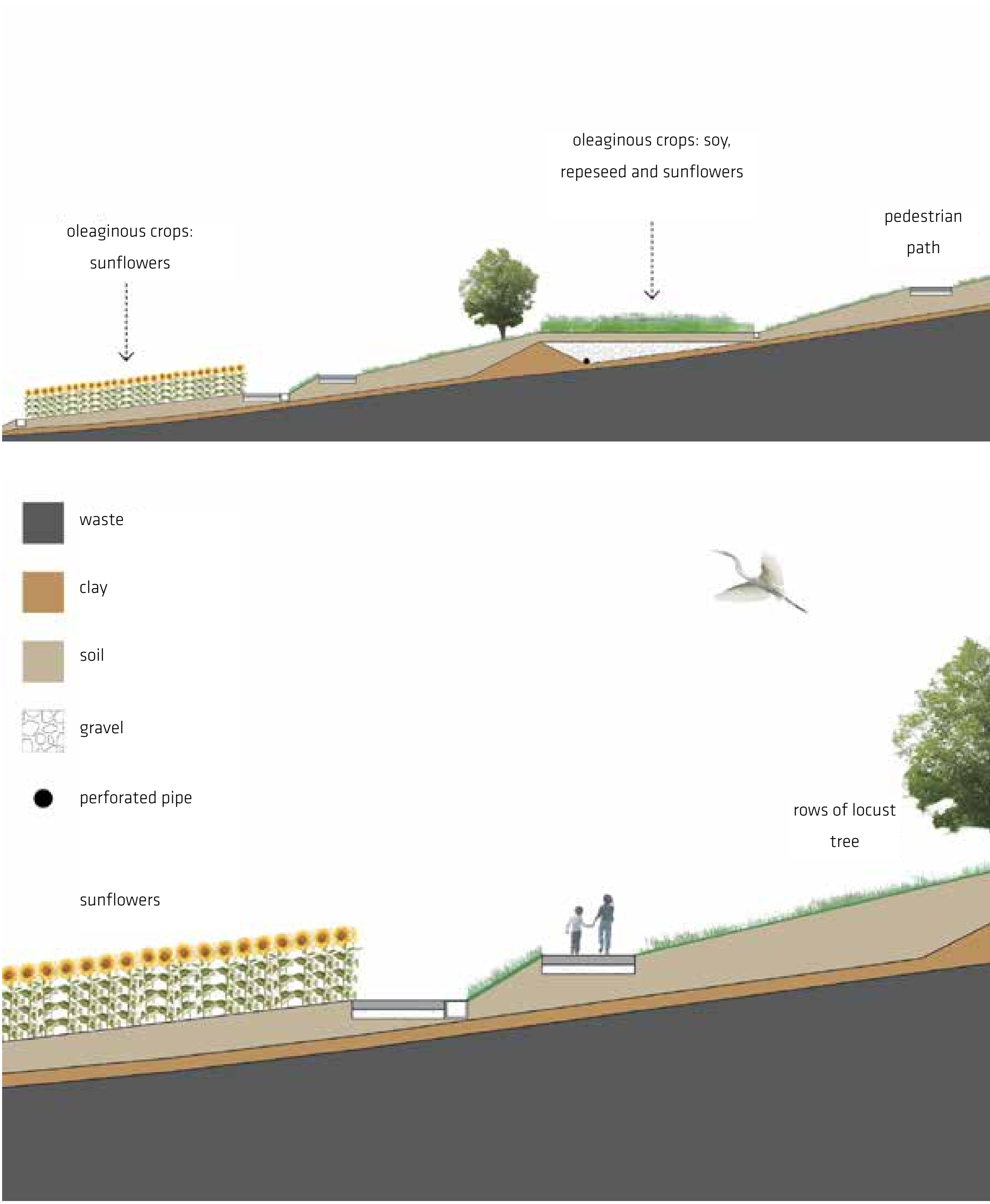
Fig. 1 – A general view of the landfill (photo: Studio Arcoplan).

be reshaped and recapped with a 30 cm layer of clay and a 50 cm layer of soil throughout the entire area. The capping is aimed at controlling the amount of leachate produced, allowing the infiltration of a limited amounts of water just to promote the biological waste degradation processes and enough to prevent waste mummification that often occurs when standard sealed capping is present.

Landscaping works will be undertaken using a series of cultivated and wooded terraces interspersed with a zigzag pathway. The anthropic and distinctive terracing will represent the key element aimed at achieving an area that is functionally and visually integrated with its surroundings, providing for the planting of the same crops on the surrounding plane (fig. 4).

The landscape design has been geared to the morphological organization of the area, taking into account those perspectives most readily visible from outside, and aims mainly to enhance the view of the landfill as seen by passers by on the main road. The terrace slopes will be planted in rows using largely indigenous species and lignocellulosic crops. The sections situated on the plane will be planted with oleaginous crops such as *Brassica napu* (rapeseed), *Helianthus annuus* (sunflower) and *Glycine max* (soya).

Landscaping of the area will be clearly visible from the main highway, thanks to the choice of species planted on the south-western slope featuring extensive blooms, and will provide a view of considerable magnitude throughout the spring and summer. In autumn and winter the scenario will be that of resting cultivated fields, in harmony with the surrounding local landscape.


oleaginous crops: soy,
repeseed and sunflowers
pedestrian
path
oleaginous crops:
sunflowers
waste
clay
soil
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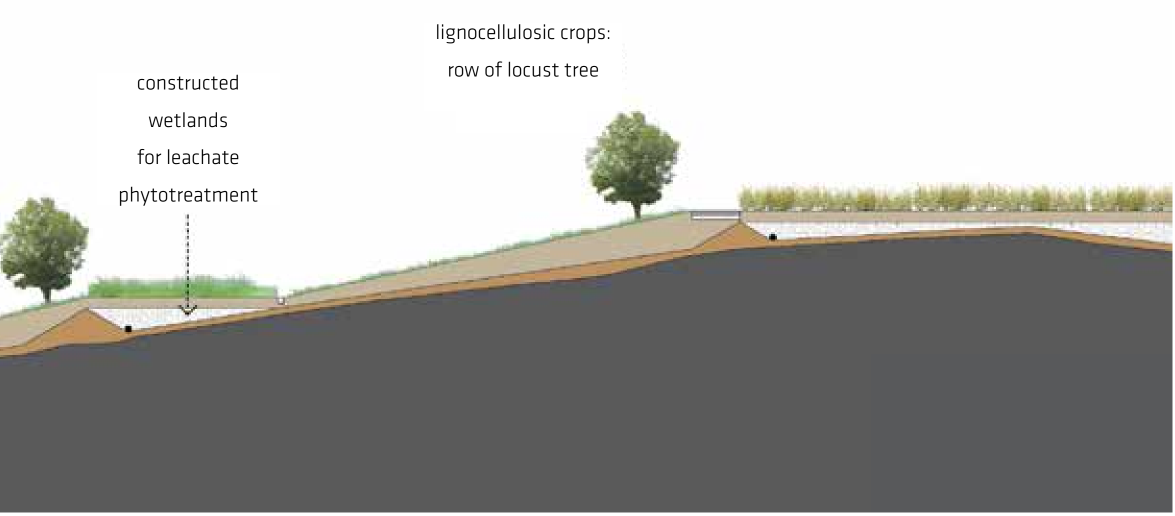
perforated pipe
sunflowers
rows of locust
tree



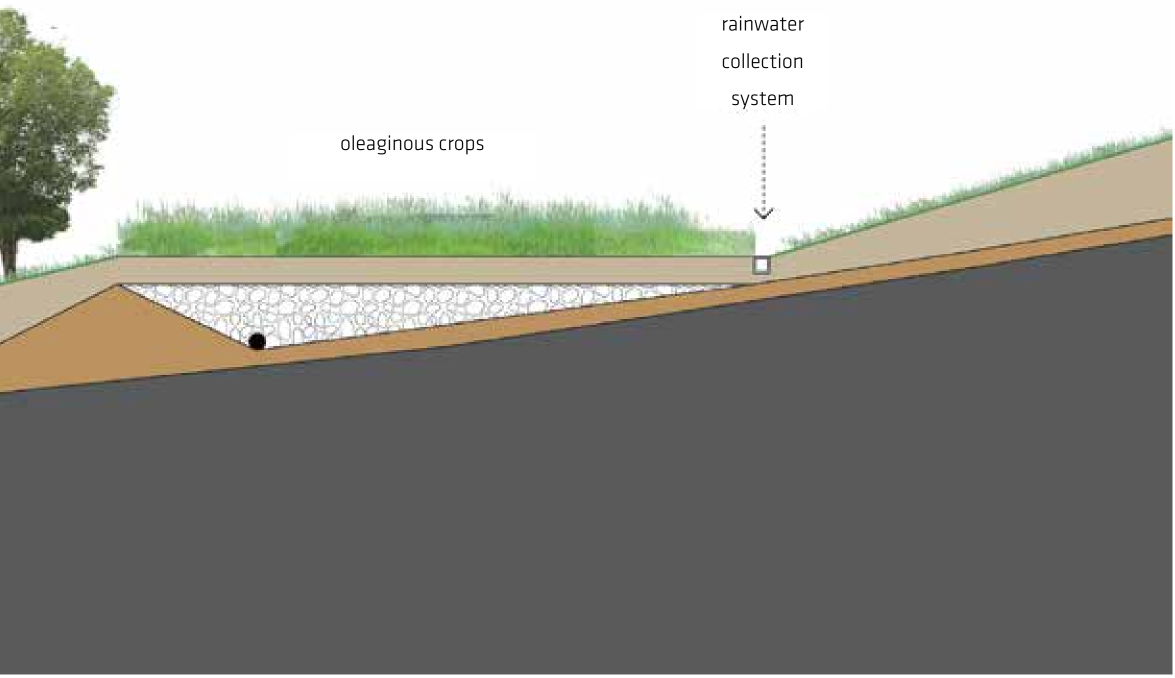


Fig. 4 – Cross section of the landfill: The reshaped morphology of the landscape (graphics: Studio Arcoplan).
Fig. 5 – Detail of the phytoremediation zones situated on the terraces (graphics: Studio Arcoplan).

Cultivation of energy crops and phytoremediation meadows. Energy requalification of the old landfill will be carried out by a series of interventions, including the use of energy crops on the landfill. Part of these crops will be irrigated using leachate produced by the landfill, thus implementing an *in situ* phytoremediation treatment. Thanks to the presence of the plants, the quantity of leachate will be notably reduced due to the effect of evapotranspiration. A pilot phytoremediation plant will be set up to test leachate irrigation of the energy crops prior to implementing full-scale operations.
The leachate irrigation system will be activated following the start up of *in situ* aeration. Leachate generated downstream of the *in situ* aeration plant, which considerably reduces the pollutant load, will however continue to represent a nutrient-rich (nitrogen, phosphorus, etc.) wastewater suitable for use in promoting plant growth due to the content of fertilizing elements, although also containing certain critical elements which will need to be administered with due caution. Therefore, both the amount of leachate to be used in irrigation, and the piezometric level inside the tanks, will be evaluated taking into account climatic conditions and results obtained from the pilot phytoremediation plant; this assessment will provide crucial information aimed at determining the method and times of irrigation, and monitoring plant resistance to increasing leachate loads.
Plants suited for use in the production of energy have been selected as energy crops for the project: their seeds will be used to obtain biodiesel, and the ligneous content applied in the production of thermal energy. Plants will be cultivated on soils that are partly compromised rather than on agricultural land, thus affording the dual opportunity of redeveloping a site the economic and social value of which has declined, and producing energy without resorting to use of valuable agricultural land.
In line with the landfill reshaping and capping project, the areas dedicated to the cultivation of energy crops for the production of biodiesel will be established on the south-western slope inside the green belt and on the top of the landfill.
The phytoremediation zones situated on the terraces comprise tanks waterproofed with a 30cm layer of clay on the bottom and sides and filled with a layer of non-woven fabric, a layer of gravel and a layer of topsoil, respectively (fig. 5).
Pilot phytoremediation plant. Leachate is a wastewater subjected to considerable changes in quantity and quality over time, even within the landfill. Accordingly, prior to commencing full-scale irrigation the times and methods to be applied need to be determined, taking into account the phytoremedia-

Fig. 6-9 – Leachate phytoremediation: Laboratory tests on energy crops

tion capacity of the chosen energy crops. These aspects will be gauged through use of a pilot phytoremediation plant (fig. 6-9).

