REPAiR

REsource Management in Peri-urban AReas: Going Beyond Urban Metabolism

D5.7 Eco-innovative Solutions Hamburg

Version 1.6

Author(s): Andreas Obersteg, Alessandro Arlati, Andrea Lopes (HCU)

Contributors: Andrea Spirito, Tatiana Moschini, Carla Tortelli (HCU), Cecilia Furlan (TUD)

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Contact of responsible author:	andreas.obersteg@hcu-hamburg.de

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Acronyms and Abbreviations in this Deliverable

AWB	Waste Management Organization) of the City of Oldenburg
BGK	Bundesgütegemeinschaft Kompost e.V. (Federal Compost Quality Association)
BUND	Bund für Umwelt und Naturschutz Deutschland (Federation for Environmental Protection and Nature Conservation Germany)
BKW	Biogas and Compost plant (Bio -und Kompostwerk Bützberg)
CM	Consortium Meeting
DECISIVE	A DECentralised management Scheme for Innovative Valorisation of urban biowastE
EC	European Commission
EIS	Eco-Innovative Solution
EU	European Union
FA	Focus Area
GA	Grant Agreement
GAB	GAB Umwelt service - public-private waste management company of the County of Pinneberg
GDSE	Geodesign Decision Support Environment
GI	Green Infrastructure
GW	Garden Waste
HH	Hamburg Federal State
ILSR	Institute for Local Self-Reliance
KEBAP	KulturEnergieBunkerAltonaProjekt (CultureEnergyBunkerAltonaProject)
KITA	Kindertagesstätte (Daycare Center)
KT	Knowledge Transfer
KW	Kitchen Waste
OW	Organic Waste (Kitchen Waste and Garden Waste)
MFA	Material Flow Analysis
NABU	Naturschutzbund Deutschland Landesverband Hamburg e.V. (Nature Conservation Association Germany Regional Association Hamburg e.V.)

NRAES	Natural Resource, Agriculture, and Engineering Service
NRDC	Natural Resources Defense Council
PULL	Peri-Urban Living Lab
RW	Residual Waste
SH	Schleswig-Holstein Federal State
SRH	Stadtreinigung Hamburg - public waste management company of Hamburg Federal State
VFG	Vegetable, fruit and garden waste
VLACO	Flemish Compost Organisation
WEEE	Waste Electrical and Electronic Equipment
WP	Work Package
ZEBAU	Zentrum für Energie, Bauen, Architektur und Umwelt GmbH (Centre for Energy, Building, Architecture and Environment GmbH)
ZRE	Centre for resources and energy (Zentrum für Ressourcen und Energien)

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Publishable Summary

This deliverable presents the Eco-Innovative Solutions (EIS) chosen and developed in the follower case study of Hamburg.

The development of the EIS in REPAiR is required to happen through a co-creation process using the format of a Peri-Urban Living Labs (PULLs) (see D5.2).

In the PULL conducted in the frame of the project, the HCU Research Team was able to merge the knowledge of different stakeholders such as public administration, private local companies, and not least waste management companies.

A university joint course between HCU and TU Delft has resulted in a first pool of ideas that served as input for the stakeholders involved in the PULL meetings.

In general, the EIS for Hamburg are divided into two groups addressing the bio waste stream:

- Altona district (Hamburg - HH), bio waste generated at household level
- County of Pinneberg (Schleswig-Holstein - SH), bio waste generated by tree nurseries

In some cases, other flows linked to those listed were taken into consideration (e.g. electronic waste).

Not all solutions achieve a complete circularity but rather tend to it. The complexity of the topic and the multitude of aspects to consider have revealed to be the biggest challenge, being the readiness level of the stakeholders high enough to proceed in the implementation. As a matter of fact, some of the EIS developed in the Hamburg case will be implemented in reality to test their efficacy.

1. Introduction

The Deliverables D5.7 "Catalogue of solutions and strategies for Hamburg" presents the catalogue of Eco-Innovative Solutions (EIS) for the follower case study of Hamburg, Germany.

The EIS have been developed after a series of meetings with the local stakeholders in the form of Peri-Urban Living Lab (PULL) with the aim of involving the main actors in play since the very beginning of the process: from the understanding of the problems of the area (co-exploration phase) to the selection of the EIS to implement (co-decision phase). For Hamburg, the PULL process was split into two parts:

- District of Altona (Hamburg): organic waste generated by private households; and
- County of Pinneberg (Schleswig-Holstein): organic waste generated by the tree nurseries.

After an explorative phase with interviews and smaller meeting, the group of stakeholders in Pinneberg met with the HCU Research Team only once: at this event, some tree nursery owners, the County of Pinneberg and the local waste management company gathered around a table to discuss their problems. After this meeting, the tree nurseries and the local waste management company started independently from the project REPAiR to work together to achieve the goal of reducing loss of materials (incineration) in favor of production of a specific compost for the tree nurseries (Chapter 6).

On the other side, in the District of Altona the stakeholders worked more along the HCU Research Team. In fact, the work in Altona has been supported by the ideas of the students from HCU and TU Delft that participated in a joint course at the HCU to design ad hoc solutions for Hamburg. These have been after analysed and discussed in the PULL meetings to draft the actual catalogue of solutions presented in the following Chapters.

The analyses deriving from WP3 were used to support the identification of the problems, the related goals and the localisation of possible implementation for the solutions. In fact, the spatial analysis resulted in the identification of the "enabling contexts", which were obtained by the over position of different layers (see REPAiR, 2018). Further, the data gathered in the Material Flow Analysis (MFA) were used to support decisions among stakeholders during the PULL events.

This deliverable represents the EIS that have been chosen after the PULL process. The methodology is presented in more detail in Chapter 3, together with a brief recap of the main characteristics and problems of the Focus Area (FA) from the Deliverable 3.6. Chapter 4 presents the EIS for Altona district; meanwhile the EIS for Pinneberg are described in Chapter 6.

In Altona the stakeholders have already started to realise some of the EIS: these together form the first Eco-Innovative Strategy for Hamburg (Chapter 5). Chapter 7 is introducing the topic of transferability; it describes, which solutions were transferred from and to other cases within REPAiR project. The methodology is explained in WP7, D7.2 (REPAiR, to be published). The final Chapter 9 concludes the Deliverable with some reflections.

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2. Framework for the development of the EIS in Hamburg

In the REPAiR case study of Hamburg, besides communicating with stakeholders and relating the EIS to local contexts, the development of solutions for the case of Hamburg, in the Focus Area of Altona, went further by:

- Collaborating with the District of Altona and consultancy companies on the development of the Climate Action Plan Altona, as already mentioned in the Deliverable 6.4 (REPAiR, 2018: p.44). Therefore, with such collaborative exchange, REPAiR offers its analytical results and EIS ideas for the development of the climate plan, while the district provides feedback from the citizen participation and the pilot testing strategy at the Sample Area of Osdorfer Born;
- By having students (from the REPAiR Elective course in HCU & Student Workshop with TUD_June2018) to support the spatial analysis and provide a first draft of the EIS needed for Altona's Focus Area;
- By having some of the strategies further developed through master thesis defended by students from Hafencity University and Polytechnic University of Turin; and
- By having the support from our local partner Stadtreinigung-SRH (who works with the REPAiR and the FORCE Horizon 2020 Research Projects) which integrates the results from both research projects to be tested in one of the Sample Areas (i.e. Osdorfer Born). Thus, some EIS will also count on feedback from the Osdorfer Born pilot, as well as being complemented with inputs from the exchange with other research projects such as FORCE & DECISIVE-Horizon 2020 Research Projects).
- Main inputs received from the WP leader were referring to the methodology part, especially how to better explain the process that we had in Hamburg to define our EIS. Further, the relation of EIS with the spatial dimension was deepened.

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3. Methodology and steps to design the EIS

Based on the process model analysis (Material Flow Analysis and Spatial Analysis) explained in the Deliverable 3.6 (REPAiR, 2018a), the Focus Area of Hamburg Case is divided into two different geographical areas (i.e., Altona and Pinneberg). Therefore, each Focus Area presents a specific approach for the development of Eco-Innovative Solutions.

3.1. Phases of EIS development

In the case of Altona, the development of EIS is based on the research through the living labs methodology, which is structured around two principal simultaneous activities:

- The transfer and adaptation of existing EIS from literature and reference projects into the case of Hamburg for Organic Waste and Wastescapes. This process re-constructs and adapts the state of the art of existing and tested EIS (i.e., design strategies, good practices, innovative policies, innovative materials) implemented in the last 5 years across Europe;
- An original co-design process of specific EIS for the context of Altona with local stakeholders (e.g. SRH, ZEBAU, Altona District) and students.
- In the case of Pinneberg, on the other hand, the development of EIS is structured according to one main activity:
- An original co-design process of specific EIS for the context of Pinneberg with local stakeholders closely related to the Tree Nurseries.

All mentioned activities are influenced by the different knowledge and expertise of the interdisciplinary REPAiR research team, partners and advisory board. This methodology is defined as a Co-creation process, which is structured by five iterative phases (Figure 3.1). Therefore, the EIS were developed in the REPAiR PULLs, which follows such interactive phases, as already described in the Deliverable 5.1 (REPAiR, 2017a: p.29) and deepened in Deliverable 5.4 (REPAiR, 2018c: p.14).

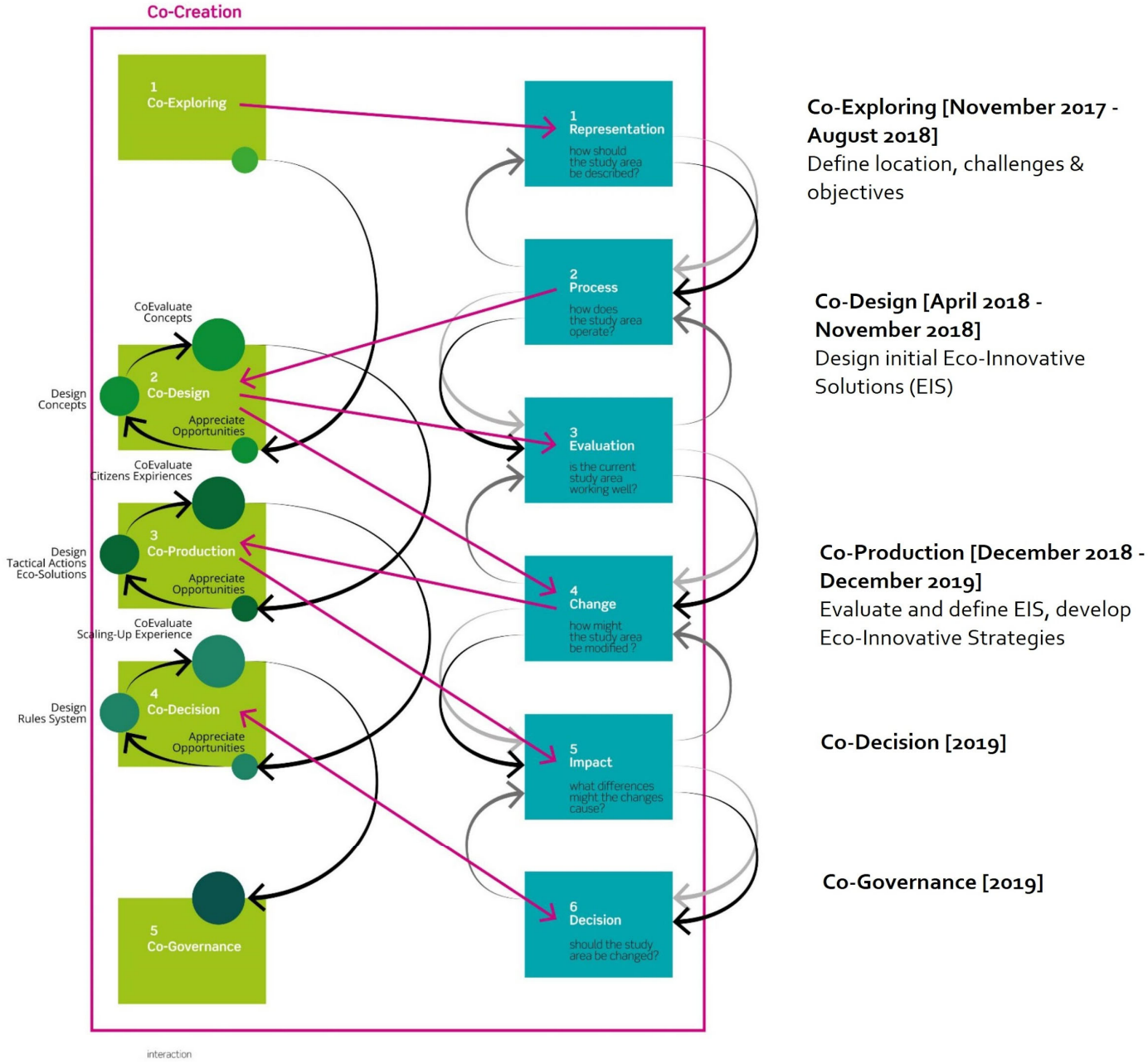

Figure 3.1 Peri-Urban Living Lab - steps and timeline adapted to the Hamburg Case (adapted from D5.2, REPAiR, 2018b).

1. Co-Exploring [November 2017 - August 2018]. The Co-Exploring phase is based on the cooperation between (mainly) WP5 and WP6, using interviews and workshops to define focus and sample areas. Interviews, workshops and surveys were used to define CE challenges and objectives, as chronologically specified below:

- **Interviews with local stakeholders from August till November 2017.** The basic information about problems, objectives as well as first ideas for solutions came from interviews respectively group discussions with stakeholders. Key stakeholders had been identified already in the development of the project, further stakeholders were involved using the snowball method. In Altona the development process of the climate

action plan and in Pinneberg the great interest in finding practical solutions supported the co-exploring phase.

- **1st PULL Pinneberg 06 February 2018.** The stakeholders exposed their thoughts on the main problems, challenges and initial objectives for achieving circularity amongst tree nurseries in Pinneberg.

- **1st PULL Altona 22 May 2018.** The stakeholders exposed their thoughts on the main problems, challenges and initial objectives for achieving high quality waste separation and closing the organic waste loop in Altona. Furthermore, the Sample Areas were defined according to their particular urban morphology and socio-economic structure.

- **Desk research by HCU REPAiR Team in June till August 2018.** Research on the contexts of MFA and Spatial analysis were carried out.

Further, the PULL events were supported by analysing existing territorial-flow dynamics and the waste they produce with multi-layer strategies and historical transformations, as well as plans and trends concerning the future development, this method allows to understand how elements of socio-technical and socio-ecological systems can be reintegrated (Berger, 2009; in Furlan, 2017). Hence, waste could become a key element for an innovative design going beyond the traditional planning schemes (Furlan, 2017).

2. Co-Design [April 2018 - November 2018]. The Co-design phase is based on workshops with stakeholders and experts in Hamburg and cooperation with education institutions (e.g., TUDelft, HCU, and TUHH). As part of a research and design studio, the conceptual ideas for EIS are developed in this phase, as chronologically specified below:

- **REPAiR Elective Class & Student Workshop HCU-TUD_Summer Semester.2018.** The students assessed each Sample Area in Altona to define locally specific problems and challenges from their perspective. In conclusion they proposed a series of conceptual ideas for Eco-innovative solutions to tackle the problems and challenges identified.

- **2nd PULL Altona 26 November 2018.** The aim was to discuss the main problems related to waste separation behavior and organic waste, including the ones exposed by the students. Moreover, the eco-innovative solutions from the student workshop were presented and its viability discussed in groups with the participants.

The results from this stage are further detailed in the sub-chapter 3.2.

3. Co-Production [December 2018 - October 2019]. In December 2018, the PULLs are carrying on the phases of co-production and co-evaluation and scaling-up the solutions. The aim is to move from conceptual idea of solutions to specific, operationalised, and accessible solutions; looking in particular to the objective and challenges identified by the stakeholders in Hamburg, throughout the iterative process allowed by the GDSE within the PULL events. Then, the

concrete feasibility and the further development of the EIS is verified with the contribution from the actors involved who, progressively, would structure a relationship of public-private-people partnership according to the Living Lab approach, which is applied to each Sample Area.

Like the Co-design phase, this phase is based on workshops with stakeholders and experts in Hamburg (now including knowledge transfer exercises during Consortium Meetings, as further referred in sub-chapter 3.3). Besides, this phase also counts on the cooperation with educational institutions and master thesis work, as chronologically specified below:

- **Desk Research by the REPAiR Team in HCU_Until Dec.2018.** The aim was to combine spatial analysis, material flow analysis and an actor analysis based on the data collected and interpreted in the deliverables D3.6, D6.2. and D6.4 (REPAiR 2018a; REPAiR 2017b; REPAiR 2018d).

- **3rd PULL Altona 13 February 2019.** The aim was to prioritise the general problems, to analyse deeper each Sample Area, and define ideas for solutions capable of addressing the specific issues found in Rissen, Blankenese, Osdorfer Born, Ottensen and Mitte Altona. The participants were brainstorming freely and, whenever a suggested idea had any relation to existing solutions from best practices or already proposed by the students, these examples were presented for being integrated into the discussion.

- **4th PULL Altona 21 March 2019.** The meeting was organised to discuss about Hamburg-Altona PULL EIS with SRH experts. Furthermore, synergies between REPAiR and the H2020 project FORCE were discussed. It was decided that in the field of organic waste synergies could be used between projects. Also, the analysis that was conducted in REPAiR on certain neighborhoods in Altona is of use for FORCE.

- **5th PULL Altona & 2nd PULL Pinneberg 22 May 2019.** The aim was to define which of the elementary solutions from the previous PULL could be implemented as a pilot test in the Sample Area of Osdorfer Born - The Strategy for Osdorfer Born. Besides, the HCU students that will be developing further some of the EIS through a master thesis were introduced to the stakeholders.

- **Sub-PULLs Altona from May 2019 onwards (several meetings, workshops 28 August 2019 and 17 February 2020).** For the pilot test in the Sample Area of Osdorfer Born (The Strategy for Osdorfer Born), some of our stakeholders were meeting independently (e.g., SRH, ProQuartier, and ZEBAU) to develop together the implementation plan. As a result, some complementary solutions were to be implemented together with the selected EIS for the pilot case in Osdorfer Born. These complementary solutions will be briefly described when necessary within the chapter of the Strategy for Osdorfer Born.

- **EISs further developed by Master Theses from students in collaboration with REPAiR.** Some of the EIS were developed in connection to the work in Master theses. The theses will develop the EIS idea in a more detailed way.

All the collected data were interrelated through a systemic design approach, as a method in which large-scale territorial dynamics and different material flows chains are interrelated in order to find synergies. This approach enables an understanding of how environmental, technological, political, economic, and social systems dynamically operate on a regional, local and product level, and how their interrelation through scale is the basis for an innovative design.

The overall iterative process consists of the Co-design and Co-production phases together, which later helped to validate and refine the objectives and led to the definition of a series of design strategies anchored on the ranked problems defined by the stakeholders in the territorial context of Hamburg and Pinneberg (Figure 3.2).

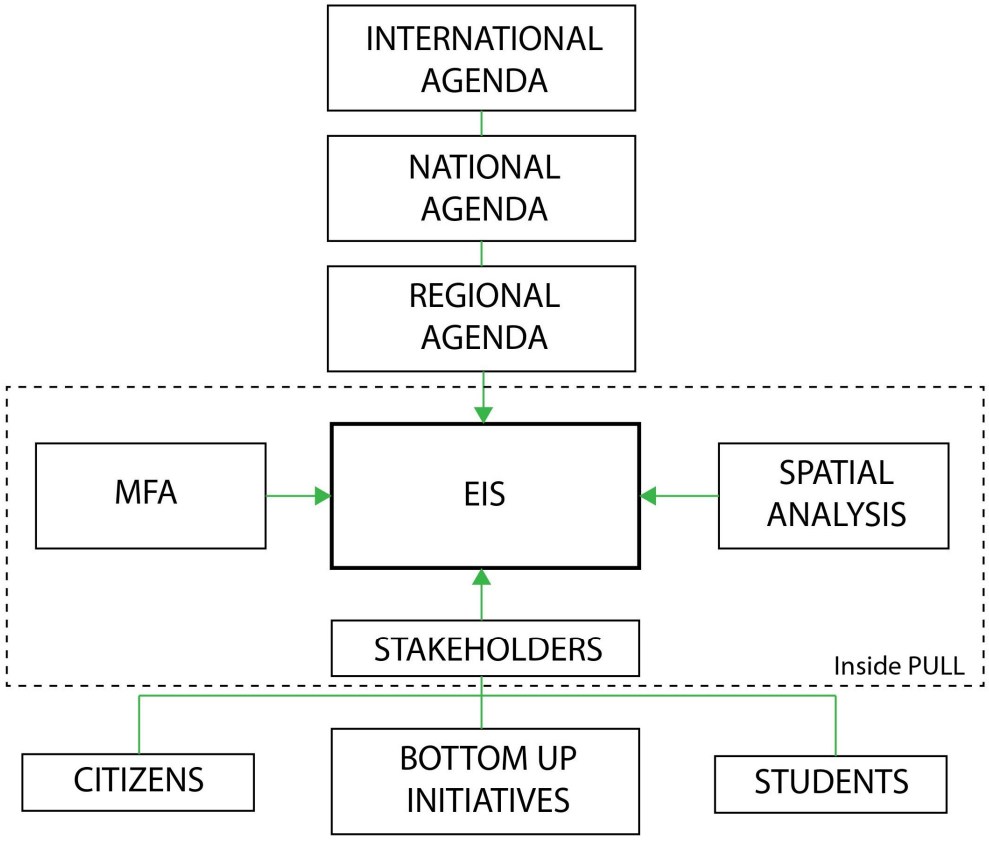

Figure 3.2 Scheme of the co-design process and systemic design operations towards the development of EIS (HCU Team, 2019).

The resulting understanding of the current situation was mainly generated by the aforementioned cartographic research, process models and design strategies, and complemented the results from the stakeholder interviews (WP6) and PULL workshops (WP5). The ambition of the design strategies is not to deliver definitive solutions, but, rather, to clarify the complex interdependence of waste processes, material flows and spatial issues and

demonstrate possible synergies between systems that could be acquired through the development of integrated solutions and strategies and thereby inform local and regional decision makers.

With this in mind, the ten solutions presented in this catalogue are divided according to the main thematic objectives resulted from the PULLs (i.e. Waste Avoidance & Separation; Enabling Environment for Circular Economy; Circular Waste Management into Urban Planning & Governance.

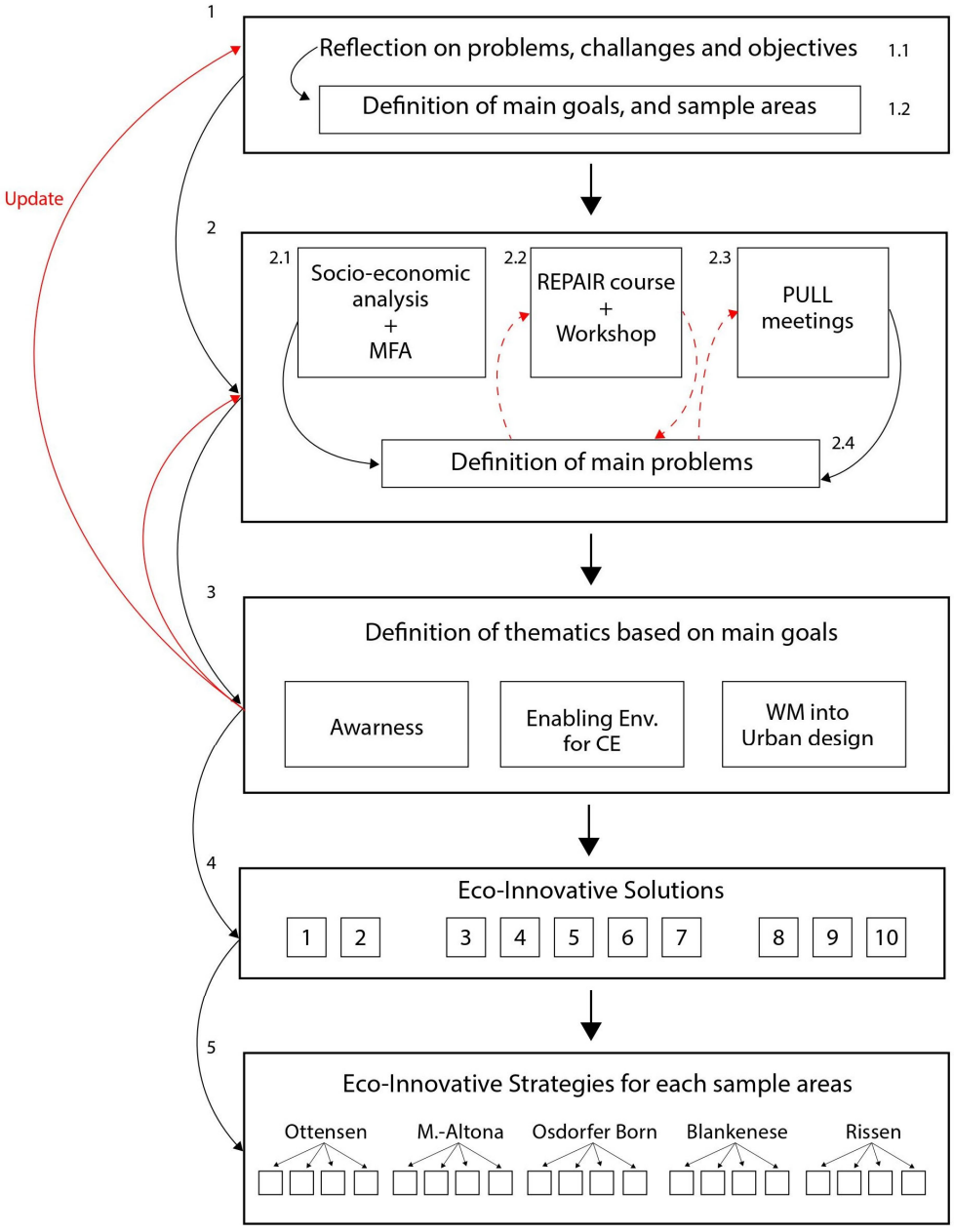

Figure 3.3 Methodology for defining the EIS in the case study of Hamburg (HCU Team, 2019).