The plant will comprise 4 waterproofed concrete tanks filled with a 50cm layer of inert material (gravel) and with an overlying 50cm layer of topsoil in which the roots will develop. This will extend over 100 m^2 in an area devoted to the setting up of plants. The plant will comprise a series of vertical phytoremediation modules for ammonia oxidation and horizontal modules for finishing; the modules may be run either in series or parallel in line with the most appropriate method of operation identified during the treatment simulation phase. Individual concrete modules will be constructed and filled with a 50cm layer of various loose materials covered by a 50cm layer of topsoil, to verify the most suitable combination in terms of plant development and depuration yield.

During the start-up phase, the plant will be fed with a specific percentage of leachate mixed with water; this percentage will be gradually increased according to the response of plant growth and yields obtained.

System for the collection of rain and lake waters. Reorganization of the water collection system is a work of major importance aimed at reducing water infiltration into the landfill body, thus limiting the vast flooding phenomena that currently occur in the presence of heavy rainfall.

All rainwater will be harvested and collected in two artificial basins (one of which outside the work area) linked to the overflow trenches adjacent to the landfill.

In particular, an additional area external to the landfill will be used to construct an artificial lake fed by the previously mentioned rainwater drainage system, with the aim of acting as a supply basin for the irrigation system, whilst also representing a recreational opportunity for the community.

Indeed, a re-naturalised lake considerably enhances a park environment and constitutes an attractive area for relaxation and observation all year-round. The surrounding areas will be densely planted using trees, shrubs and typical riparian vegetation (fig. 10).

Photovoltaic meadow on the landfill. The project moreover foresees the construction of a photovoltaic plant integrated with the morphological, functional and environmental characteristics of the site. The main objective is to make the complex of plants implicated in the environmental requalification of the area as energy autonomous as possible. Accordingly, the most convenient plant compatible with both user load profile and with legal requirements relating to the use and promotion of electric power produced by renewable sources has been identified. The plant, with a nominal power of 200 kWp, will operate under a net energy metering system for

Fig. 10 – View of the re-naturalised lake (graphics: Studio Arcoplan).
Fig. 11 – Plan of the requalification project: 1. Cultivation of sunflowers; 2. Cultivation of energy crops and phytoremediation meadows; 3. Lignocellulosic crops planted in rows; 4. Pilot phytoremediation plant; 5. Photovoltaic meadow; 6. Artificial lake for water collection; 7. Park (cycle tracks, footpaths, thematic itineraries, etc.); 8. Re-naturalised lake (graphics: Studio Arcoplan).

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Fig. 12 – Areal view of the project area (graphics: Studio Arcoplan).

the first 7 years, and subsequently under a purchase and resale arrangement with the GSE; this should result in a full energy autonomy of the park, provide the possibility to power other Municipal uses, and ensure electric power for at least 20 years. The plant will be equipped with an innovative installation system using metal tensile structures aimed at supporting potential settlements and ground subsidence following *in situ* aeration.

Functional re-use of the area: the park

All activities and functions envisaged for the area have been conceived in synergy with the landscape design project and have been distributed, as shown in the general design plan, to ensure full accessibility to the area (fig. 11).

The usability of the Park has been designed to allow both visitors (even those taking part in a guided technical visit) and workers and maintenance vehicles ease of access. The Park will include cycle tracks and footpaths, thematic itineraries with observation points and staging posts, wooden benches and an exercise route (fig. 12).

The project envisages additional planting on the north side of the area using woodland trees interspersed with autochthonous shrubs featuring characteristics suited to ensuring rapid growth and ready integration with the surrounding environment. The following species have been selected for this purpose: *Carpinus betulus, Fraxinus, Tilia cordata, Populus alba, Ulmus minor, Acer campestre, Prunus avium, Sambucus nigra, Crataegus monogyna, Rosa canina, Ligustrum* and *Salix alba* (fig. 13).

The footpath linking the two lakes will be planted with lignocellulosic species such as *Miscanthus x Giganteus* and rows of *Salix alba* and *Robinia pseudoacacia*.

Conclusions

From a neglected suburban area to a place for socializing and undertaking leisure activities: transformation of the area into a park will provide local communities with additional green spaces in which to organise social, educational and leisure activities, thus contributing towards promoting an improved quality of life.

opposite page
Fig. 13 – Selected species for the greening project (graphics: Studio Arcoplan).

The achievement of this ambitious aim has been made possible thanks to the multidisciplinary approach that has characterized this complex project from the outset.

The need to integrate such a complex task in a town planning project focussing on the environment, the territory, the landscape and the municipal areas indeed dictated the need for an integrated project design and a multidisciplinary approach in which the technical aspects (conventionally dealt with by engineers and environmental experts) became the field of action for the architects as well. This gave rise to an interesting synergy with a professional figure of crucial importance in ensuring the successful outcome of this type of territorial transformation.

The project is undeniably unique, particularly due to the plurality of works undertaken in the area, which have frequently been carried out individually, but which have never before been designed for implementation together on the top of a landfill. In particular, for the first time a real-scale, as opposed to lab-scale, phytodepuration of leachate is proposed.

References

Artuso A., Cossu E. 2008, *Piano di ripristino ambientale del complesso IPPC di Scala Erre (SS)*, Relazione tecnico-illustrativa, unpublished.

Artuso A., Cossu E. 2013, *Riqualificazione ambientale, paesaggistica, funzionale ed energetica del corpo ex discarica di Ciliverghe*, Relazione tecnico-illustrativa, unpublished.

Dimitriou I., Aronsson P. 2010, *Landfill leachate treatment with willows and poplars - Efficiency and plant response*, «Waste Management», n. 30, pp. 2137-2145.

ISPRA 2012, *Guida tecnica per la progettazione e gestione dei sistemi di fitodepurazione per il trattamento delle acque reflue urbane*, unpublished.

Jones D.L., Williamson K.L., Owen A.G. 2006, *Phytoremediation of landfill leachate*, «Waste Management», n. 26, pp. 825-837.

Garbo F., Lavagnolo M.C., Malagoli M., Schiavon M., Cossu R. 2017. *Different leachate phytotreatment systems using sunflowers,* «Waste Management», n. 59, pp. 267-275

Lavagnolo M.C., Cossu R., Malagoli M., Alibardi L. 2011, *Energy crops cover in landfill*, Proceedings of the Thirteenth International Waste Management and Landfill Symposium, Cisa Publisher, Padova.

Robinson T. 2018. *Robust and reliable treatment of leachate at a closed landfill site in Sussex, UK*, «Detritus», n. 1, pp. 116-121.

Stegmann R., Ritzkowski M. 2007, *Landfill aeration*, Cisa Publisher, Padova.


LEGEND
Tree species
Shrub species
Rows of Robinia pseudoacacia
Miscanthus x giganteus
Robinia pseudoacacia
Salix alba
Glycine max
Brassica napus
Helianthus annus
Lawn
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18


TREE SPECIES
01 Quercus robur
02 Carpinus betulus
03 Fraxinus
04 Tilia cordata
05 Populus alba
SHRUB SPECIES
06 Crataegus monogyna
07 Sambucus
08 Cornus mas
09 Ligustrum
LIGNOCELLULOSIC CROPS
10 Miscanthus giganteus
11 Robinia pseudoacacia
12 Salix alba
ENERGY CROPS
13 Helianthus annus
14 Brassica napus
15 Glycine max
AQUATIC SPECIES
16 Butomus umbellatus
17 Sagittaria sagittifolia
18 Nymphaea

Eco-Innovative Solutions for Wasted Landscapes

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Abstract

The paper focuses on the impact generated by the un-efficient management of waste flows, on both natural environment, and urbanization process, and on the opportunity to invert it by regenerating Wasted Landscapes, i.e. underused, polluted and abandoned sites, especially located in peri-urban areas. This is one of the aims of the REPAiR project, funded in 2016 by the European Commission within the Horizon 2020 framework, developed by University of Naples with TU Delft as Lead Partner. The implementation of multi-scaling/multi-disciplinary approach, for testing out collaborative decision-making, has seen so far the research of a scientific based definition of peri-urban area in the context of the Metropolitan Area of Naples. The selection of the peri-urban areas has also been tested through Living Labs, aimed at designing eco-innovative solutions towards circularity.

Keywords

Wasted Landscapes, Circular Economy, Urban Metabolism, Peri-Urban, Eco-innovation, Living Labs

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Introduction

This paper[1] explores the paradigm of circularity as an innovative approach for planning, stressing out the complexity of urban systems and working on the interactions between in-bound and out-bound flows (Swyngedouw, 2006; EC, 2011, 2014; Allen, Broto and Rapoport, 2012; Golubiewski, 2012; Ibañez and Katsikis, 2014). Such approach is based on the critical review of planning paradigms, not anymore referred to the linear urban growth (Latouche, 2009), but focused rather on both the paradigm of urban resilience (Davoudi, 2012) and resource preservation. This approach is here referring to the capacity of enhancing, recovering and re-using urban and peri-urban areas in terms of reducing soil loss and managing waste cycles.

Therefore, circularity refers to multi-scaling design approaches and to innovative models of designing products, processes, and projects. In particular, the concept of eco-innovation seems to be appropriate to explain the design potentials, when extended to the environment according to the EU definition: «Eco-innovation refers to all forms of innovation – technological and non-technological – that create business opportunities and benefit for the environment by preventing or reducing their impact, or by optimizing the use of resources» (EC, 2012).

The EU Commission boosts the role of eco-innovation as a central action for the transition towards a sustainable growth. To do so, a set of policies and measures such as the *Europe 2020 strategy for a smart, sustainable and inclusive growth* (EC 2010b), the seven flagship initiatives (EC 2010b), the *Eco-innovation Action Plan* (EcoAP, 2011) and the program Horizon 2020[2] have been developed so far. Within this framework, the call *WASTE-6b-2015: Eco-innovative strategies* aims at promoting the development of Eco-innovative solutions for waste prevention and management in urban and peri-urban areas. The call adopts an integrated urban metabolism approach and actively engages local authorities, citizens and all kind of relevant stakeholders, in a way that is consistent with the objectives of the European *Resource Efficiency Roadmap* (COM 2011) and the *Directive 2008/98/EC on waste* (EC, 2008).

The Horizon research project REPAiR (REsource Management in Peri-urban Areas: Going Beyond Urban Metabolism – GA 688920)[3] runs under the above-mentioned call, and it aims at providing eco-innovative solutions for fostering the quantitative reduction of waste flows in peri-urban areas. Furthermore, REPAiR aims at integrating Life Cycle Thinking and Geo-Design approaches to operationalize Urban Metabolism especially in terms of reduction of Wasted Landscapes[4] in peri-urban areas. Wasted Landscapes are discarded urban are-

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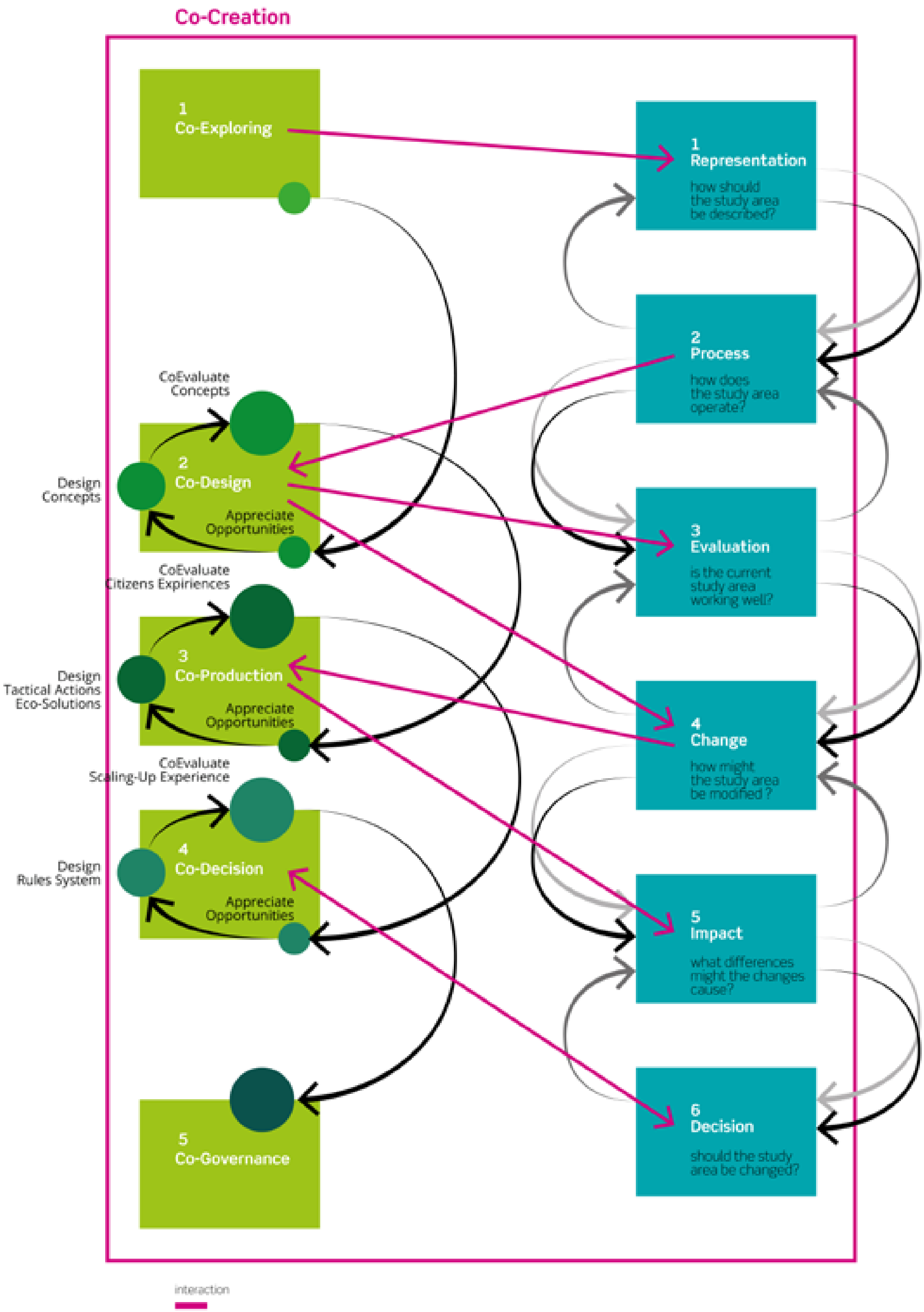

Fig. 1 – REPAiR Peri-Urban Living Labs across Europe (Image credit: REPAiR proposal. Graphic: Libera Amenta).

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Fig. 2 – Relation between Living Labs process and Geo-Design (Graphic: Maria Cerreta, Pasquale Inglese).

as, mainly characterized by a bad quality of life and environmental problems, the leftovers of exhausted lifecycles of territories (Amenta, 2015; Palestino, 2015).
REPAiR does not focus on 'end-of-pipe' solutions, on the contrary, it aims at tracking waste flows back to resource consumption patterns in order to reduce them and estimate the best routes for changes.
This approach makes it possible to achieve iterative visions of both production course and consumption processes within the territorial specificities of each (different) countries involved into the project. Criticalities and opportunities of the whole life cycle are pointed out; boosting the concept of waste from discarded matters to potential resources, (the REPAiR approach is briefly reported in fig. 2).
REPAiR specifically focuses on:

- Selected categories of waste flows (Construction&Demolition Waste, Biowaste, *Post consumer plastic waste*, *Waste electrical and electronic equipment*, *Municipal solid waste*), including Wasted Landscapes as innovative object of study;
- Providing more sustainable waste management systems, based on Life Cycle Thinking;
- Testing out new practices for collaborative problem solving, through the implementation of six Peri-Urban Living Labs (PULLs) aimed at involving local communities in the problem solving activities (Mitchell, 2003; Bilgram, Brem and Voigt, 2008; Steen and Bueren, 2017);
- Supporting decision-makers, through innovative tools, such as Geo-Design Decision Support Environment (GDSE) (Steinitz, 2012; Campagna, 2014);
- Providing new planning approaches, and design solutions for regenerating and recovering Wasted Landscapes in peri-urban areas.

Within the REPAiR partnership (fig. 2), the Italian Research unit (Department of Architecture of Naples of the University of Naples Federico II) has mainly focused on the territorial dimension of waste management and specifically on Wasted Landscapes as scrap products of the urban metabolism. The research interest is given to the peri-urban areas, where waste flows management follows a sectorial, un-efficient approach, running without a comprehensive, territorial strategy by administrators and without any of inhabitants' awareness. Further, peri-urban areas (Donadieu, 1998; Viganò, 2001) are those more affected by the presence of Wasted Landscapes (EC, 2011). They are located in between the urban-rural territories, and they are featured by a kind of chaotic, not-planned land use, where urban uses melt with the (former) rural areas, thus generating new geographies of waste: REPAiR 'wastescapes' (Amenta and Attademo, 2016).

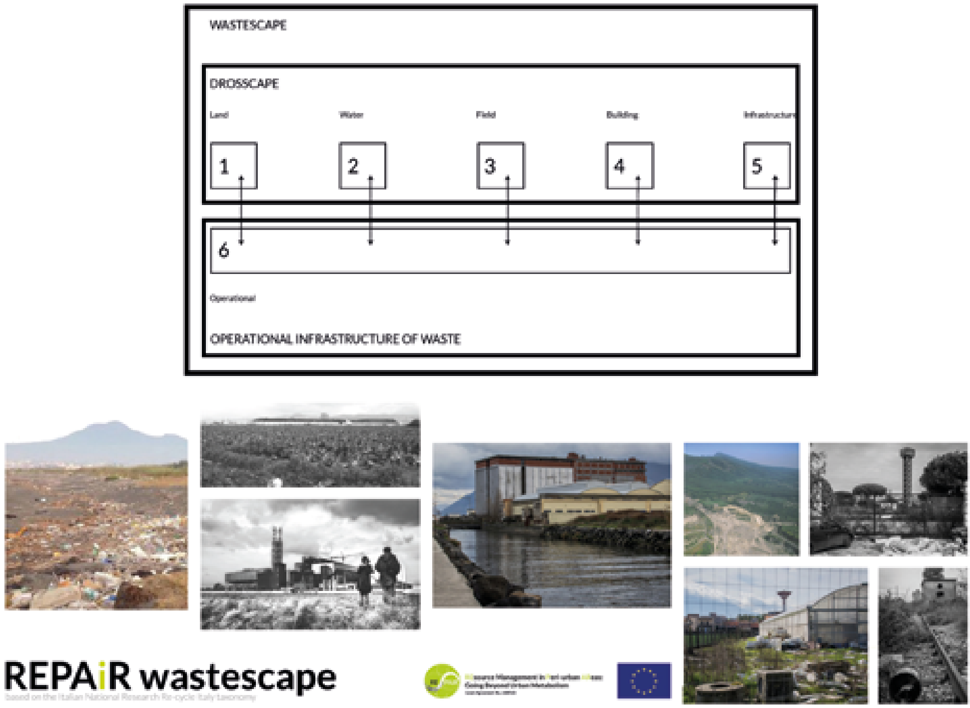

Fig. 3 – REPAiR Wastescapes identification (Graphic by UNINA Research Team).

This paper illustrates the first advances of the Neapolitan research team, in applying a crosscutting analysis of the study area by the aim of providing a scientific based description of peri-urban areas. The analysis is oriented to collect quantitative and qualitative data, as well as data for the spatial analysis, for representing, understanding and improving the relationship between the detection of peri-urban area borders and the current urban metabolism of waste flows.

Case study area

As part of the REPAiR proposal, two pilot cases are carried out in order to develop and test eco-innovative solutions in peri-urban areas: Naples, in Italy and Amsterdam, in The Netherlands. The other partners (Pecs, Hungary; Ghent, Belgium; Hamburg, Germany; and Lodz, Poland) will test the capacity of transferring knowledge within the consortium. Specifically, in Naples the research focus is mainly oriented on the Wasted Landscapes, deepening territorial and landscape issues (fig. 3). Whereas, in Amsterdam, the research deepens the knowledge on the potentialities of circular economy, stressing both the waste/resource flows optimization and business development.

The Italian case study area is located within the Metropolitan Area of Naples, where waste flows and Wasted Landscapes characterize the peri-urban territory. Sadly known as '*Terra dei Fuochi*' ('Land of Fires' in English – authors' translation), the Metropolitan Area of Naples is increasingly losing its former values as relevant area for agriculture. The dramatic exploitation of the original agricultural habitats leads to the deep degradation of the environmental and cultural assets (Legambiente, 2015); although, criminal organizations have significant influence in this area, especially in terms of illegal waste management and of built-up areas

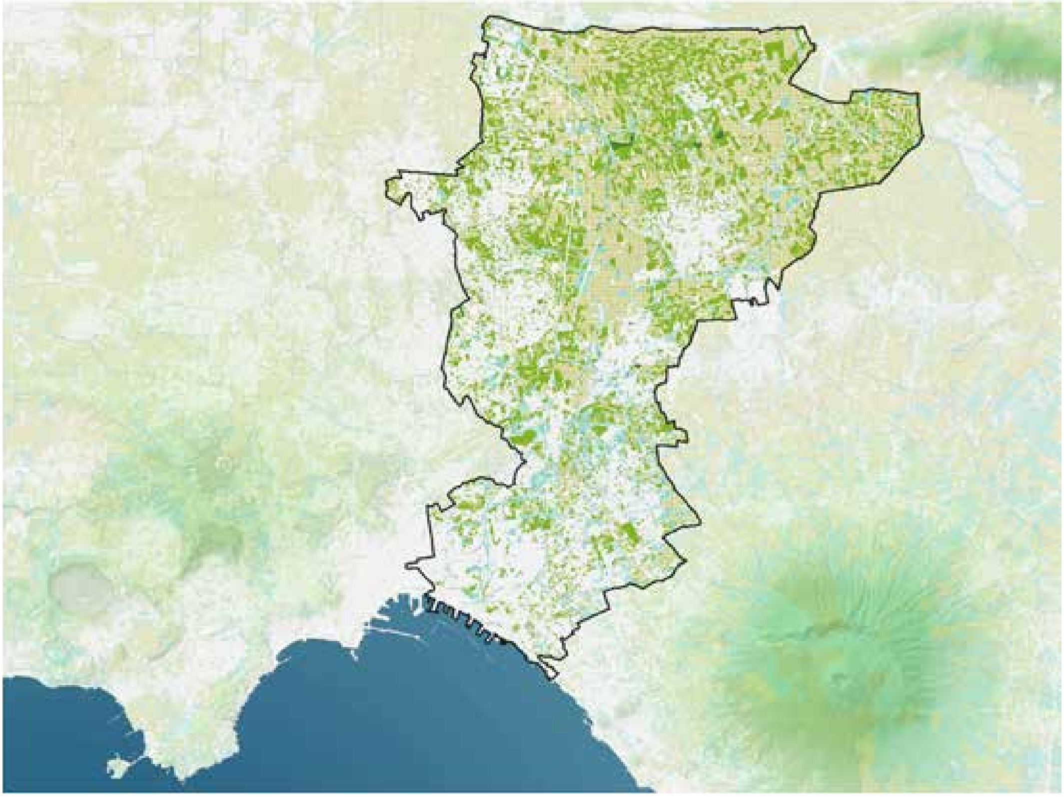

Fig. 4 – REPAiR Focus Area within the Metropolitan Area of Naples (Graphic: Pasquale Inglese).