Each solution is described and structured across four main parts:

- EIS Description, with the main implementation idea and process model illustration;
- EIS Evaluation Model, for some of the EIS;

- EIS Change Model, where the potential or actual location of the EIS will be displayed; and
- EIS References, for the EIS that are based on existing best practices.

Finally, in the Annex 1 it is possible to find the schemes for the current and proposed process: here the solutions are represented in their ability to change the current flows according to the style designed by WP2 (solutions in the GDSE).

Such structure is adapted from the digital workflow of the Geodesign framework (Steinitz, 2012), which has been applied and further developed during the first two years of REPAiR, and describes how an EIS addresses four main research questions:

- what is the content of the EIS?
- how does the EIS change the process of the area?
- why is the EIS valuable?
- where could the EIS be applied observing in particular the spatial role and component of the EIS

Nevertheless, the ten solutions are presented in different levels of detail since not all of them will be necessarily assessed by the REPAiR sustainability framework (WP4). As a matter of fact, just some of the EIS will be accounted for a LifeCycle Assessment.

The co-production and co-evaluation phases will be concluded in the first months of 2020. Then, the EIS will be integrated in the GDSE so that the phases of Co-decision and Co-governance can start.

3.2. Definition of Sample Areas to locate the EIS

During the Co-Exploring phase, the stakeholders decided to choose Sample Areas within the two Focus Areas of Hamburg-Altona and Pinneberg County (see Figure 3.4). The five Sample Areas in Altona represent different urban typologies (single housing areas, densely built urban areas, large housing estates and new housing development areas). The aim of the Sample Areas in Altona is to better understand the specific situation in different urban typologies and to develop EIS corresponding to the specific problems in the different Sample Areas. The Sample Area in Pinneberg is the production area of the tree nurseries as the EIS in Pinneberg is focusing on the improvement of the metabolism of this type of agricultural production. The following section aims to present each of the defined Sample Areas and summarize the main problems and challenges towards circular economy; this, according to the student workshop, the Spatial and Material Flow Analysis from the Deliverable 3.6 (REPAiR 2018a), and the PULL meetings.

Figure 3.4 Country area, region area, focus area, and sample areas in Hamburg case (REPAiR, 2018a).

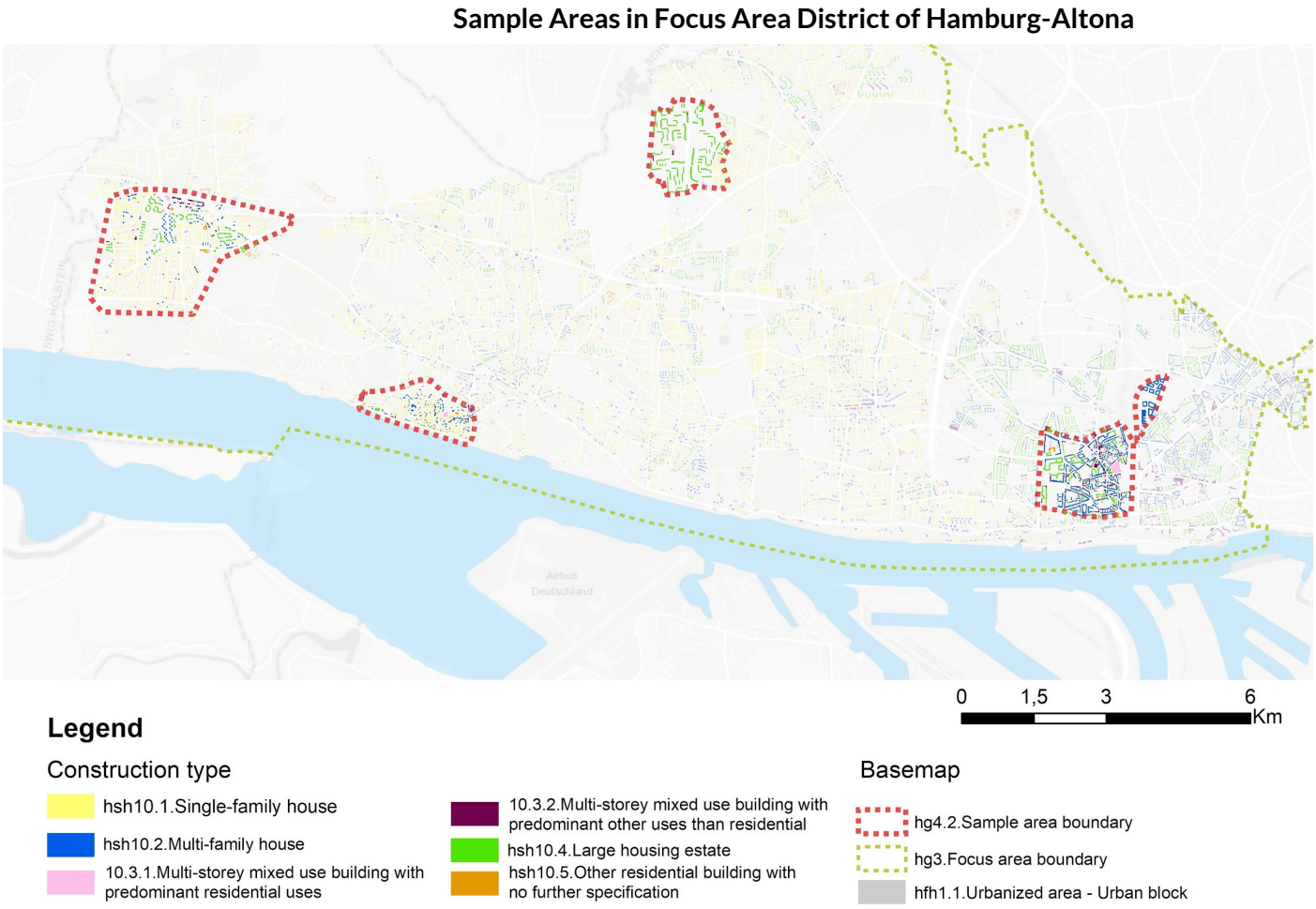

Figure 3.5 The five Sample areas in Hamburg-Altona - Residential building types (HCU Team, 2019).

Excurse: Enabling contexts and wastescapes in the case of Hamburg-Altona and Pinneberg

In the REPAiR pilot cases of Amsterdam and Naples some of the EIS were developed by using the concepts of enabling contexts and wastescapes.

In Hamburg-Altona and Pinneberg the stakeholders were more inclined to address the waste-related spatial problems by relating them with potential

opportunities that would facilitate circularity. The concept of Enabling Contexts therefore fits better to the way the stakeholders in Hamburg-Altona and Pinneberg were thinking than the concept of wastescapes.

Thus, in Hamburg-Altona and Pinneberg the concept of wastescapes was not directly used to generate EIS. But it was used to deepen the analysis of problems and then to further develop the solutions that (both problems and solutions) had been defined in the PULL process by the stakeholders.

As defined in D3.1, Wastescapes are related to the spatial effect of material waste flows on the territories and to the configurations of the infrastructures for their management. From a spatial, environmental, and social point of view, Wastescapes can represent challenging areas. Therefore, to be spatially connected with the surrounding settlements and become accessible areas as public spaces, they need to be transformed and regenerated.

In the case of Altona, it was possible to relate some waste-related spatial problems with the following type of wastescapes (D3.3, REPAiR 2019a: pp.17-19).

- W4.2: Urban settlements suffering from fatigue. Urban areas in socio-economic suffering (D3.3, REPAiR 2019a: p.17)
- W5.1: In peri-urban areas there are neglected - dismissed or underused - infrastructures such as roads, railways, pipelines, power lines, sewerage, etc.
- W5.2: Dismissed or underused public facilities, like parking areas, petrol stations, service areas, plants, etc.

These wastescape types can be observed in the following phenomena in the Sample Areas in Altona:

- In all sample areas, the lack of accessibility for elderly and people with disabilities.
- In Osdorfer Born, bulky waste on the streets and the lack of care for waste separation in collection points.
- In Ottensen, with the space competition between different uses in public areas and the lack of care by the tourists leaving trash on the sidewalks.
- In Mitte Altona, the lack of planned spaces for the containers and the collection logistics

In the case of Pinneberg, it was possible to relate some waste-related spatial problems with the following types of wastescapes:

- W5.3, which includes some intangible Wastescapes that can be mapped and are not immediately recognized spatially: the noise, light and the odor landscapes.
- W6, Operational infrastructure of waste related to the facilities dedicated to the waste storage and management.

These wastescape types can be observed in the following phenomena in the Sample Areas in Pinneberg:

- Odor caused by on-site incineration and storage of green waste in the tree nurseries harming their neighbours.
- Existing biowaste treatment plant in Pinneberg County that is currently used only for the treatment of biowaste from households and potentially has capacities for treating biowaste from tree nurseries.

As mentioned before, the concept of Enabling Context turned out to be more useful than the concept of Wastescapes during the work with the local stakeholders both of Altona and Pinneberg.

Rissen

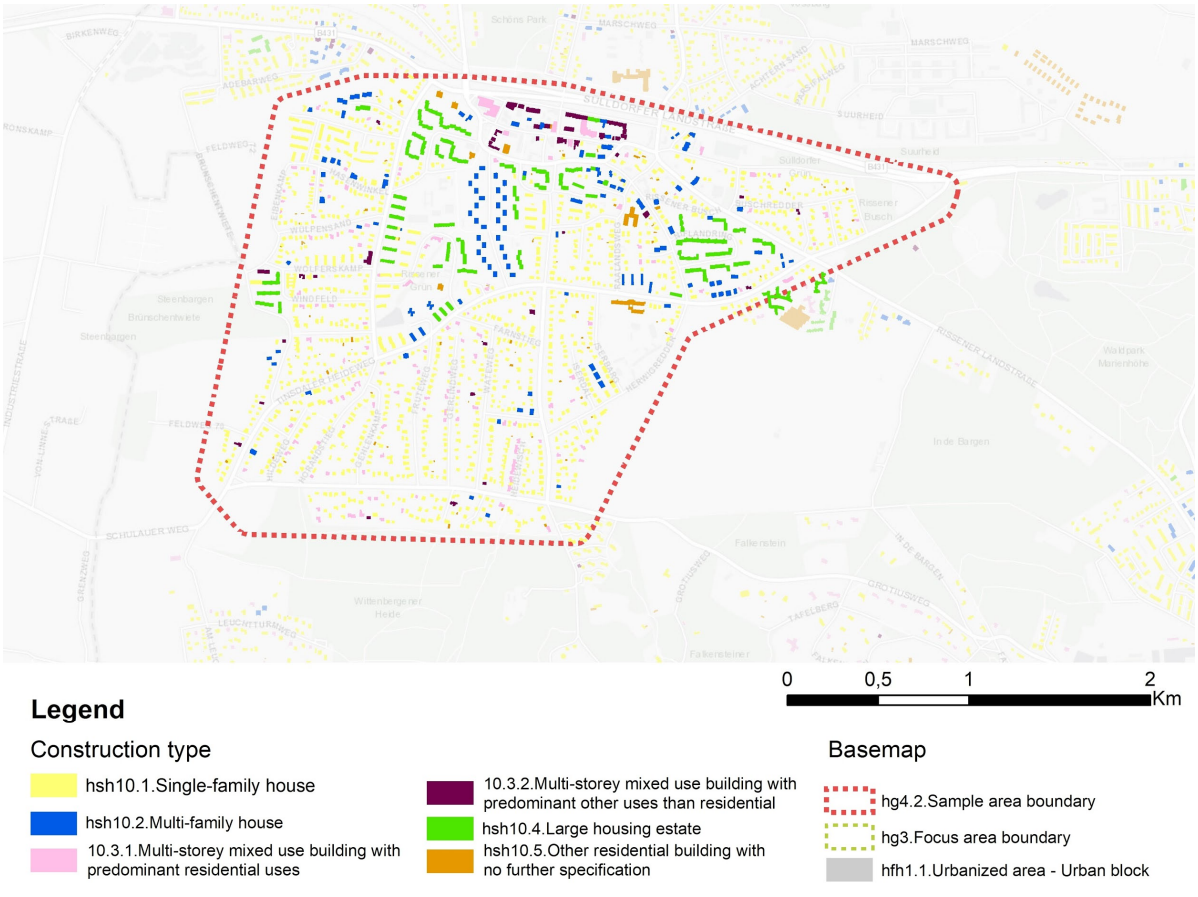

Figure 3.6 Residential building types in the sample area Rissen (HCU Team, 2019).

The sample area is located in the most western part of the district of Altona, next to Pinneberg County. Rissen is the largest sample area in terms of surface area, in fact it measures about 16.7 km2. In relation to this characteristic, therefore, it is also the least dense with a total of 15 192 inhabitants and a distribution of 909 inhabitants per km2. In Rissen, land use is largely divided between residential use (72.5%), mixed use (10.89%) and transport (6.36%) and the other categories considered do not exceed 5 percentage points. For further information about demographics, building type, labour force etc., please look at the "Deliverable 3.6 Process Model Hamburg" (REPAiR, 2018a).

As already said, the building type is mainly single-family, so there is the possibility to make a correct waste collection, having a lot of space both inside and outside the properties. However, it has been pointed out that the bio waste bins are mainly filled with garden waste, while kitchen waste is mainly thrown into the residual waste bins. The kitchen waste that is wrongly put into the residual waste bin is then incinerated. This is a wasted opportunity because kitchen waste could be digested and then composted in the bio waste plant; it has a higher value for the production of compost and biogas than garden waste.

Blankenese

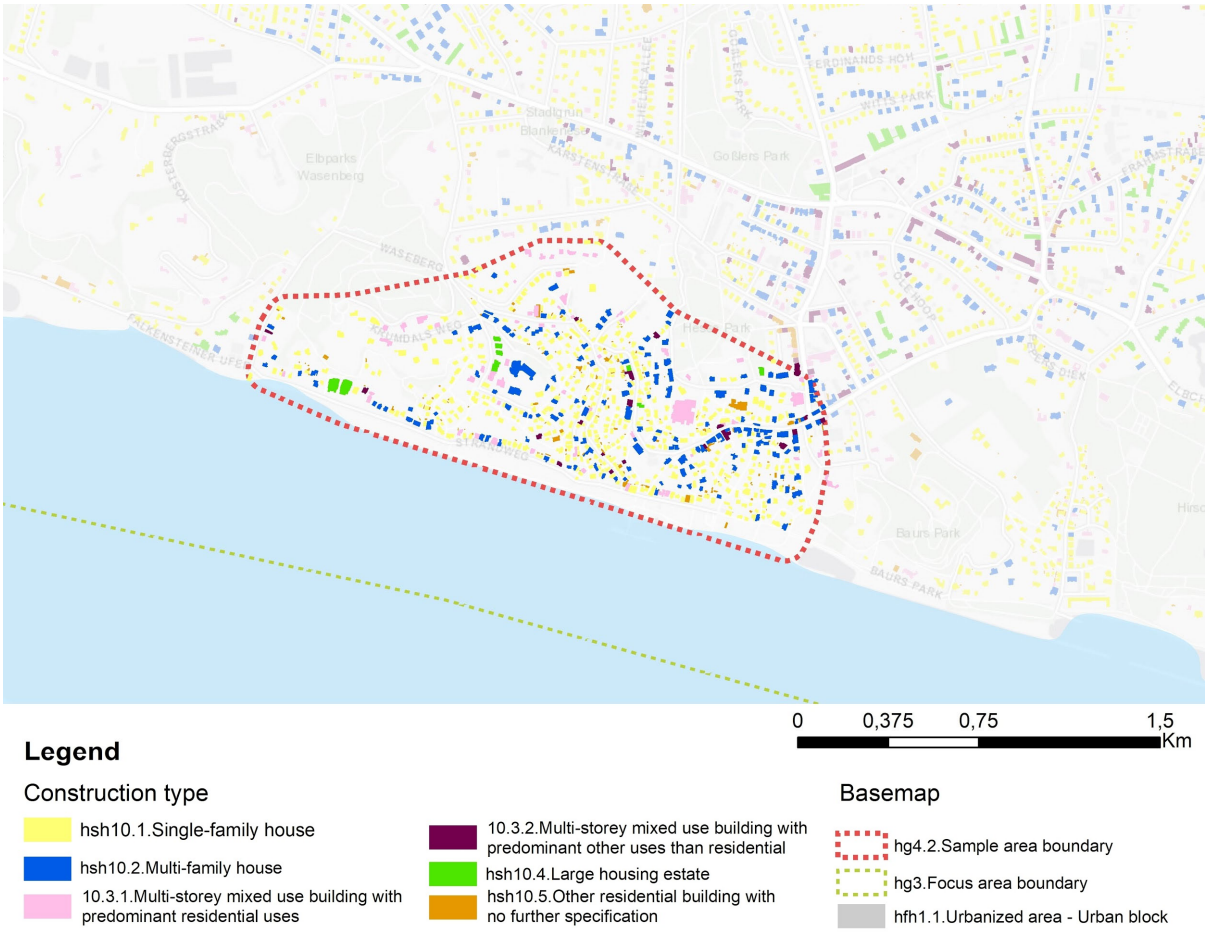

Figure 3.7 Residential building types in the sample area Blankenese (HCU Team, 2019).

The sample area is located in the South West part of the district of Altona, close to the Elbe River. Blankenese, has an area of 7.7 km2 with the presence of 13 407 inhabitants, characterized by a population density of 1 733 inhabitants/km2. The type of building that characterizes this area is mainly the single-family type and many of these houses are used as second houses. The land use is largely divided between residential use (79.17%) and mixed use (14.47%), the percentage of residential use is the highest of all sample areas. For further information about demographics, building type, labour force etc., please look at the "Deliverable 3.6 Process Model Hamburg" (REPAiR, 2018a).

In this Sample Area, like in Rissen, there is enough space inside and outside most of the houses for placing four bins for separate waste collection. There are two main problems in the area. Firstly, like in Rissen kitchen waste is often disposed in the residual waste bin and not in the bio bin, while the bio bin mainly is used for garden waste disposal. Despite information campaigns, there is still the need to better inform the citizens about correct waste separation. Secondly, due to the hilly topography of Blankenese, there are many streets with bag collection (*Sackabfuhr*), instead of using bins for collection which would be more difficult to transport. In Hamburg the bag collection is only used for residual waste, packaging waste and sometimes paper. A separated collection of organic waste is not conducted by Stadtreinigung Hamburg mainly for hygienic reasons. Therefore, households in the bag collection areas are forced to dispose their organic waste in the residual waste bags. Furthermore, the bag collection causes

problems of littering, bad smell and negatively influences the esthetic impression of the touristic area of Blankenese.

Osdorfer Born

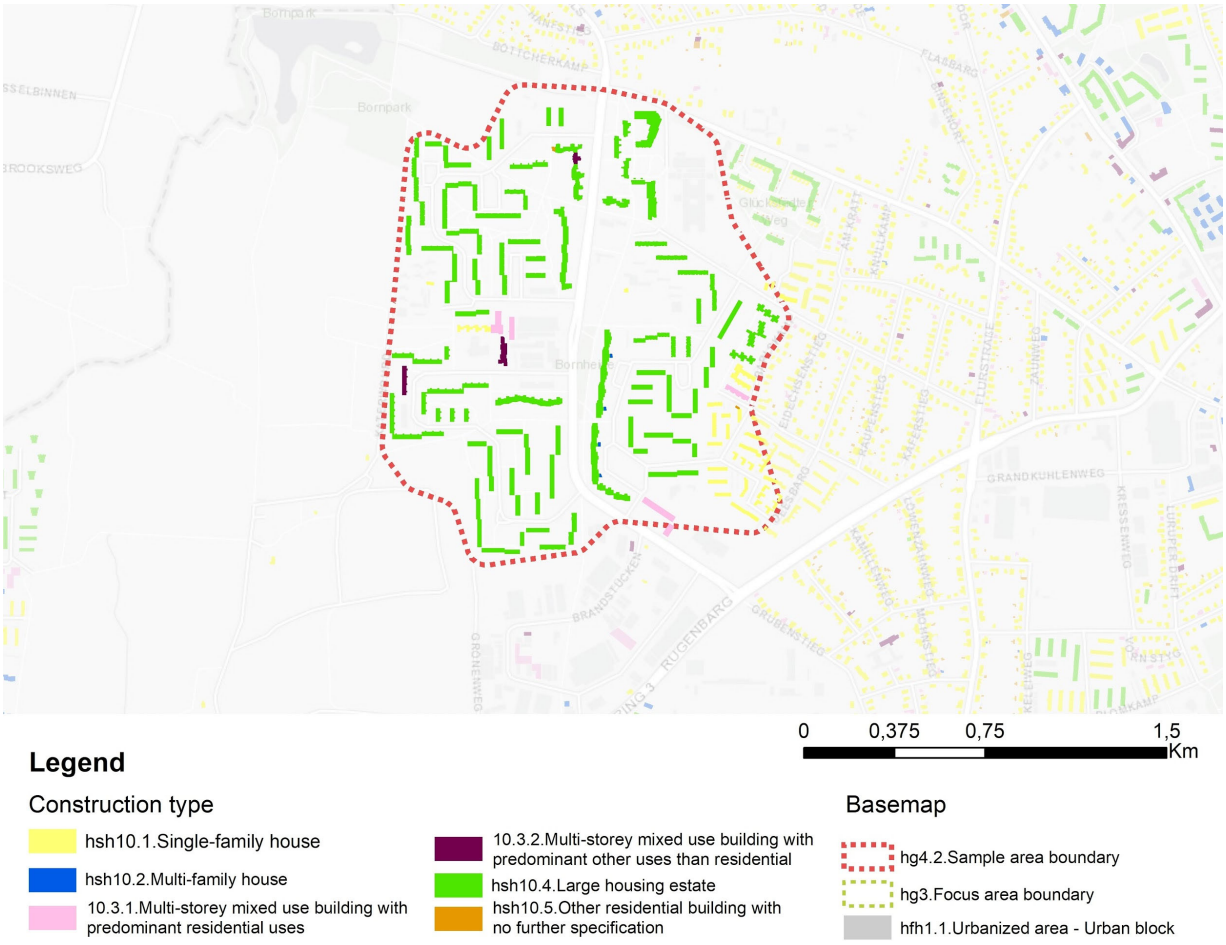

Figure 3.8 Residential building types in the sample area Osdorfer Born (HCU Team, 2019).

The sample area is located in the northern part of the district of Altona, close to the border between Altona and the County of Pinneberg. Osdorfer Born, has an area of 7,3 km2 with a presence of 26 140 inhabitants, and is characterized by a population density of 3 605 inhabitants per km2, which is in line with the population density of the entire district of Altona with 3 469 inhabitants/km2. Osdorf, compared to the other Sample Areas, has the highest share of educational and commercial uses 14.57%, 5.88% respectively and 60.98% of residential use. For further information about demographics, building type, labour force etc., please look at the “Deliverable 3.6 Process Model Hamburg” (REPAiR, 2018a).

Due to the small size of the kitchens in the apartments, the space is sufficient only for residual waste bins, but not for the four-bin system (residual, bio, paper, packaging), so it is not easy to separate organic waste and recyclables from residual waste, therefore many households put most of the waste in the residual waste bin. The spaces for waste collection outside the buildings are problematic

with regard to accessibility, especially for elderly and disabled persons. Furthermore, littering around the sites for bins and containers as well as in open spaces is considered as a problem by local stakeholders. An improved design of the collection tools from the bins in the kitchen to the collection points outside the houses and in public spaces has been identified as necessary to improve the waste separation by households. Osdorfer Born is an area with a comparable high percentage of people with migrant backgrounds. Therefore, it is also necessary to support the understanding of the German waste management system. Another problem is the limited social control due to the anonymity in the large housing blocks that is regarded as another reason for the comparably bad waste separation. Therefore, it has been considered as crucial to involve the inhabitants more intensively

Ottensen

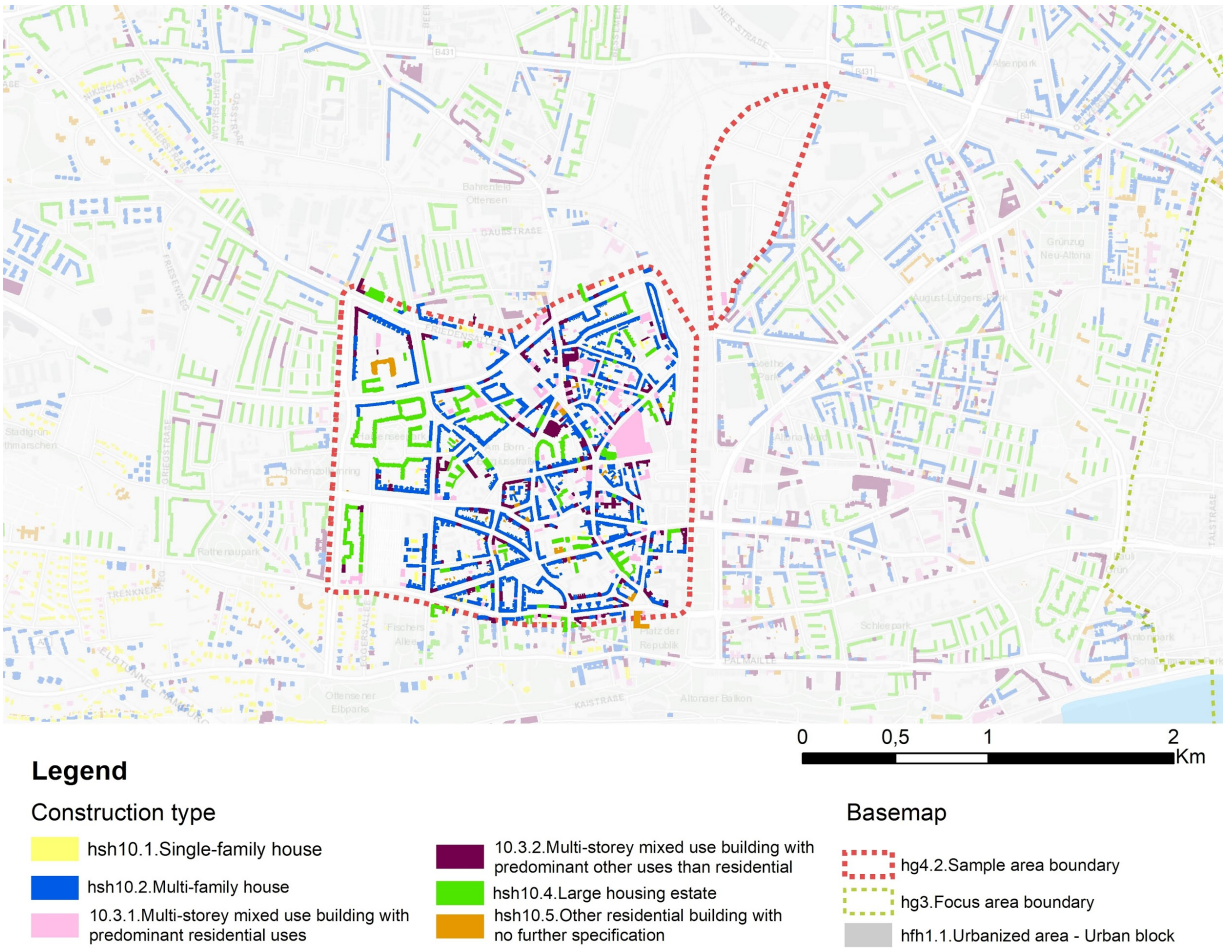

Figure 3.9 Residential building types in the sample area Ottensen (HCU Team, 2019).