development. In addition, the whole Campania Region has potentially 2551 contaminated sites, mostly of which are landfills or other areas of uncontrolled waste dumping. The Campania Region presents six Sites of National Interest (SIN), areas featured by relevant pollution; hence, the 15.8% of the entire region is polluted, ranging 2,157 km^2 (ARPAC 2008). These alarming data make urgent for planners, professionals and decision makers to move forward this situation, finding strategies to improve the quality of living conditions. According to this, the REPAiR team is focusing on a wide, sprawling urban area, hereinafter called Focus Area. It is located at the edges of the compact cities, and featured by the lack of planning and by illegal building activities. Here the historical centers, mostly originated from the former rural areas, have merged into a continuous urban environment, where hybridization exists between urban and rural landscapes. Lack of facilities, public infrastructures and public spaces characterize the Focus Area too. There is not an acclaimed tradition of spatial planning, nor did regional and / or municipal levels of planning, thus such territorial 'fragmentation' (with low quality urban patterns) generate a sort of 'no man's land'.

Materials and Methods: Peri-urban areas analysis

Starting from such description, the first aim of the research team is to provide a scientific based definition of peri-urban area within the Focus Area and in the context of the Metropolitan Area of Naples. The first assumption regards the definition of how the Focus Area should be described (Geldermans et al., 2017):

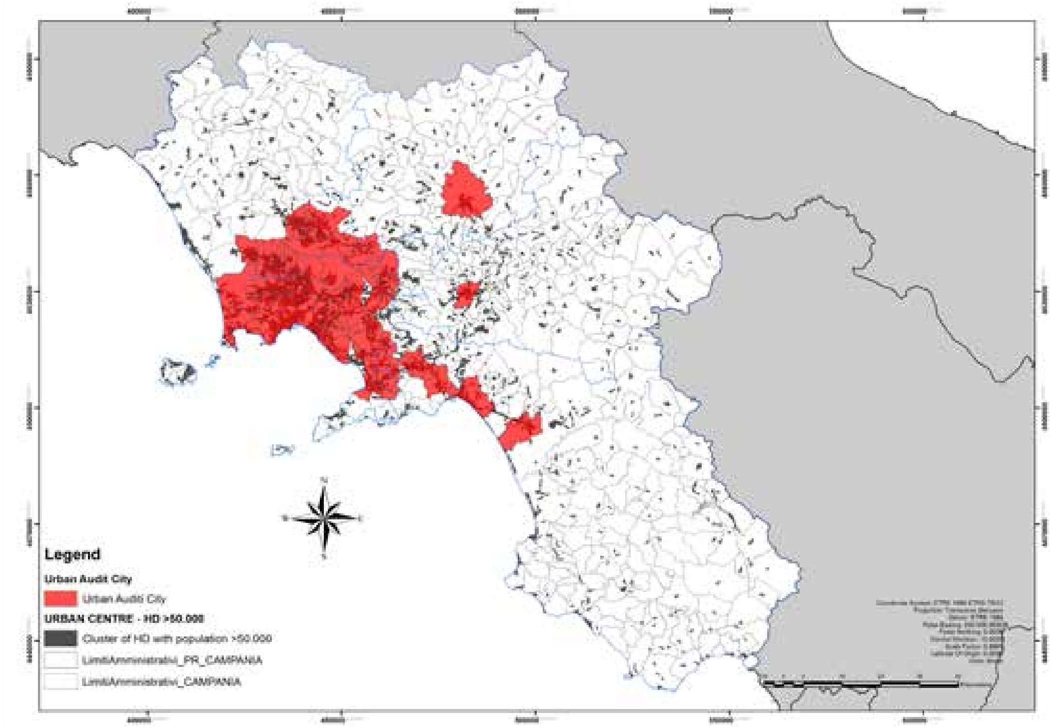

Fig. 5 – City identification.

- A representative sample of the Regional context, containing:
  - Mix of urban, rural and peri-urban areas, with a dominant share of peri-urban ones;
  - Wastescapes;
  - Huge infrastructure networks;
  - Productive areas and logistic platforms.
- A 'paradigmatic' area, having the value of 'model' for investigating problems and challenges and for testing potential eco-innovative solutions.
- A defined area based on administrative borders, socio-demographic and land cover data as well as on qualitative assessments.

So far, the Focus Area has also defined, including its spatial requirements according to REPAiR's definition (Geldermans et al. 2017), and it is specified by:

- High density population, urban dispersion and peri-urban features;
- Lack of public spaces and facilities.

The research Focus Area is therefore represented in fig 4. It is the array of local municipalities located in North-Est Naples featured as above. Moreover, the Focus Area border is consistent with the ATO Napoli 1 border, where ATO means *Ambito Territoriale Ottimale* (Optimal Territorial Area), and it represents the basic territorial unit for the urban solid waste management as planned by the Regional Waste Management Plan made by the Campania Region in 2016.

Regarding the peri-urban areas depicting, generally those areas have not the same features of urban compact cities, nor the ones of suburban villages. They are somehow dispersed urban development, widespread cities (*città diffusa* in Italian) (Soja, 2000; Forman, 1995 and 2008; Indovina, 2009). The research assumes the following definition of peri-urban areas as «areas where new functions, uses and lifestyles arise as a result of the on-going

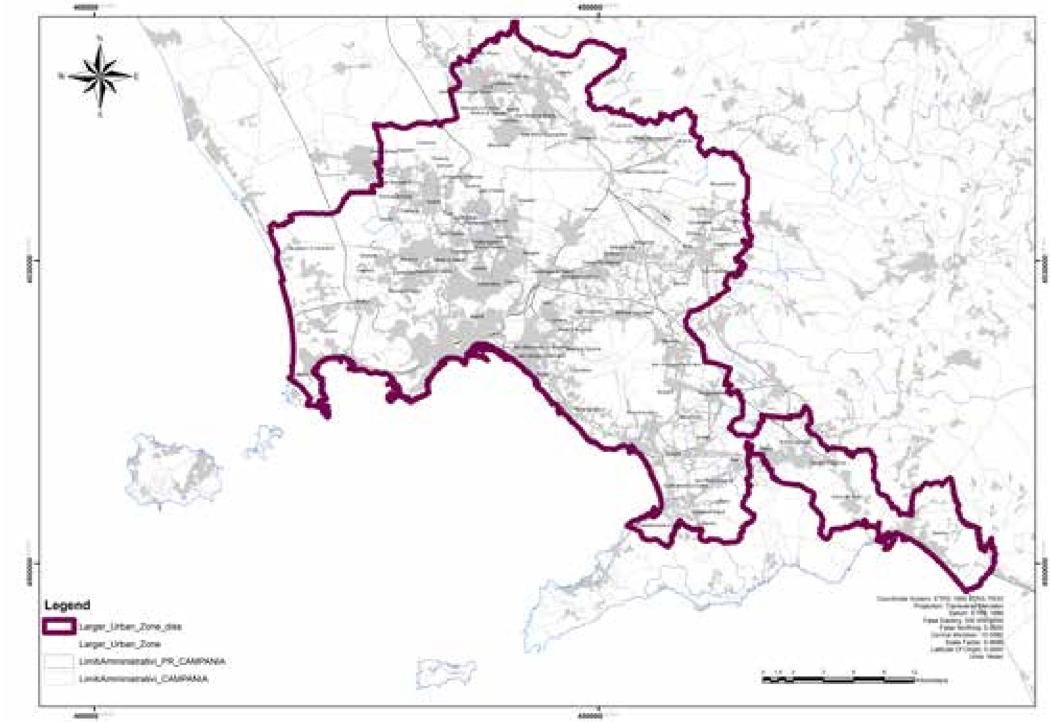

Fig. 6 – Commuting-zone identification - 145.000 ha.

interaction of urban and rural elements» (Wandl *et al.*, 2014).

To understand the peri-urban characteristics of the Metropolitan Area of Naples, the research compares some specific territorial features, carried out by distinguishing (and mapping) the follow urban patterns: A) the City, B) the Commuting Zone and C) Territories in transformation.

Furthermore, the research distinguishes the following steps in methods:

- Step 1: Definition and individuation of 'City'
- Step 2: Individuation of 'Commuting Zone'
- Step 3: Individuation of the 'Territories-in-between'
- Step 4: Individuation of the 'Territories-in-between' in the Focus Area

In Step 1, the research unit mapped the 'City' according to the New OECD-EC Definition (2012) using the following data: CORINE Land Cover 2012, XV ISTAT Census Data and the administrative boundary (fig. 5). Step 1 was done in four sub-steps:

- All grid cells with a density of more than 1.500 inhabitants per sq. km are selected;
- Then contiguous high-density cells are clustered, gaps are filled and only the clusters with a minimum population of 50.000 inhabitants are kept as an 'urban centre';
- All the municipalities (local administrative unit's level 2 or LAU2) with at least half their population inside the urban center are selected as candidates to become part of the city.
- The city is defined ensuring that:
  - there is a link to the political level;
  - that at least 50% of city the population lives in an urban centre; and
  - that at least 75% of the population of the urban centre lives in a city.

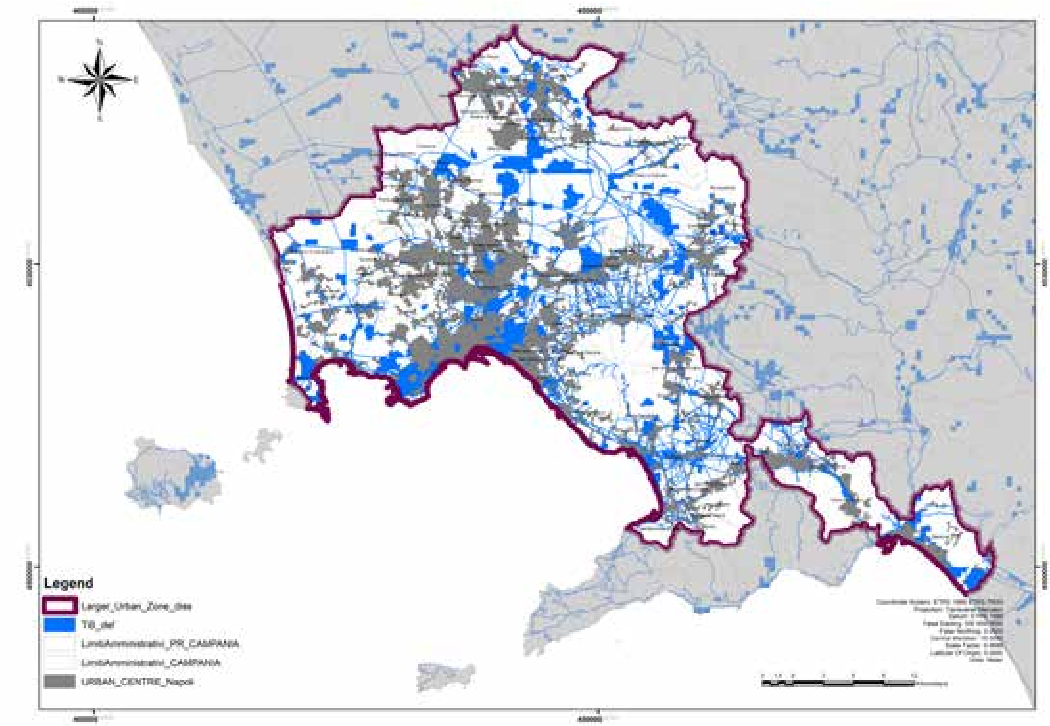

Fig. 7 – Territories in-between identification - 145.000 ha.

In Step 2, the research unit mapped the 'Commuting zone' (Fig.6) according to the New OECD-EC Definition (2012) using the Commuting Flows Data that are in the XV ISTAT Census Data. As for the previous step, the second step requires three sub-steps:

- Less than 15% of employed persons living in one city work in another city, these cities are treated as a single city.
- All municipalities with at least 15% of their employed residents working in a city are identified.
- Municipalities surrounded by a single functional area are included and non-contiguous municipalities are dropped.

The step 3 was achieved with the following GIS operations:

- Dividing the area into 500x500m (0.25 km²) grid cells and selecting those grid cells with a maximum population density that is characteristic for territories-in-between (150-5000 In/km2). This density corresponds in a grid cell a number of inhabitants of 38-1250 In/Cell
- Adding those grid cells, with a maximum rural population that spatially overlap with typical infrastructures and services;
- Subtracting those grid cells with territories-in-between corresponding maximum population that are not characterized by the intermingling of built and open landscape pattern. To this were subtracted the areas that are classified as class 111 in CLC 2012.

At the end the Territories In-Between define the commuting zone with a precise range of population density according with Wandl (2014), and they are not continuous urban areas (fig. 7).

The Step 4 corresponds to the cutting of the x map with a shape of municipalities within the selected focus area.

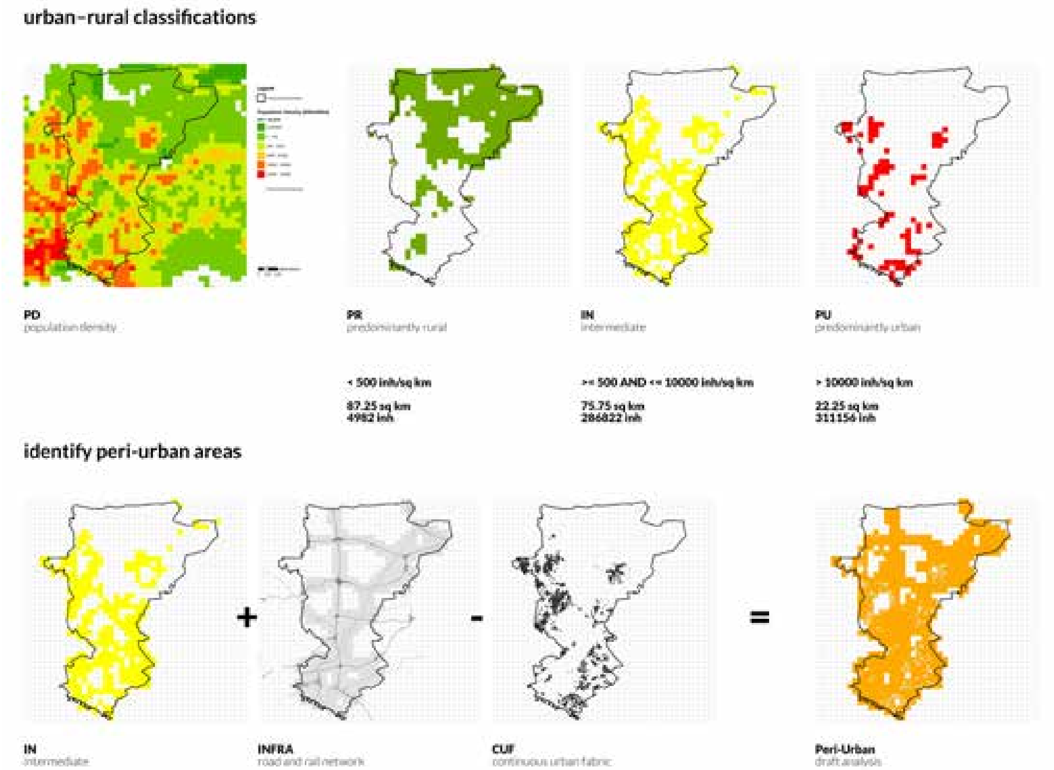

Fig. 8-9 – Urban-rural classification and peri-urban areas identification (Graphic: Pasquale Inglese).

Results and Discussion

The 'territories-in-between' of the Metropolitan Area of Naples are identified from the interconnection of commuting areas and infrastructure networks, excluding the urban continuity.

On a total Focus Area surface of 163.72 km², the area is equal to 4153 ha, so that the 'Territories-in-between' therefore represent the 25% of the whole Focus Area. This percentage (25%) is significantly lower than that determined by Wandl (2014) for Southern Netherlands (54%), but higher that the percentage of the Tyrol Region (estimated as 1%), also calculated in Wandl 2014. Furthermore, the 'Territories-in-between' value (25%) is consistent with the observation of the Metropolitan Area of Naples, and it strengthens the idea that an approach based on the land cover category 'urban-discontinuous' as a starting point would be misleading. The result is that the 'Territories-in-between' not correspond to the whole Focus Area. Conversely, they define specific areas within the selected area where it is more likely to find wastescapes and territories in transition of uses. Therefore, the 'Territories-in-between' were selected within the commuting zone, and featured by a precise range of population density. Furthermore, the originality of the research approach is to not consider these areas through the assumption of the spatial proximities with the city.

It is possible to recognize numerous spaces 'in transition' and in a 'waiting condition', such as the Eastern part of Naples, the fringe areas of Casoria, Acerra and Afragola (fig. 8), the vast plain around Caivano (fig. 9), and many others. These 'stand-by-spac-

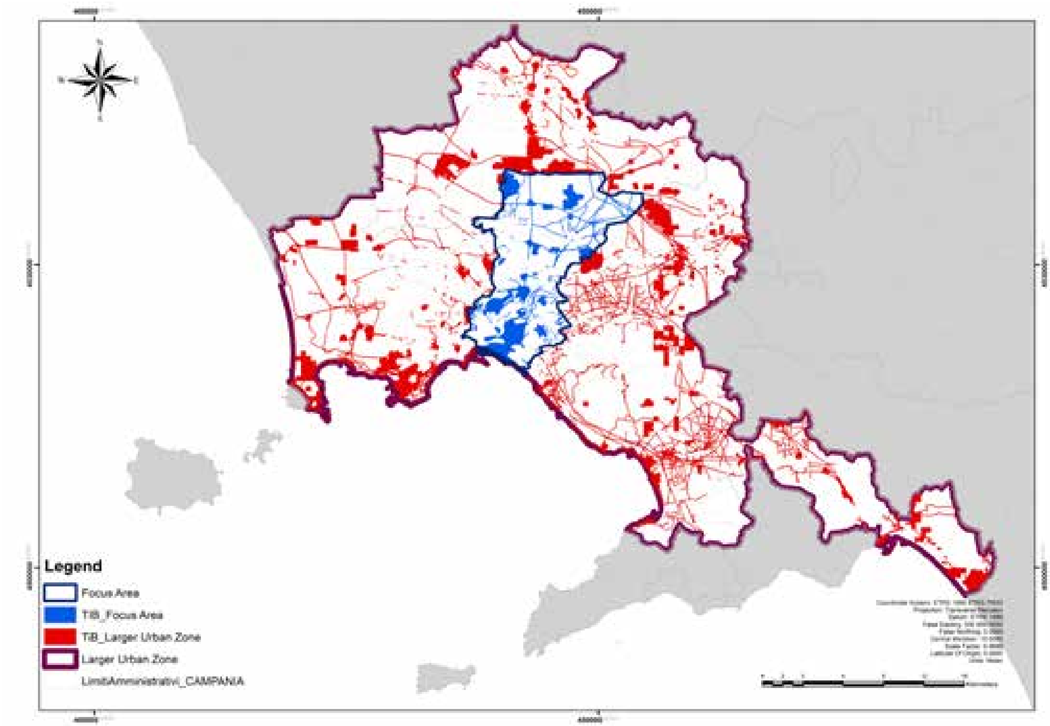

Fig. 10 – Territories in-between identification – additional approach.

es' are declining or have ended their lifecycle; today they represent spaces with a strong potentiality. Indeed, they can represent strategic parts for the regeneration of the whole Focus Area, especially if included in the new topological and functional framework that can result by the on-field work with residents and stakeholders.

Conclusions

In conclusion, we assume the Wandl approach is not considering peri-urban as a gradient, resulting from the distance of the urban center to the edge fan, while the definition of peri-urban as areas with both urbanization features and infrastructure availability.
These results are consistent with the description of the urban typologies recorded in the Focus Area by the aim of fostering a change in sustainable resource management, and thereby preventing waste generation. Through the recognition of the territories-in-between, REPAiR aims at providing dedicated design and planning approach by which reducing wastescapes and expressing the site potentials in terms of planning, providing new uses for the wasted lands consistent with the local needs (i.e. new public spaces, as green infrastructures with high eco-systemic values). Planning and architecture are also considered key challenges to reconfigure peri-urban areas, asserting new collective identities, overcoming the social and ecological vulnerability of those territorial systems (Russo, 2012).
In the current phase, the process of selection of the Focus Area through spatial analysis has shared within the Living Lab carried out in the Afragola Municipality, where a wide range of stakeholders is involved in (Ståhlbröst and Holst, 2012). Moreover, the territories-in-between defined through the spatial analysis could be used by local authorities, to better recognize and manage urban issues in terms of

Fig. 11 – Fringe areas between Casoria and Afragola (Photo: Anna Attademo).

waste reduction and management, by the aim of applying circularity models, including those of Circular Economy. Such ambitious goal explain the reason of identifying such analytical methods for enhancing the spatial relations between waste cycles and urban metabolism, focusing on the specific characteristic of the territories. The methodology could be applied for the entire Metropolitan Area of Naples.

The methodology for the selection of the case study area is scalable and transferable to other European case studies of REPAiR, considering the local differences. Moreover, the selection of the territories-in-between can be tested through the participatory process, together with the stakeholders involved in the Living Labs (fig. 10), generating new ideas, creative innovations and strategies for the implementation of circularity in planning and in local economies.

Endnotes

[1] All the paragraphs have been written and approved by all the authors M. Rigillo, L. Amenta, A. Attademo, L. Boccia, E. Formato and M. Russo.

[2] See more at the link https://ec.europa.eu/programmes/horizon2020/.

[3] REPAiR has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 688920.

[4] In REPAiR research proposal is used the term 'Wasted Landscapes', referring to open spaces as well as built entities, like buildings and infrastructure. In the development of the project, the research team widened its meaning, introducing the term 'Wastescapes', referring to the material and immaterial condition of these landscapes.

References

Allen A., Broto V.C., Rapoport E. 2012, *Interdisciplinary Perspectives on Urban Metabolism. A review of the literature*, «Journal of Industrial Ecology», n. 16(6), pp. 851-861.

Amenta L., 2015, *Reverse Land. Wasted Landscapes as a resource to re-cycle contemporary cities,* University of Naples Federico II, Napoli.