The sample area is located in the eastern part of the district of Altona, not so far from the Elbe River and very close to the city centre of Hamburg. The area, has an area of 2.2 km2 with the presence of 22 137 inhabitants, characterized by a population density of 9 981 inhabitants/km2; for this reason, it is five times denser than the average of Hamburg. The area is characterized by many historical buildings. Among all residential buildings is a share of 54.59% residential buildings and of 34.64% mixed use buildings (often with retail, services or restaurants on the ground floor). For further information about

demographics, building type, labour force etc., please look at the "Deliverable 3.6 Process Model Hamburg" (REPAiR, 2018a).

Due to the high density of the built environment, there is a high competition for space, especially for public space. Therefore, it is difficult to dedicate spaces, both private and public, to waste collection. For this reason, there is little space for the positioning of tons or containers inside and outside of the buildings. In some parts of Ottensen the residual waste and packaging waste collection is done by using of pink respectively yellow bags (*Sackabfuhr*). The use of bags instead of bins makes it impossible to separate organic waste and residual waste. Furthermore, the bag collection causes problems of littering, bad smell and negatively influences the esthetic impression of the area. Other recyclable (paper, glass) materials are collected in storage containers in public spaces, for example at the roadside. Concerning bio waste collections, tests with underfloor containers have shown that people did not separate waste properly, also due to the lack of social control as well. Therefore, the use of underfloor containers for bio waste collections needs to be examined more in detail and probably needs further improvement.

Mitte Altona

Figure 3.10 Residential building types in the sample area Mitte Altona (HCU Team, 2019).

The area of Mitte Altona is located in the district of Altona which is characterized by the types of mixed (34.64%), residential (54.59%) and educational (6.96%) buildings. Its first development area will be completed in the upcoming years, it covers an area of 0.15 km2 and will have a population of circa 3 500 inhabitants with a population density of more than 30 000 inhabitants per km2. For more information about demographics, building type, labour force etc., please look at the "Deliverable 3.6 Process Model Hamburg" (REPAiR, 2018a).

It is clear that there is a need for greater cooperation between spatial planning on the one hand and waste management on the other. At present, waste management does not play an important role in spatial planning in Hamburg. This is the case in various fields, for example in the planning and situation of containers in public spaces or in the planning phase of new residential complexes and new neighborhoods where the topic of waste is often neglected. Mitte Altona is in fact a new development and new residential area, in contact with the Sample Area of Ottensen, but in the newly built area no measures have been taken to improve or make sustainable waste management. The result is revealed by the presence of some situations where the bins occupy public spaces such as bike paths or parking lots because they do not have a dedicated station or with bags of waste abandoned on the street.

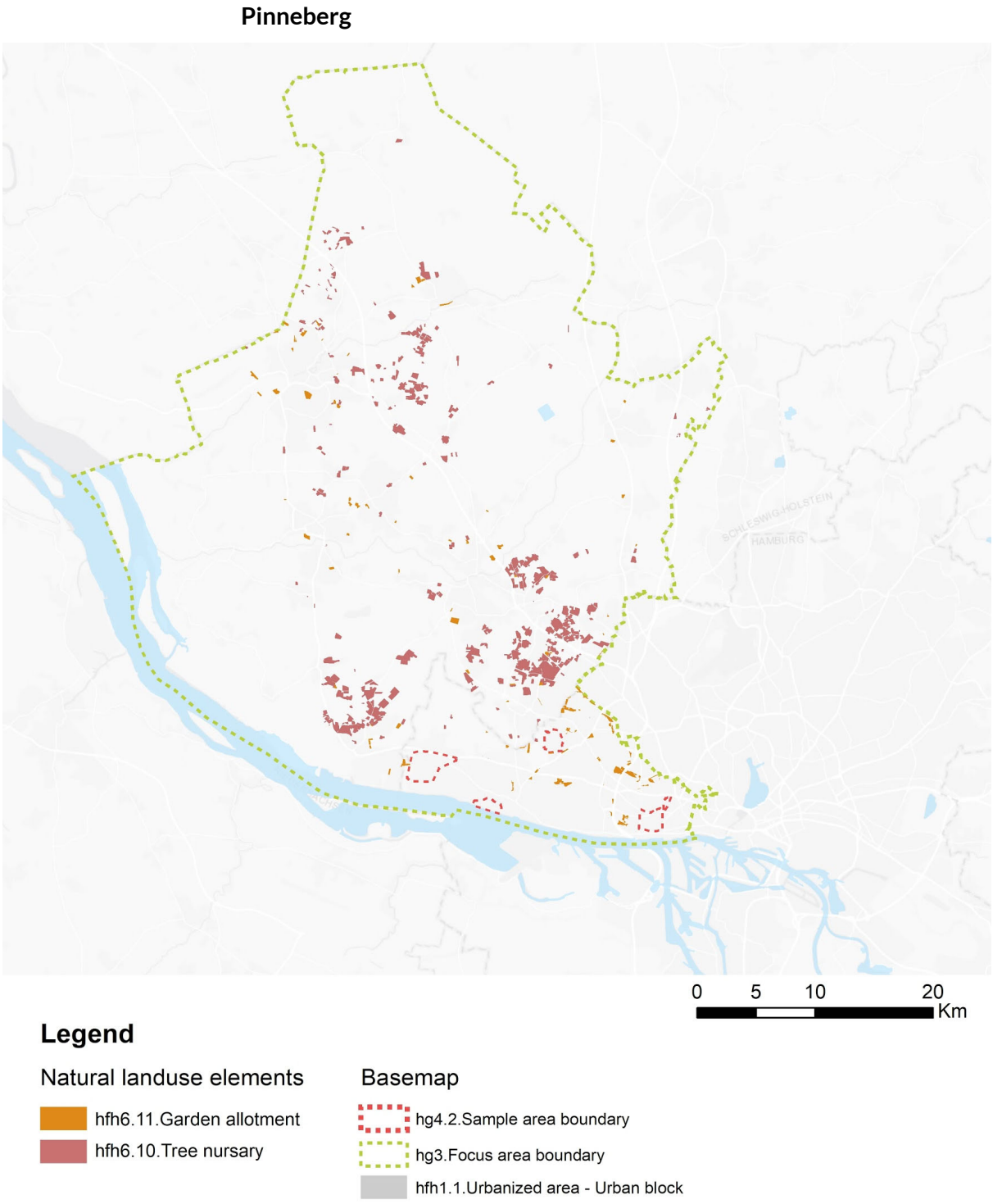

Figure 3.11 Tree nurseries and garden allotments in the focus area (HCU Team, 2019).

Pinneberg is characterised by different types of land uses (e.g. villages centers, detached housing areas, social housing) and open spaces (agricultural land, one of the largest European areas of tree nurseries, garden plant production). With a concentration of circa 200 tree nurseries and garden plant producers that make Pinneberg unique. The County of Pinneberg extends for about 664 km2 with a population of 310 653 inhabitants; the density is 468 inhabitants/km2. For more information about demographics, building type, labour force etc., please look at the "Deliverable 3.6 Process Model Hamburg" (REPAiR, 2018a).

The work of REPAiR in the Pinneberg County focuses on green waste as main fraction of waste produced by the tree nursery. Further information can be found in the description of EIS7.

3.3. From Problems and Objectives to Solutions

As already mentioned, the Focus Area of Hamburg is divided into two main urban regions: the District of Altona (HH) and the County of Pinneberg (SH). Since the PULL events organised for Altona and Pinneberg took distinct paths, they will be addressed separately within the catalogue.

Altona

Based on the Co-Design and Co-Production phases, the next step was to relate the solutions back to the problems and objectives individuated and ranked (Table 4.1). As it was clearer for our stakeholders, during the PULL events the discussion for developing EIS was based on the ranked problems (which followed the 3 main goals defined in previous PULLs). Further, the evolution of the EIS was supported by the work of the students, by desktop research on best practices and successively further definition with stakeholders (Table 4.2).

Pinneberg

The PULL series in Pinneberg took a different path. As a matter of fact, after a series of interviews and smaller meetings with stakeholders, just one larger PULL event was conducted: Several tree nurseries entrepreneurs, the head of the tree nurseries association, GAB Umwelt Service (local waste management company), and the County of Pinneberg were present to the event organised by HCU. Main issue was to discuss the problems of the tree nurseries concerning their activities related to waste.

In Pinneberg around 200 tree nurseries produce organic waste (green cut and woody green waste). There are various ways of waste processing at the moment: incineration on the area, stock on the area, composting on the area, collection and treatment by service companies, digestion and composting on the area (according to the information given by the tree nursery association, one tree nursery had a digestion plant on its site producing biogas). Due to the high costs for collection of the waste from private companies, tree nurseries prefer to incinerate their waste on site, practice still allowed by law in the County. Because of the current practices, the potential for organic waste digestion (and gas production) and composting is lost. Furthermore, the incineration practice rises conflicts with neighbours. Secondly, tree nurseries do not see the compost produced from household waste as optimal for their activities, because this might contain particles that could lead to aggravate the plants. Therefore, peat acquisition is still the preferable solution.

The objective that was individuated at the end of the PULL is the following: close the loop of organic waste from tree nurseries, produce additional bio gas (energy) and high quality compost. Reduce conflicts with neighbors due to incineration of organic waste.

After the meeting GAB and the tree nurseries opened a dialogue regarding the collection of their green cut and woody green waste. GAB offered to collect for free their waste and to conduct laboratory tests to demonstrate that the compost generated exclusively from the green waste can be used for the tree nurseries purposes.

The dialogue between these two actors is still ongoing but first results show to be positive. The EIS 7 presented in this deliverable is referring to this new practice.

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4. Eco-Innovative Solutions for Altona

In Hamburg-Altona a total of 10 EIS have been chosen by the local stakeholders and are described in the following sections. The solutions can be ordered in three categories addressing different types of objectives:

- Waste avoidance and separation
- Enabling environment for Circular Economy
- Circular waste management into urban planning and governance

The EIS were developed in order to address a set of problems individuated with the local stakeholders in order to reach determined goals (Table 4.1). In Table 4.2 the EIS with the related problems are listed.

Table 4.1 Main Objectives and Problems ranked by the stakeholders during the PULL events (HCU Team, 2019).

Main Objectives (Goals)
G1) The Key Goal: To achieve high-quality separation of recyclables and bio-waste in Hamburg
G2) Secondary goal: To close the OW loop locally
G3) The Broader goal: To integrate WM and CE into the urban planners and governance agendas
Ranked General Problems
P1) 38% of biowaste is thrown into the residual waste bin and incinerated instead of being used for biogas and composting.
P2) When planning buildings, waste management is hardly taken into account, which is not required by law.
P3) Urban planning and waste management do not communicate and cooperate sufficiently.
P4) The residents do not include waste management in their routine.
P5) With the growing collection of biowaste, there is a risk that quality will be compromised by plastic pollution.
P6) The separation of bio-waste has a bad image with many citizens ("bio-waste stinks") and they prefer to throw it into the residual waste bins, although it also stinks.
P7) The financial incentives given to citizens to separate their waste are not clear or not high enough.
P8) Some public containers are not placed in the optimal position for the user.
P9) Social pressure on the residents of housing estates is not enough to separate waste properly.
P10) Older people and people with disabilities do not have access to some of the public containers.
P11) At schools and kindergartens, children do not learn enough about waste problems.
P12) Garden waste from public green spaces is generally not passed on to the waste management company for compost and biogas production.

Table 4.2 Relation between EIS, problems and goals according to the stakeholders (HCU Team, 2019).