Amenta L., Attademo A. 2016, *Circular wastescapes. Waste as a resource for peri-urban landscapes planning*, «CRIOS Critica degli Ordinamenti Spaziali», n. 12, pp. 79-88.

Bilgram V., Brem A., Voigt K.I. 2008, *User-centric innovations in new product development – Systematic identification of lead users harnessing interactive and collaborative online-tools*, «International Journal of Innovation Management», n. 12(3), pp. 419-458.

Campagna M. 2014, *Geodesign: dai contenuti metodologici all'innovazione nelle pratiche*, in Atti della XVII Conferenza Nazionale SIU, Società Italiana degli urbanisti. L'urbanistica italiana nel mondo, Milano, 15-16 maggio 2014. (ed.), Planum Publisher, Roma-Milano.

Davoudi S. 2012, *Resilience: A Bridging Concept or a Dead End?*, «Planning Theory & Practice», n. 13(2), pp. 299-307.

Dijkstra L., Poelman H. 2012, *Cities in Europe: The new OECD-EC definition*, Regional and Urban Policy, 16, <http://ec.europa.eu/regional_policy/sources/docgener/focus/2012_01_city.pdf>.

Donadieu P. 1998, *Campagnes urbaines*, Actes Sud / E.N.S.P, Arles-Versailles.

European Commission 2011, Innovation for a sustainable Future – The Eco-innovation Action Plan (Eco-AP), European Commission. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011DC0899&from=EN> (06/18).

European Commission 2018, *Innovation Policies, European Commission, Innovation Policies*. <https://ec.europa.eu/growth/industry/innovation/policy_en> (06/18).

European Commission 2018, *ECO-INNOVATION at the heart of European policies*. <https://ec.europa.eu/environment/ecoap/about-action-plan/objectives-methodology> (06/18).

European Commission 2008, *Directive 2008/98/Ec of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives*. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex-%3A32008L0098> (07/18).

European Commission 2010, *Being wise with waste: the EU's approach to waste management*. < http://ec.europa.eu/environment/waste/pdf/WASTE%20BROCHURE.pdf>.

European Commission 2011, *A resource-efficient Europe – Flagship initiative under the Europe 2020 Strategy*. European Commission. <https://www.eea.europa.eu/policy-documents/a-resource-efficient-europe-flagship> (07/18).

European Commission 2012, *Eco-innovation the key to Europe's future competitiveness* <http://ec.europa.eu/environment/pubs/pdf/factsheets/eco_innovation.pdf> (07/18).

European Commission 2014, *Towards a circular economy: A zero waste programme for Europe*, <https://www.oecd.org/env/outreach/EC-Circular-econonomy.pdf> (05/18).

European Commission 2011, *EC COMMUNICATION: Roadmap to a Resource Efficient Europe*, European Commission, 32, <http://doi.org/COM(2011) 571 final> (06/18).

European Union 2010, *Europe 2020 – A strategy for smart, sustainable and inclusive growth*, Communication from the Commission, <http://doi.org/10.1016/j.resconrec.2010.03.010> (06/18).

Forman R.T. 1995, *Land Mosaics. The ecology of landscapes and regions*, Cambridge University Press, Cambridge/New York.

Girardet H. 2000, *Cities, People, Planet*, *State of the World*. <http://bieb.ruaf.org/ruaf_bieb/upload/2407.pdf> (05/18).

Golubiewski N. 2012, *Is there a metabolism of an urban ecosystem? An ecological critique*, «Ambio», n. 41(7), pp. 751-764.

Ibañez D., Katsikis N. 2014, *New Geographies 06*, in *Grounding Metabolism*, Harvard University Press. pp. 2-10.

Indovina F. (ed.) 2009, *Dalla città diffusa all'arcipelago metropolitano*, FrancoAngeli, Milano.

Fig. 13 – REPAiR Waste Geography and 'circular features' in Peri-Urban Areas (Image credit: REPAiR proposal. Graphic: Libera Amenta).
Fig. 14 – REPAiR's stakeholders landscape (Image credit: REPAiR proposal. Graphic: Libera Amenta).

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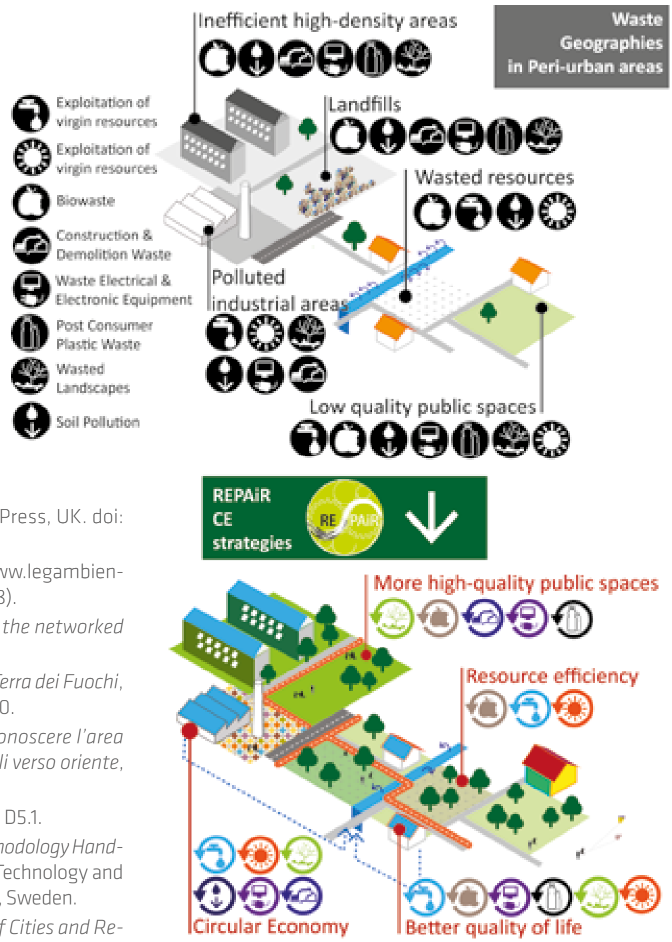
Fig. 12 – Wastescapes in the Metropolitan area of Naples (Photo: Libera Amenta).



Latouche S. 2009, *Farewell to Growth*, Polity Press, UK. doi: 10.1111/j.1468-2257.2011.00571.x.

Legambiente 2015, *Ecomafia 2015*. <http://www.legambiente.it/contenuti/dossier/ecomafia-2015> (07/18).

Mitchell W.J. 2003, *Me++ : the cyborg self and the networked city*, MIT Press, Cambridge.

Palestino F. 2015, *Per un'agenda radicale della Terra dei Fuochi*, «CRIOS Critica degli Ordinamenti Spaziali», n. 10.

Russo M. 2012, *L'esperienza come progetto: conoscere l'area est di Napoli*, in Lucci R., Russo M. (eds), *Napoli verso oriente*, Clean edizioni, Napoli, pp. 144-163.

Russo M., *et al.* 2017, *REPAiR PULLs*, Handbook D5.1.

Ståhlbröst A., Holst M. 2012, *The Living Lab Methodology Handbook*, Social Informatics at Luleå University of Technology and CDT – Centre for Distance-spanning Technology, Sweden.

Soja E. 2000, *Postmetropolis: Critical Studies of Cities and Regions*, Basil Blackwell, Oxford.

Steen K., Bueren E. Van 2017, *Urban Living Labs. A living lab way of working*, Amsterdam Institute for Advanced Metropolitan Solutions Delft University of Technology.

Steinitz C. 2012, *A Framework for Geodesign. Changing Geography by Design*, E. Press, New York.

Swyngedouw E. 2006, *Metabolic urbanization*, in *In the nature of cities: Urban political ecology*, Routledge, UK, pp. 20-39.

Viganò P. (ed.) 2001, *Territori della nuova modernità Provincia di Lecce. Assessorato alla gestione territoriale: Piano territoriale di coordinamento = Territories of a new modernity*, Electa, Napoli.

Wandl A. *et al.* 2014, *Beyond urban–rural classifications: Characterising and mapping territories-in-between across Europe*, «Landscape and Urban Planning», n. 130, pp. 50-63.

Community planning activities for rehabilitation projects in Italy. The positive case of the children participatory design on the area of Vergomasco landfill in Odolo, Brescia

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Abstract

Participatory planning methods are an essential tool for rebuilding the relationship between the inhabitants and their environment.
This paper presents a successful participation process with children and the adult inhabitants of the small town of Odolo through which a landfill of inert waste was transformed in a park of 10 hectares with recreational facilities.
Following the proposals of the children and the other stakeholders, the implementation of the park was carried out between the end of 2009 and the beginning of 2010. The paper also gives a short presentation of the outcomes of a qualitative evaluation of the process and its outcomes, conducted in September 2015.

Keywords

Participatory Planning, Children, Waste Management, Green Areas

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Waste management and participatory planning

The recent weakening of the link between the inhabitants and the environment where they live has very serious social and environmental consequences in the world of waste management, up to well-known medical emergencies throughout the country. Usually the population face the concepts of waste, landfills and treatment plants with prejudice. It is the well-known 'NIMBY syndrome', which has in recent years extended to regional and national levels (Livezey, 1980).

The behaviours of some politicians, who do not play the role of promoters of responsible values towards their territory, but feed people's fears and stereotyped images, often worsen these problems. The outcomes are that the location of new plants has hampered as well as the development of existing installations and rehabilitation work (Lavagetti, 2014; Nimby Forum, 2018). Moreover, that brings on the one hand to the export of waste outside the territory with impacts and costs that are not sustainable and on the other to the proliferation of uncontrolled and illegal management of waste (EEA, 2016; ISPRA, 2016).

Participatory or collaborative planning (Bishop, 2015) is a very useful tool to decrease the levels of conflicts and to attain more sustainable, shared and higher quality projects. The involvement of children in these processes has further positive effects. First, it helps a wider and more diverse group of adults to get involved and it facilitates the creation of more collaborative positions. Second, as children are more open to the needs of other users and more responsive to natural elements, it is more likely to foster sustainable design projects. Finally, children's involvement adds a powerful educational value to the planning process, because children can experience first-hand how to manage the common good (Hart, 1997; Lorenzo, 1998; Driskell, 2002).

In our country, participatory projects with children started spreading in the late 1990s. The approval of the UNICEF Convention on the Rights of the Child in 1989, ratified by Italy two years later, was the legal milestone of this process. Article 12 affirms «the right to express those views freely in all matters affecting the child, the views of the child being given due weight in accordance with the age and maturity of the child», being the quality of the environment where children live a very relevant matter. The issuance of the National Law n. 285 (known as *Legge Turco*) in 1997 and the project '*Città sostenibile dei bambini e delle bambine*' (Sustainable city of boys and girls) gave further boost to the involvement of children in community planning projects, offering legal and financial support to municipalities interested in carrying out participatory planning pro-

cesses with children (Lombardo, 1998; Amodio et. al. 2001; Unicef Insight, 2005).

The local context and preliminary steps of the participatory process

Odolo is a small town (2.000 inhabitants) located in the Valsabbia (Brescia province) 80 kilometres east from Milan.Iron industry in Odolo and the Province of Brescia has had a long history starting from the 14th century, thanks to the presence of iron ore, rivers and charcoal. In the 50s Odolo became a national center for the production of steel round bars, used in reinforced concrete for the post-war development of Italy. Odolo's steel round is produced by electric ovens, a technology that produces waste, the so-called steel slag, made of iron silicates with a consistency similar to lava rock (Pedrocco, 2000).
Until the 80s, Odolo's steel mill waste was deposited on the ground in the valleys and cliffs close to the steel mills, such as the Vergomasco valley, located very close to the town and the parish church. After the waste legislation (Lombardy Regional Law n. 94/80), it became a landfill site. The oldest part of the landfill, which is further from the town centre, was already transformed in a green area (Fig. 1).
In 2005 Vergomasco S.c.ar.l., a new consortium of Odolo steelwork companies, committed Montana S.p.A., a Milan environmental engineering company, for a new environmental recovery project.
The site of 15 hectares, inaccessible for many years, needed to be turned into a public park with recreational facilities. The entire construction cost of the project would be charged to the consortium, as well the cost of its maintenance for 10 years.
The project was authorized, in order to adapt the landfill to European and National regulation by mitigating the morphologies to the surrounding landscape.
In 2006 the environmental geologist Piero Simone of Montana S.p.A. and landfill area supervisor, proposed to Vergomasco the use of participatory methods as he was deeply convinced of their of

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Fig. 1 – View of the project area and the landfill (Photo: Piero Simone).

their positive impact in the management of rehabilitation projects.

The consortium agreed in line with its strong tradition of attention towards the inhabitants' needs and questions. And, so did the Mayor, who was interested in trying out an innovative project in the town of Odolo.

The team of facilitators, hired to manage the participatory process by Montana, conducted an initial analysis of the local context, in collaboration with the Municipality. The outcomes of this analysis led to the decision to give children the leading role in the process. The reasons were both educational as well as for a successful implementation of the park project and its management

Specifically, the team wanted this project to be an interesting opportunity to enforce the European Landscape Convention (art. 6) (Castiglioni, 2009) and to create a sense of ownership and meaningful connection between children and the new park, a place strategically located close to a church parish, sports fields and the school. This last goal was even more important in the small town of Odolo, where the percentage of students with foreign origins was very high.

Moreover, children were among the main stakeholders, as future main users of the new area. At the same time, as sensitive to other users' needs, they could become powerful mediators of local conflicts and involve, as they actually did, their families and their community in a proactive dialogue. Finally, projects that are planned with children are usually more sustainable both environmentally and economically (Lorenzo, 1998).

In the spring 2007, the local municipality contacted the primary school, as it could guarantee, better than other more informal social environment, a continuous and articulated participatory process with children. In June, the project was presented to the school principal and the teachers, who joined it with enthusiasm. The project was carried out through a unique cooperation among public institutions (the Municipality of Odolo, the local primary school and the Province of Brescia) and Vergomasco, the local consortium of steelwork companies (Ferriera Valsabbia, Bredina and IRO). The project had also the patronage of Lombardy Region.

The process: participants, content and results

The main participants were a group of around 70 children aged from 7 to 10. Nearly half of them had foreign origins (Chile, Pakistan, India, Mali, Morocco, etc.).

The process covered three school years between the autumn 2007 and June 2010. The process with children was divided into a dozen of workshops (2 hours each) - some took place in the classrooms and

Fig. 2 – Exploring children's needs using the drawings of their favourite play activities (Photo: Claudia Zaninelli).

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Fig. 3 – The inspection of the project site: each group of children was given a sheet of paper with its task (photo: Claudia Zaninelli).

some on the project area – that were managed by experienced facilitators with the support of teachers. More specifically, before each workshop, the facilitator team briefed the teachers about goals, process and desired outcome, so they could be part of the team and give effective support during the in-class activities. The activities were planned by the facilitators, giving particular attention to the development of tools as diversified as possible (pictures, maps, questionnaires, interviews, role-play games, etc.) and to the mixture of individual work and teamwork, in order to encourage the best participation of all the children.
In September 2007, the facilitators, together with the teachers and Montana technicians, pointed out the first steps of the participatory process.
The starting point was the identification of what makes a quality green space. Each student drew his/her favourite activity in a natural environment and pointed out the main features of these spaces; including: the alternation of large spaces and smaller ones hidden by the vegetation, water (lakes, rivers), fruit-bearing plants, shrubs, aromatic herbs, plants with coloured, sweet-smelling flowers, etc. (Fig. 2).
The following inspection of the area allowed the children to check its position with respect to the country and to gather data for its analysis from both a subjective and an objective point of view. The collected information included the size and morphology of the area and its native vegetation, as well as the positive and negative feelings that this place gave the children. During the inspection the children were also informed about the 'design space' available and the main environmental and regulatory constraints that were to be taken into account (Fig. 3).
As the park would be a public space, the children identified the other future users (mothers with young children, elderly, teenagers, etc.), wrote a short questionnaire, that was then refined by the facilitators, and asked a sample of known people, beneath the identified groups, to fill it.
Once completed the analysis of context and needs, the team proceeded to the planning step itself and the development of the first design proposals. The tool used was an *ad hoc* variant of Planning for Real, a widely used tool in the context of participatory planning. Similarly, to what usually happens in role-playing games, children, divided into small groups, were asked to describe a visit in the park by the different groups of users (children, adolescents, mothers with toddlers, dog's owners, old people, etc.) and then act as advocates defending their ideas. Then, using a large map of the project, conflict situations were solved, bringing to a proposal supported by the whole class (Fig. 4).
On June 4th 2008, an exhibition and a meeting were

held at the town hall. The children presented the work they had done and their proposals to the Mayor of Odolo, the Vergomasco CEO Pierluca Levrangi, the representatives of Montana, Piero Simone and Alessandro Bertelli, and many parents and friends. The purpose of the meeting was also to gather adults' suggestions and ideas about children's projects.

In autumn 2008, at the beginning of the second year, the participatory process was divided into two parts. While Montana worked at the assessment of technical and economic feasibility of the children's project and the complex paperwork to authorize the project, the facilitators developed the second phase of the process with children. The aims were to draw the final project and to get children to participate to the implementation of some interventions directly. Following the presentation at the town hall and the gathering of comments by adults, landscape architect Anna Marelli drew a draft of the final project, which also took into account the technical and economic feasibility of the proposals (Fig. 5). The project was presented to the children, who were asked to write further comments on post its (Fig. 6). On these comments, the landscape architect drew the final project (Fig. 7). Then the children were asked to choose the plant species to be used in the park. This was done starting from a preliminary selection of plants made by a naturalist who was involved on a voluntary basis. Between the end of 2009 and the spring 2010, the children were involved in monitoring the progress of the implementation of the project, through visits to the site and continuous updating by the facilitators (Fig. 8). In May, as the project was almost completed, the children planted aromatic herbs in some flowerbeds (Fig. 9) and organized the opening event: children wrote their speech, prepared the communication materials and wrote a letter to their schoolmates' families asking to cook traditional dishes of their country for the party. The children through a contest chose the name 'Odolandia Park'. The opening event took place on June 12th, the last day of the school year. More than three hundred people participated (Fig. 10).

Evaluation and conclusions

In May 2015, Montana was asked to present the Odolo project at the International Workshop on Waste Architecture at the Sardinia Symposium in October.

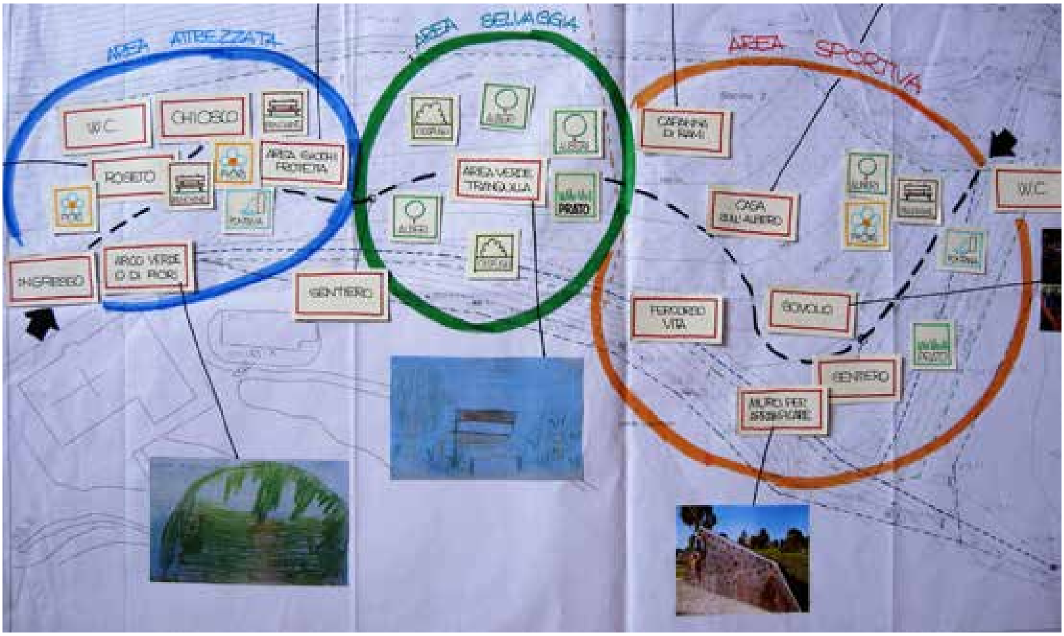

Fig. 4 – One of the very first project proposal: the park was divided into three parts: the area with recreational facilities, 'the wild area' and the area with sporting facilities (photo: Claudia Zaninelli).
Fig. 5 – The draft of the final project (photo: Monica Vercesi).

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Fig. 6 – Children's comments on the draft of the final project (photo: Monica Vercesi).

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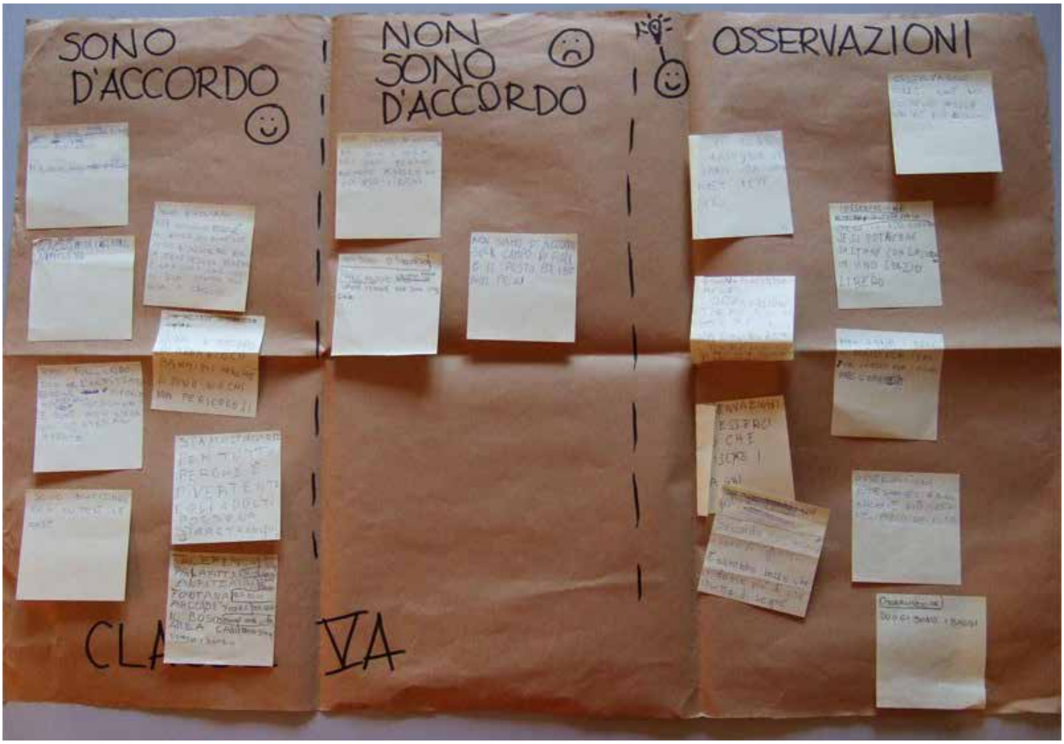
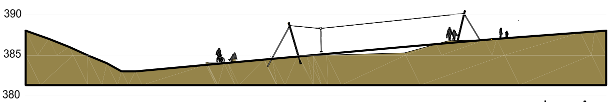
Fig. 7 – The final project.