EIS		
Thema	**Related Problems**	**Related Main Goal**
WASTE AVOIDANCE & SEPARATION		G1) The Key Goal: To achieve high-quality separation of recyclables and bio-waste in Hamburg
EIS1) Creating awareness about waste	P1, P4, P5, P6 & P9	
EIS2) Rewarding good waste avoidance and separation behaviors	P4, P5, P7, P9	
ENABLING ENVIRONMENT FOR CIRCULAR ECONOMY		G2) Secondary goal: To close the OW loop locally
EIS3) Quarter Service Center	P4, P8, P10	
EIS4) Educational composting in climate-environmental schools and kindergartens	P1, P6, P11	
EIS5) Organic waste for urban gardening	P1, P6, P12	
EIS6) ZRE - Centre for Resources and Energy	P3	
CIRCULAR WASTE MANAGEMENT INTO URBAN PLANNING & GOVERNANCE		G3) The Broader goal: To integrate WM and CE into the urban planners and governance agendas
EIS8) Planning guide for planners to address the waste management topic	P2, P3, P10	
EIS9) Design manual for spaces dedicated to waste bins & public containers	P3, P10	
EIS10) Guideline for new quarters towards Circular Bioeconomy	P2, P3, P10 , P12	

4.1. Waste Avoidance & Separation

EIS 1_Creating awareness about waste through targeted campaigning

Flow Organic waste

Category Outcome Social / Technological / Environmental / Economic

Author PULL team Hamburg

Implementation area Municipality level / All sample areas

Purpose Waste avoidance and separation

Target group Households

EIS Description

Main Idea & Milestones

The main idea of the EIS is to create awareness about waste. The aim is to reduce the amount of waste produced respectively the better separation and recycling of waste by households.

In order to achieve this goal, single actions are not enough; a new culture of knowing how to avoid waste and how to dispose waste correctly is needed.

Therefore, the diffusion of awareness and sensitization of the citizens about waste related topics should entail activities to be put at the base, in order to obtain a sustainable behavior.

The problems that should be addressed through the application of this EIS have been explored during the spatial and socio-economic analysis in the frame of REPAiR. A major problem regarding waste in Hamburg is the relatively bad separation of bio waste by households. The residual waste collected in Hamburg consists to 38% of biodegradable organic waste. This volume of organic waste - due to bad separation – is being incinerated together with the residual waste. On the contrary the bio waste that is correctly disposed into the bio waste containers could be used for the production of biogas and compost instead. The incorrect wastes separation occurs because many citizens have little awareness of the potential of bio waste as a resource.

Figure 4.1 Example of biowaste with impurities (HCU Team, 2018).

The separate collection of bio waste at home has a bad image; as a consequence, citizens do not include the proper management of waste in their daily routine.

Finally, this action should also create and strengthen, where it already exists, a social and media pressure among citizens. This could support even the less environmentally oriented people to improve and correct their personal habit related to waste, in order to achieve a collective goal of sustainability.

Figure 4.2 Poster from campaign of Stadtreinigung Hamburg (SRH, 2019).

Actions

The implementation of this solution is divided in three main steps that are: Information, Participation and Incentivisation.

In order to inspire a strong sense of responsibility, create awareness and stimulate the participation of the citizens of Hamburg.

- **Information,** on the correct behaviour in waste management, would create an adequate separation of the products inside the bins allowing then the reuse and processing of these wastes for the production of other products. To carry out advertising campaigns through different channels through advertisements on the Internet, newspapers, televisions. Installation of publicity posters inside the city's supermarkets (Budni, Edeka, Aldi, etc.). Especially advertising in the subway and in the stations, as they are places frequented by citizens and tourists in large numbers every day in order to reach and inform the largest number of citizens. Finally, expand SRH's distribution of organic waste paper bags with imprinted information images, in collaboration with Budni or within the Quarter Service Centres (EIS3 Hamburg). Families may apply for paper bags using a voucher.
- **Participation**, implementation of cultural events and communication campaigns, periodically and during major events in the city of Hamburg, such as on the occasion of the traditional fair (Hamburger DOM), the sustainability fair in the frame of the Altonale festival, the Hafengeburtstag and the Christmas markets, as they are very popular in the city and therefore have a very high potential to distribute information. In addition to informing the public, these events can also be used to organise waste management activities or workshops by non-profit organizations or Quarter Service Centre (EIS3 Hamburg) staff. It also could be used for the delivery of the SRH's small BIO bins (*Mülli*) and to disseminate information on their correct use by SRH.
- **Incentivisation**, encouraging the citizens of Hamburg to use mobile Apps both for information on the correct use of bins, and for recreational purposes, thus raising awareness by playing and offering rewards (by collecting points, discounts or free bags can be obtained at the supermarket). Example: the "Sunflower" App of the Waste 4 Think Horizon2020 project with the aim of taking care of a sunflower by adding compost and water (WASTE4think). The user in this way can learn both the art of composting and replicate it in their daily routine at home; furthermore, the user can get bonus points to win prizes.

Physical resources

In order to implement the eco-innovative solution, it is necessary to establish a new concept for advertising waste sensitivity together with local media. In

addition, a partnership with the large retailers in Hamburg should be aspired for implementing advertising campaigns for the prevention of food waste.

For the awareness campaign during events, the construction of stands or mobile offices should be planned, in collaboration with the Quarter Service Centers (EIS3) using second-hand objects. By positioning the artefacts during the cultural and social events described in the space dedicated to the actions above, in the "Participation" section. For these reasons, it will not be required to acquire new buildings or offices or to rent them for the realization of the EIS1.

Actors to be involved

- Retailers such as Budni, Rossmann, Edeka, Aldi, Lidl, REWE….
- Local newspapers
- Quarter Service Centers
- Students from universities in Hamburg (HCU, HAW, UHH, TUHH)
- SRH
- HOCHBAHN (public transport provider in Hamburg)

EIS Change Model

Below you can see possible layouts for the advertising campaign to be included in public transport or in the spaces of the stations. The idea is to bring all age groups closer to the concept of "don't waste food" by providing interesting data about food and with a design that is also youthful.

Figure 4.3 Example of a food waste advertising campaign (HCU Team, 2019).

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EIS 2_Rewarding good waste avoidance and separation behavior

Flow Several Materials

Category Outcome Social / Technological / Environmental

Author PULL team Hamburg

Implementation area All sample areas

Purpose Waste avoidance and separation

Target group Households

EIS Description

Main Idea & Milestones

The main goal of this EIS is linked to the one of EIS1. Namely, the EIS2 is aiming at rewarding the good avoidance and separation behaviour related to waste at households' level.

For the vision of an increased separation of waste and consequently higher amount of bio waste from households in the future, it is a condition that the quality of sorting will not be altered or compromised by other materials. In order to mitigate this possible problem, it would be useful to provide incentives or fines for virtuous or vicious behaviours. Therefore, possible economic incentives offered to citizens to separate their waste should be high enough and/or easy to receive to reach visibility for all citizens. Certain forms of rewarding are already practised in Hamburg, but despite this a rather high share of incorrect waste behaviour can be observed.

Furthermore, it could be intended as a good opportunity to strengthen the "sense of community" of citizens. Friendly waste separation competitions could be organized, in the frame of new or existing events, to award the best separated collection in the neighbourhood. These competitions could have the aim of both introducing citizens to waste related topics as well as distributing rewards for the results obtained. The latter could happen through vouchers or bonus cards as an economic incentive. These competitions could be organised by working in cooperation with Quarter Service Centers (EIS4), schools and youth organisations (environmental youth, other youth organizations and sports clubs) as local multipliers to attract and involve the inhabitants of the neighbourhood more effectively. In Germany, in many areas that are struggling with socio-economic difficulties, frequently public and / or private funded quarter managements are set up to actively support the neighbourhood. These quarter managements could play a guiding role for the organisation of such events (e.g. ProQuartier, a public quarter management company in the case of Osdorfer Born, see Chapter 5).

Actions

- ØWaste App and the TRASH/manual

In order to reduce the quantity of food waste, we propose to develop a mobile app called ØWaste App that can suggest the user the quantity of food to buy according to the personal preferences expressed, thus avoiding to purchase too much food and unnecessary costs. Actually, this service is already offered through the websites of some supermarkets (e.g. by some German discounters), but using an App instead of multiple websites is more comfortable, because it is much faster and easier to use than a website and therefore it can be expected to be used much more consistently.

The implementation of the App could help to minimize the amount of food that is wasted at household level. By recording the expiry date of the products that are bought, the App alerts you to consume them before the expiration deadline of the food is reached. At this point, it advises you to use the particular food that will expire and offers a variety of dishes that could be prepared with the respective ingredients. The App also allows to read through the camera of the smartphone the barcode of the product, to know the type of material of which it is composed and how and where to dispose it. A useful support to differentiate correctly and consequently avoid the risk of contaminating the waste between them.

In order to promote the use of the App by citizens, collaboration agreements should be activated with large retailers, which could for example offer discounts on the purchase of food to users who register and use the application. In total the ØWaste App could contribute to a modest reduction of food waste of households.

The ØWaste App can also be used for saving food that is not consumed in school meals, hotels, catering services, respectively leftovers from the preparation of dishes in restaurants, which still can be used. In a dedicated section of the App, "business" users offer their available food, which in other ways would be thrown away, to non-profit associations or NGOs.

The TRASH/manual aims at supporting to change the citizens' behaviour by offering an informative and useful tool to understand the correct separation of waste in the different bins. The TRASH/manual lists and suggests to citizens the correct bin for each type of object that they want to throw away. The manual will be distributed free of charge during events like neighborhood festivals to promote the correct waste separation.

- WASS Plant Festival (Winter, Autumn, Spring, Summer)

Raising the awareness of citizens is a very important step to change respectively improve their behavior with regard to waste avoidance, separation and recycling.

For this purpose, at different times of the year, we aim to organize a cultural event, called “the WASS Plant Festival”, in which the participating citizens can learn about the practice of home composting and seasonal gardening and

receive a seasonal plant as a gift.

The event aims at exchanging knowledge and strengthening local communities. Additionally, competitions can be proposed to award the one who is able to make the plant last longer till the end of the season, documenting their activities, families who have been able to take care of the plant at best, receive awards in the form of vouchers for free cultural or sporting activities, such as museums, events, etc.

This festival, which takes place in each season, aims to involve more and more people and over time to increase and improve the skills of participants, until it becomes a sharing of ideas and knowledge about waste management and not anymore simply a teaching event. In this context, the aim is also to make citizens understand that it is not enough to just reach a greater quantity of separated biowaste, but that also a high quality of sorting is necessary for good compost. This faces the problem, that a greater quantity of separated biowaste often lowers the quality, especially due to pollution with plastic.

Actors to be involved

- Retailers such as Budni, Rossmann, Edeka, Aldi, Lidl, REWE….
- Quarter Service Centers for the event
- Students from universities in Hamburg (HCU, HAW, UHH, TUHH)
- SRH
- Tree nursery
- Altona district
- Free and Hanseatic City of Hamburg

EIS Change Model

Figure 4.4 Example of the layout and functions of the app ØWaste *(HCU Team, 2019).*

EIS References
Study case App for the intelligent use of 'use by/ best before' expiring date on food products in Ghent
Flow Several Materials
Category of outcome Social / Economic / Environmental
Location of the good practice Ghent, Belgium
Author of the EIS PULL Ghent team
Actors involved Households, retail, IVAGO, app-developers, municipality

Specific objective Purchase and stock management are known concepts in the retail and catering business. To optimise the use of food products, tools have been developed to link the follow-up of expiring dates of food products to stock management. A simplified (and less expensive) version of these tools could also help households to avoid wasting food products. Combining a tracking system to register expiring dates with a shopping assistant app, can help households to keep track of their stock, prevent unnecessary purchases and avoid wasting food.
Further Information
https://store.smarter.am/products/fridgecam
https://www.eatbyapp.com/
D5.5 Catalogue of solutions and strategies for follow up cases: Ghent

4.2. Enabling Environment for Circular Economy

EIS 3_Quarter Service Center

Flow Several Materials

Category Outcome Economic / Social / Technological / Environmental

Author PULL team Hamburg

Implementation area All the sample areas. A locally adapted type of quarter service center should be designed for each area according to its socio-economic characteristics and to the existing services in the neighborhood.

Purpose Implement waste separation and reuse through quarter service centers

Target group Households

EIS Description

Main Idea & Milestones

The "Altona Climate Concept Framework" (*Klimaschutzkonzept Altona*) picks up the concept of *neighbourhood service centers* or *neighbourhood hubs* in its measure 08k (Bezirk Altona, 2019: p.68) as important space to support a climate-friendly lifestyle. Residents of a neighbourhood should use these as easily and quickly accessible contact points for various offers of daily needs. These easily accessible locations can provide various functions (repair, recycling, sharing, advice, support), which in particular allow car-free or car-reduced households to easily integrate offers from different service providers into their daily chains of routes.

The quarter service centers will become the collection point in the neighbourhood for a variety of households' waste that should not be disposed in the four-bin system and items that might still be used. It offers functions of repair, reuse, recycling. Additionally, they will work as an information hub in which, through workshops and neighbourhood events, the population will learn to reduce and avoid waste (for example food, clothes and everyday objects).

In areas with a lack of services or information offers, new centers will be developed; while in areas where services/functions are already in place, only services that are missing will be implemented, respectively a network to connect the different offers will be created to better meet the needs of the neighbourhood.

For this reason, a differentiation between the sample areas is necessary to define the objectives of the new centers in the best possible way.

Ottensen and Mitte Altona sample areas already have several services that could be efficiently combined and used to reach the goal of a quarter service center. The map below shows the location and the typology of these existing services.

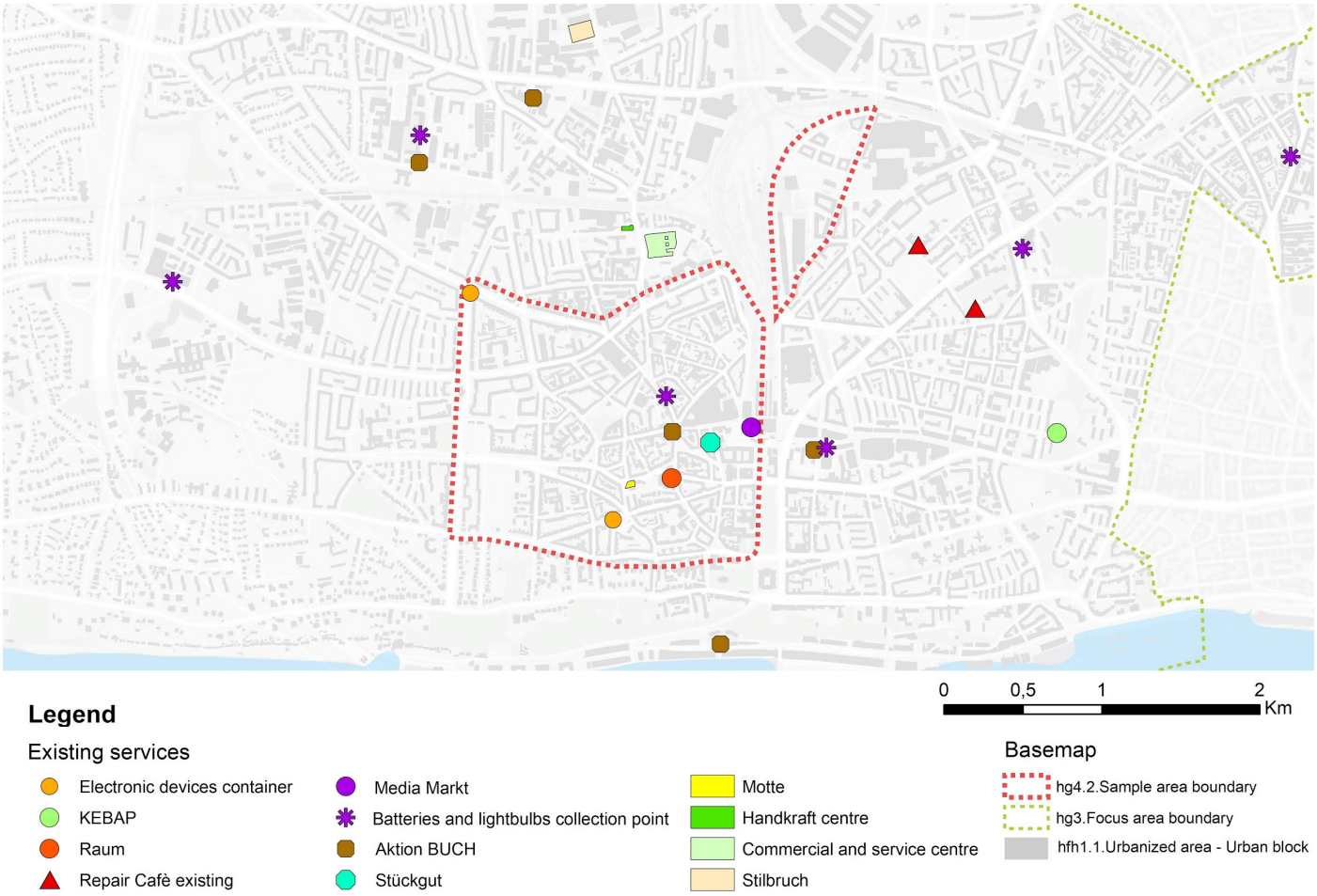

Figure 4.5 Location and typology of the existing services in Ottensen and Mitte-Altona areas (HCU Team, 2019).

Two public containers for electronic devices, four places (managed by the association Aktion BUCH) for donating used books, CDs and DVDs, two collection points for batteries and lightbulbs, a consumer electronics shop with a collection point for electronic devices) and Stilbruch (second hand shop and collection point for several waste) are the collection services existing in the area.

Additionally, there are AK LOK and Repair Café Altona, two Repair Cafés; Stückgut, an unpacked shop; Raum, a space in which Zero Waste Hamburg organizes workshops; KEBAP (*KulturEnergieBunkerAltonaProjekt*) a community garden and meeting point for various neighborly activities; Motte, a community center and community garden in the district. Here events, courses and workshops take place for children, young people and adults.

Figure 4.6 Pictures illustrating the KEBAP Garten and the MOTTE Garten in Altona (HCU Team, 2019).

Lastly, there is a commercial and service center at the intersection between Bahrenfelder Str. and Gaußstraße with empty space that could be used for a new Repair Café. In addition, near this center, there is the handcraft center (*Ottensen Hof*) with several craft firms that could work in synergy with the new Repair Café.

The main idea for Ottensen and Mitte Altona is to create a network of cooperation and collaboration between all the services and functions in order to repair and recycle most of the potential waste and at the same time advice and support the citizens through workshops, events and information campaigns in the neighbourhood.

Osdorfer Born has fewer repair and re-use related services and a different socio-economic situation compared to the other sample areas. The average income here is significantly lower than the Altona district average, 62% of the population has a migration background and 25.9% of inhabitants have a foreign nationality. According to information by Stadtreinigung Hamburg and interviews conducted in the area, it has a comparably low separation rate especially of organic waste, which partly could be explained by the language barrier that keeps a part of the population from fully understanding the recycling system in Hamburg. Another phenomenon is that bulky waste is left on the road or in the vicinity of public containers. This has been explained in interviews with the lack of transport possibilities of some households and the too large distance to the next recycling site (HCU Student, 2018).

In Osdorfer Born the EIS has two main aims: to improve the awareness about the recycling system in Hamburg and the management of bulky waste. The raise of awareness could be achieved with workshops and with the redesign of the bins and the containers (for this see the EIS 9). In order to improve the management of bulky waste it would need more structural solutions like the insertion of new containers for bulky waste or the strengthening of the second-hand shop and of the recycling station.

The map below shows the current services situation in the area. There is *Cappello*, a second-hand shop inside the Bornheide community centre; a recycling station south of Osdorfer Born and two collection points of Aktion BUCH (which can be considered as too far away from the sample area).

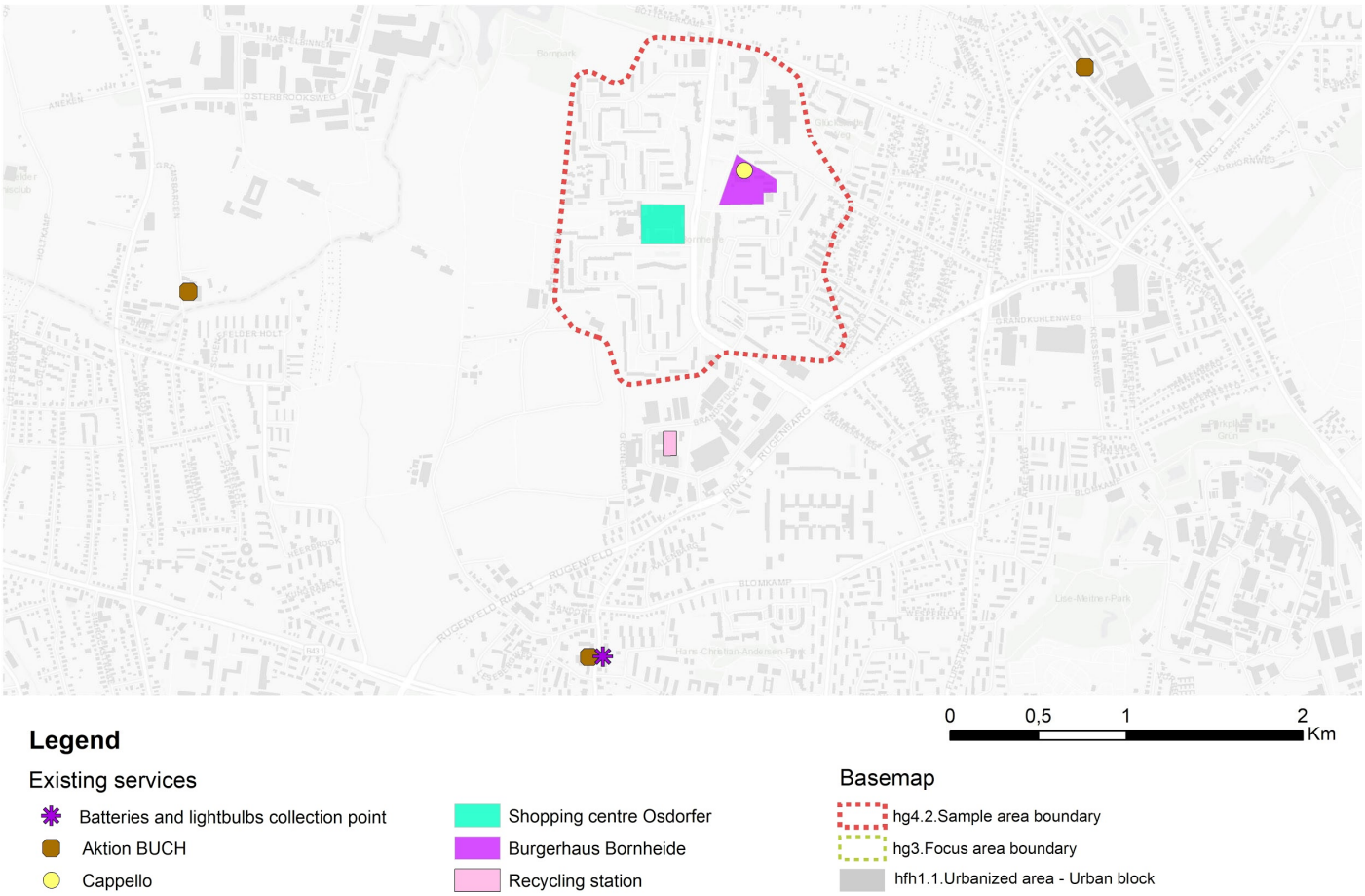

Figure 4.7 Location and typology of the existing services in Osdorfer Born area (HCU Team, 2019).

Rissen and Blankenese are residential areas almost without services from the waste management point of view, as it is shown in the map below.

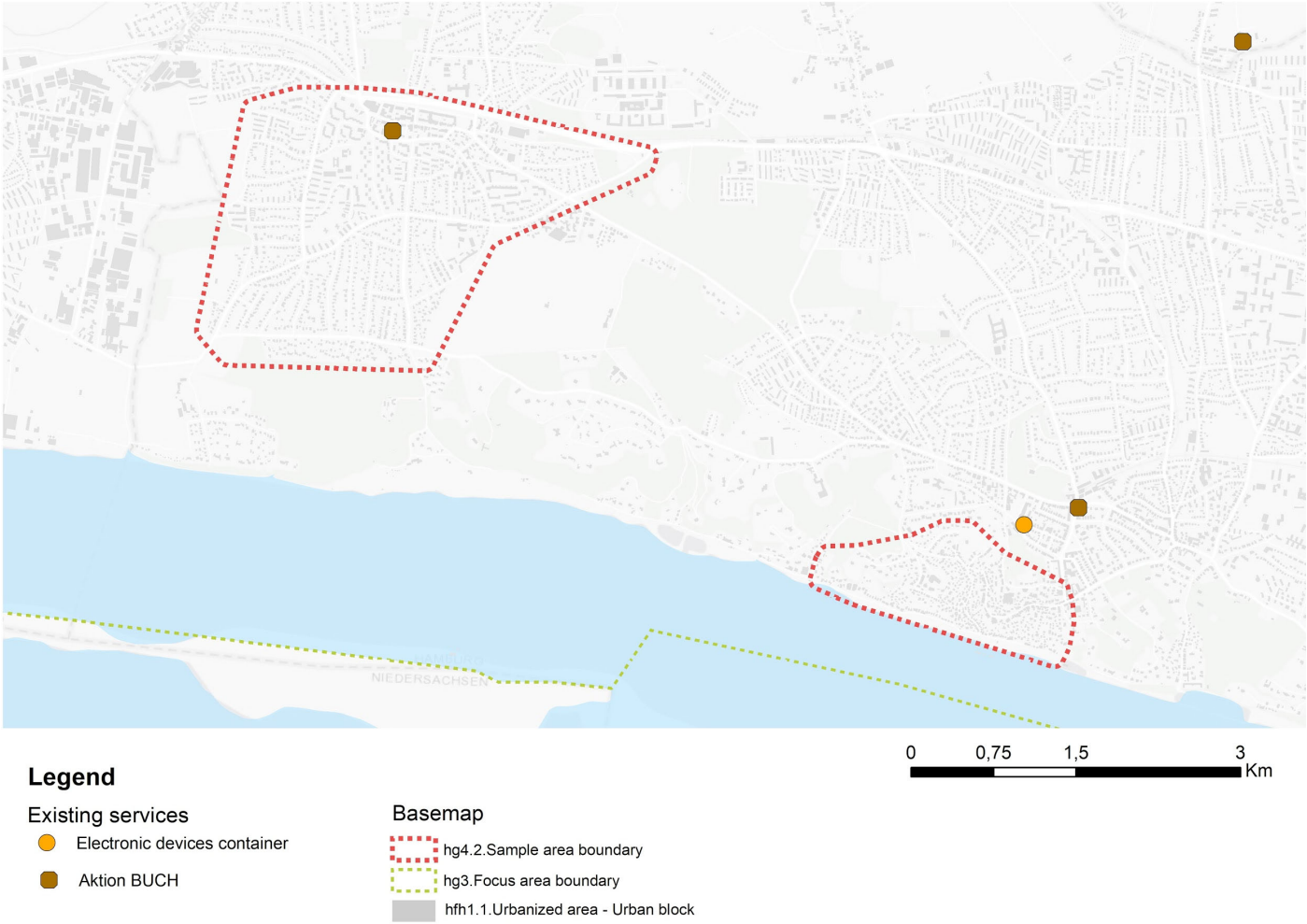

Figure 4.8 Location and typology of the existing services in Rissen and Blankenese areas (HCU Team, 2019).