The facilitators took this opportunity to conduct a post-construction evaluation of the project with its stakeholders to assess the impact of this experience after a few years. Specifically, the goal was to evaluate the process (feelings and memories they have kept of this experience) and its outcomes (the quality of the green area and their feelings towards it).

The evaluation was carried out using different tools. The school's teachers and a group of ex-students were invited to attend a town hall meeting where they were first asked to fill two questionnaires with open questions (one for the teachers and the other for the ex-students) and then discuss the results. The other stakeholders (the Mayor of Odolo, the Vergomasco CEO and the Montana landfill work supervisors) were interviewed.

In everybody's opinions, the park has always been popular since its opening, because it is well planned, located near the schools, the parish church and the town centre and well kept by Vergomasco. The teachers appreciated the consistency between the initial objectives and the results, the methodology and, above all, the capacity of the project to involve foreign-born students and their families: «the activities were well planned and succeeded in involving all children, including the ones who didn't speak Italian very well», «the project succeeded in reinforcing the connection between children and their environment and increase their sense of responsibility towards it». The ex-students gave a high score to the project process and outcome (between 4 and 5 on a 1-5 scale). Among the main reasons cited, they wrote they were able to express their needs, desires and creativity, «to work together with our schoolmates», «to be heard by adults», to see the outcomes of their work, «to feel very important» because they had done something good for their town and to be able to visit a place which they had planned and designed. Four out of six students said that the park was implemented as they had planned it.



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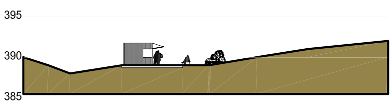

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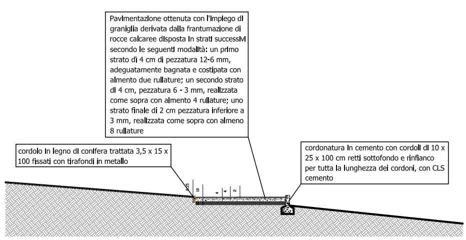

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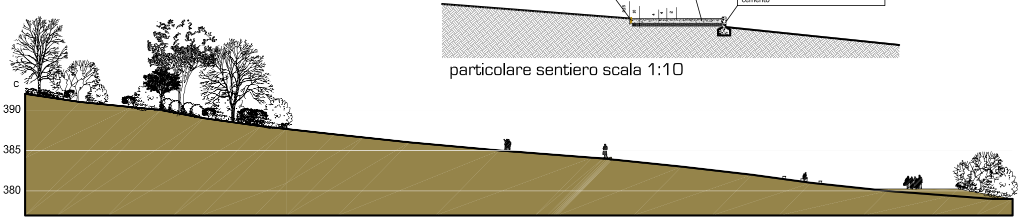

sezione C scala 1:500

Planimetria di progetto scala 1:500

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02	revisione progetto preliminare	28/04/09	A.M.	P.S.	L.N.
01	revisione progetto preliminare	06/03/09	A.M.	P.S.	L.N.
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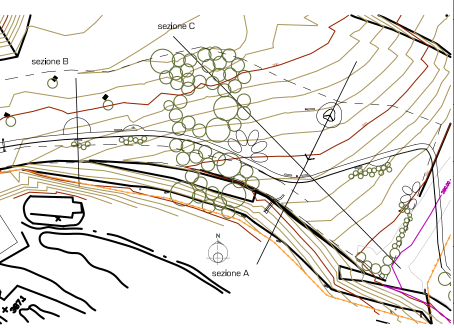

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Progettisti
Dott. Arch. Anna Marelli
Dott. Arch. Monica Vercesi
Dott. Arch. Claudia Zaninelli

Oggetto
PROGETTO PRELIMINARE
PARCO SULLA DISCARICA VERGOMASCO

Tavola
PLANIMETRIA E SEZIONI

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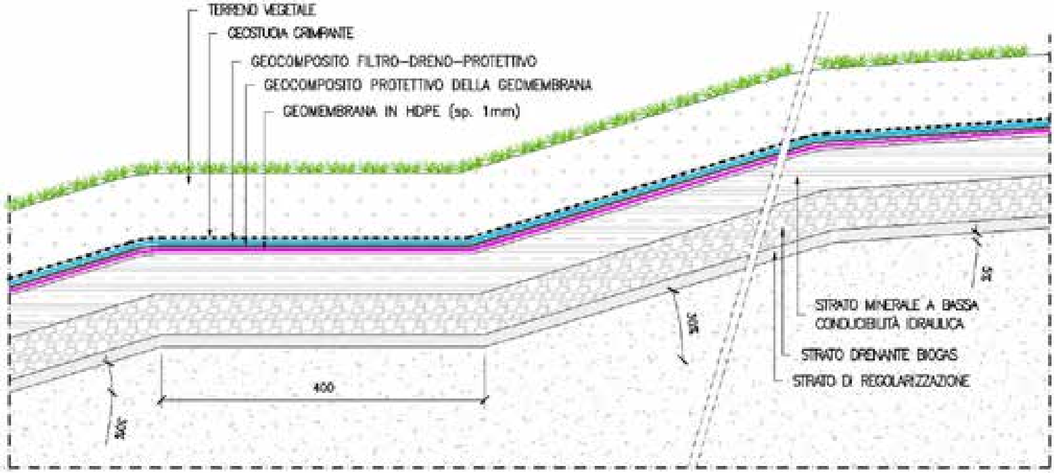
TERRENO VEGETALE
GEOSTUOIA CRIMPANTE
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GEOCOMPOSITO PROTETTIVO DELLA GEOMEMBRANA
GEOMEMBRANA IN HDPE (sp. 1mm)
STRATO MINERALE A BASSA CONDUCIBILITÀ IDRAULICA
STRATO DRENANTE BIOGAS
STRATO DI REGOLARIZZAZIONE
400

Fig. 10 – The opening ceremony (photo: Claudia Zaninelli).

opposite page
Fig. 8 – The soil layers over the landfill.
Fig. 9 – The children plant the aromatic herbs (photo: Monica Vercesi).

The negative aspects of this experience are nearly non-existent. The Mayor said that this experience was a great opportunity for their town and he really appreciated the way children had committed themselves to the project. There have been a few episodes of vandalism, but they were less frequent than in other green area. The only problem they had, at the beginning, was the custom-made slide (the bottom filled with water when it rained), but then they solved it. While the Vergomasco CEO said that was an «extremely positive experience, to be repeated as soon as the economic situation will allow it». The landfill work supervisors said that the participation of children succeeded in lowering the conflicts with some people who lived around the site. Even though the group of stakeholders involved in the evaluation was not truly representative[1], the results confirmed that the project's aims were almost reached.

In conclusion, we can say that when evaluating the success of the Odolo project several factors should be considered. Children's involvement should start only when there is high potential for project's implementation, i.e. decision makers are truly committed to the project and the appropriate funding for planning and implementation is available. In the project's initial phases, children should be informed about their role in the process; they should understand the characteristic of the site and take into account its main environmental and regulatory constraints. It is very important that children are not given the impression that anything can be built on the site without constraints: idea feasibility is a very important aspect of the planning process and it will help them feel that their contribute is taken seriously. Therefore, if some of their proposals are not feasible children will have to be informed about the reasons (Iltus and Hart, 1995; Unicef Insight, 2005). Children should be involved in the planning process as well as in the implementation of the project, even though it is a small part. This will increase their sense of ownership and responsibility towards the project.

Endnotes

[1] The primary schoolteachers were asked to get in touch with the ex-students, but it was not an easy task. Specifically no foreign-born students participated in the evaluation.

References

Amodio L., Majorano C., Riccio C. (ed.) 2001, *I bambini trasformano la città*, Ministero dell'Ambiente e della Tutela del Territorio, Rome, Istituto degli Innocenti, Florence.

Baldoni A. et al. 2004, *Future città, nuovi cittadini*, La Mandragora, Imola.

Balducci A. 1994, *Progettazione partecipata fra tradizione e innovazione*, «Urbanistica», vol. 103, pp. 113-116.

Bellaviti P. 1994, *Una mappa delle nuove esperienze italiane: origini, autori, metodi e tecniche*, «Urbanistica», vol. 103, pp. 92-104.

Bishop J. 1995, *Bambini disegnatori e progettisti*, «Paesaggio urbano», vol. 3, pp. 54-59.

Bishop J. 2015, *The craft of collaborative planning*, Routledge, New York-London.

Castiglioni B. 2009, *Education on landscape for children*, Secretariat document, Cultural Heritage, Landscape and Spatial Planning Division, Council of Europe, Strasbourg.

European Environmental Agency (EEA) 2016, "Prevention of hazardous waste in Europe" Report n. 35.

Driskell D. 2002, *Creating better cities with children and youth*, Earthscan, London.

Ferraresi G. 1994, *La costruzione sociale del piano*, «Urbanistica», vol. 103, pp. 105-112.

Hart R. 1997, *Children's participation*, Earthscan, New York.

Iltus S. Hart R. 1995, *Participatory planning and design of recreational spaces with children*, «Architecture & Comportément/Architecture & Behaviour», vol. 10, n. 4, pp. 361 – 370.

Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA) 2016, Rapporto Rifiuti Speciali.

Lavagetti C. 2014, *The management of local issues in environmental permitting and E.I.A.*, «4th International Conference on Industrial and Hazardous Waste Management», 2nd-5th September, Crete.

Livezey E.T. 1980, *Hazardous Waste*, «The Christian Science Monitor», November 6th.

Lombardo S. (ed.) 1998, *La guida alle città sostenibili delle bambine e dei bambini*, Ministero dell'Ambiente, Roma.

Lorenzo R. 1998, *La città sostenibile. Partecipazione, luogo, comunità*, Elèuthera, Milan.

Lorenzo R. 1995, *La città dell'infanzia: parole, programmi, partecipazione, ricerche e, speriamo, progetti concreti*, «Paesaggio urbano», vol. 3, pp. 16-21.

Nimby forum 2018, *XII Rapporto dell'Osservatorio*, http://www.nimbyforum.it/.

Pedrocco G. 2000, *Bresciani: dal rottame al tondino. Mezzo secolo di siderurgia (1945-2000)*, Jaca Book, Milan.

Società Montana 2009, *Relazione sul progetto preliminare per la riqualificazione dell'area della discarica Vergomasco*, unpublished.

Società Montana 2008, *Relazione sul percorso partecipato per la riqualificazione dell'area della discarica Vergomasco*, a. s. 2007-'08, unpublished.

Società Montana 2008, *Relazione sul percorso partecipato per la riqualificazione dell'area della discarica Vergomasco*, a. s. 2008-'09, unpublished.

Unicef Insight 2005, *La città con i bambini, città amiche dell'infanzia in Italia*, Unicef.

Vercesi M. (ed.) 1999, *Milano, il quartiere Adriano: gli abitanti "progettano" la città*, Istituto di Ricerca Ecopolis, Franco Angeli, Milan.

Vercesi M. 2005, *Il progetto di riqualificazione a verde urbano dell'ex-area dell'Italcementi nel quartiere di Borgo Palazzo a Bergamo*, in *Aree dismesse e verde urbano. Nuovi paesaggi in Italia,* ed. Leone U., Patron, Bologna.

Vercesi M. 2006, *Riqualificazione di un giardino scolastico: un esempio concreto di sostenibilità ambientale*, «Ufficio Tecnico», vol. 3, pp. 78-83.