Rissen is characterized mainly by single family houses with large yards and therefore a considerable distance between housing units. This is a problem from the collection point of view, because trucks have to travel a considerable distance in the neighbourhood to collect bins from every household. Moreover, the closest recycling station (run by Stadtreinigung) is 9 km away from the area. Therefore, a recycling station in a central position could be a solution to improve the recycling rate, but also to make the housing collection easier. The flat topography of Rissens would allow the construction of a recycling station to improve the waste management in the area.

Blankenese on the contrary is characterized by a hilly topography that makes the collection of waste comparatively difficult. For this reason, a service quarter centre in this area could not be implemented easily. Therefore, for Blankenese it can be recommended to focus more on other EIS (e.g. EIS8 and EIS9).

Actions

Ottensen and Mitte Altona

1. There is already a second-hand shop, Stilbruch, with a 'laboratory' to repair items, close to the two sample areas. It should be better promoted in the areas in order to become a collecting point for the neighbourhood. Consequently, more citizens could bring their bulky waste and electronic devices there, the latter could also be deposited into the two public containers or in the consumer electronic shop. From the two public containers the devices will be brought to Stilbruch to be checked, thus they could be fixed or reused in part (instead of bringing the electronic devices to the incinerator).
2. A new Repair Café will be opened in the commercial and service centre, here citizens can learn how to fix broken items and, furthermore, it will become a meeting point for the neighbourhood.

3. Workshops will be organized to advice and support citizens. The aim is to create a cooperation between the Motte, Stückgut, Raum and the new Repair Café. In Motte and Raum there are already some initiatives.

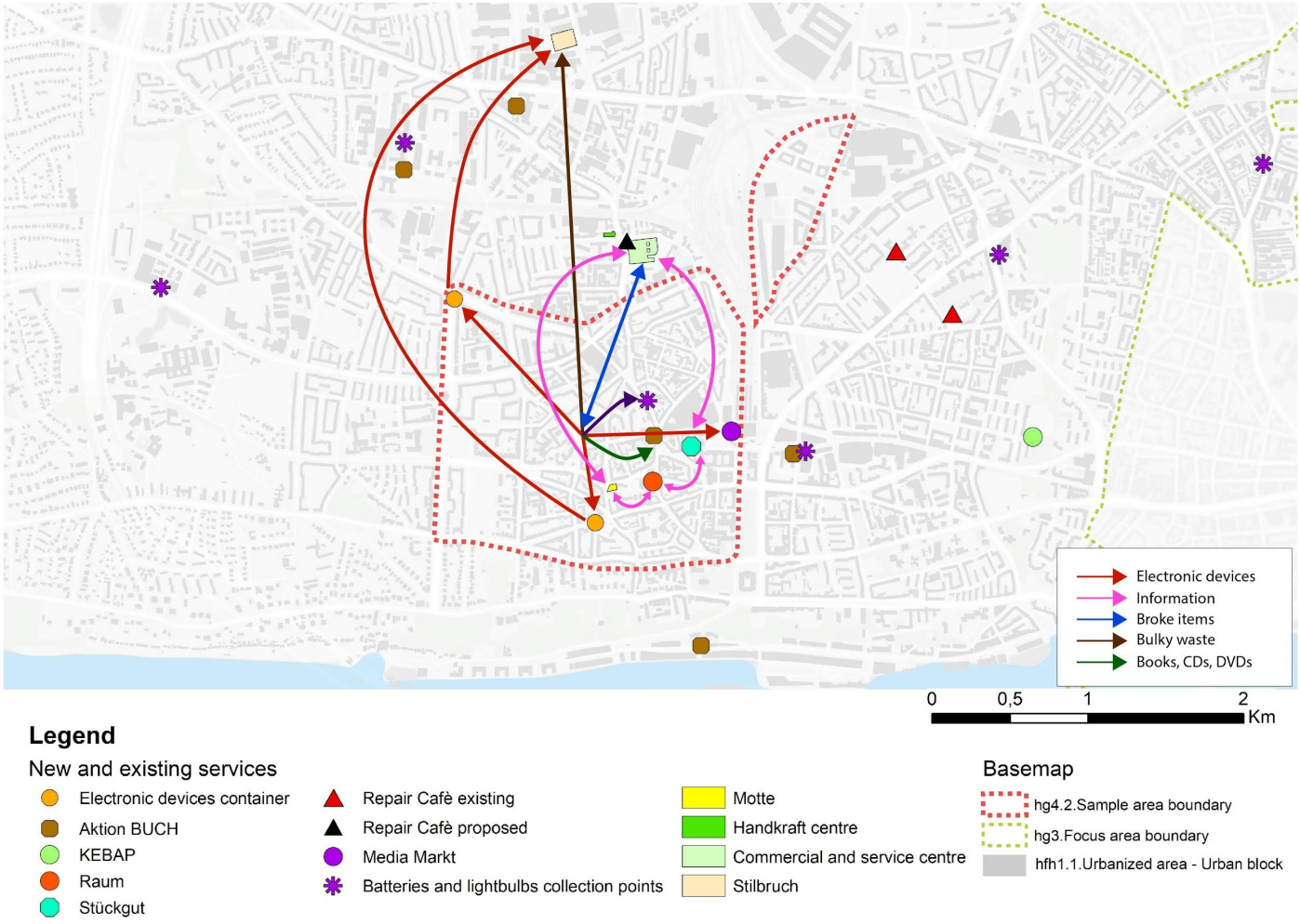

Figure 4.9 New services and network in Ottensen area. It shows how the services could be linked together and which kind of flow they support (HCU Team, 2019).

Osdorfer Born

1. Inside the Bornheide community centre the second-hand shop Cappello is located. However, it is opened only part-time on Monday, Wednesday

and Friday and it does not accept all the items that are brought to the shop, because the supply is greater than the demand.

Structural changes like the opening hours are necessary to make it more attractive. Additionally, near the shop new containers for bulky waste shall be installed, where customers going to the shop can leave their bulky waste items and the shop can repair or reuse them. What cannot be recovered could be transported to the recycling station south of the sample area.

2. Two Repair Cafés will be opened: the first inside the second-hand shop, to improve its attractiveness; the second will be in the shopping center parking, this is a strategic point because on the way to the different shops, customers can stop to leave or fix broken objects.

3. Improve the recycling station already existing in the area. Data shows that not everyone has an own car, so a pick-up service or a collection near the second-hand shop should be provided.

4. In the lobbies of the large building blocks information about waste separation, repair and waste reduction could be provided, and some of the concierges could give assistance.

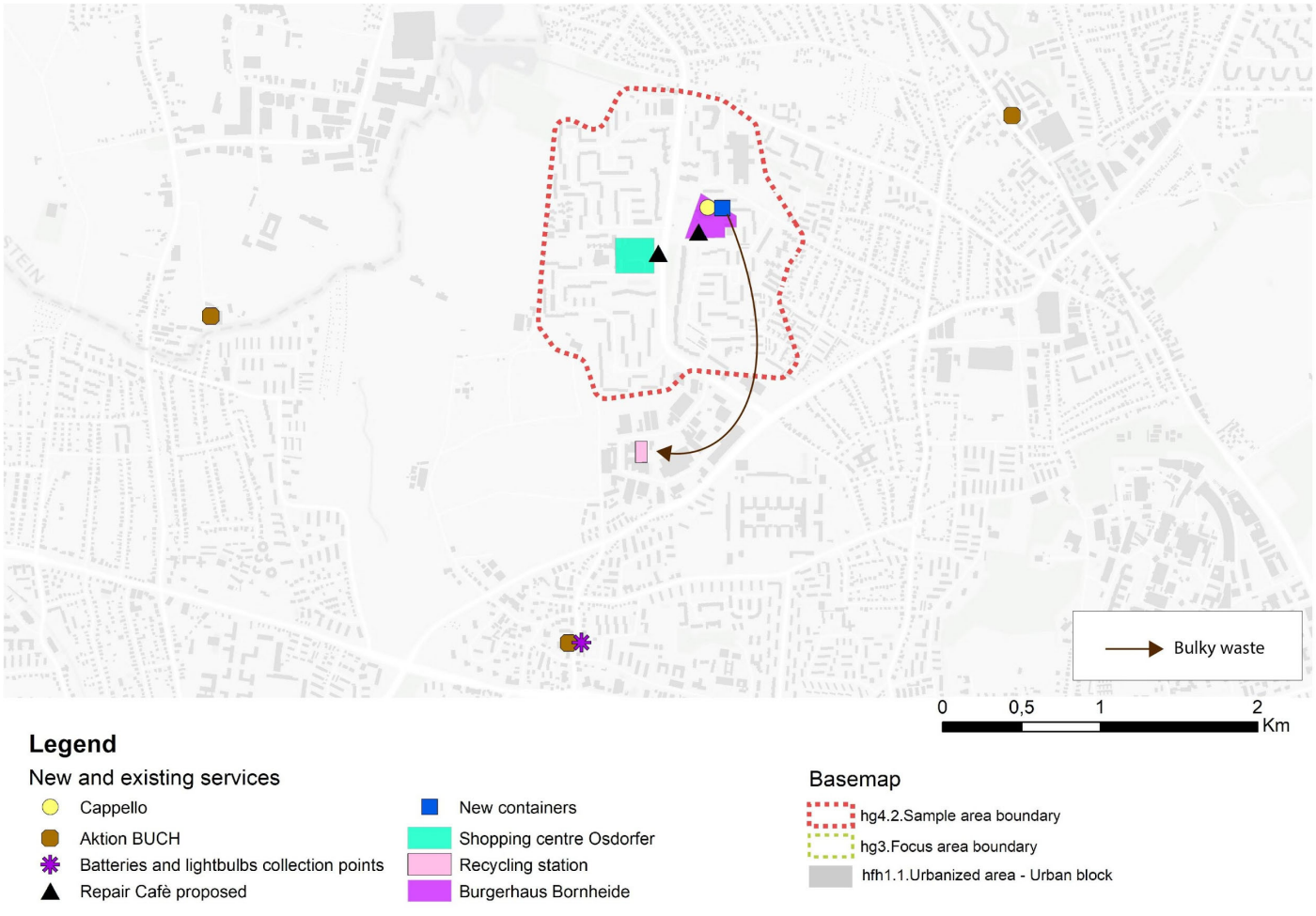

Figure 4.10 New services and network in Osdorfer Born area. It shows how the services could

be linked together and which kind of flow they support (HCU Team, 2019).

Requirement for implementation

In order to implement the solution a network between existing services should be created.

In addition, SRH should reorganize some paths (e.g. bring electronic devices to Stilbruch instead to the incinerator).

An office inside the commercial center in Ottensen sample area could be created and serve as a hub to organise workshops and social events, but also to promote information through posters, advertising in synergy with EIS1.

Physical resources

In most of the cases this EIS can be implemented by using already existing buildings and premises.

In Ottensen there is no need to build new spaces, we can convert empty spaces or improve the usage of already existing ones. The situation is similar in Osdorfer Born where there is anyhow a need to improve the Bornheide community center. The new services, the Repair Café in the shopping center parking and the container for bulky waste could be built by reusing shipping containers.

Financial resources

This EIS could be partly financed by the district of Altona, as it is one of the measures of the "Altona's Climate Concept Framework".

Actors to be involved

The district of Altona, SRH and the owner of all shops and services that are involved. After the creation of the network between the shops and services, it is really important to involve citizens as active actors. Indeed, only through knowledge and active participation, these offers will be successful.

EIS Evaluation Model

Potential Environmental, Social, and Economic Benefits

Environmental Benefits:

- Reduction of CO2 due to the waste transportation and due to the incineration 9process.

Social Benefits:

- more information and awareness on the waste system management;
- creation of a more compact community through workshops, events, meeting at the Repair Cafés;
- Improvement of the urban spaces (no more bulky waste along the streets).

Economic Benefits:

- Reselling second-hand objects, less transport costs.

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EIS 4_Educational composting in climate-environmental schools and kindergartens

Flow Organic waste

Category Outcome Social / Technological / Environmental / Legal

Author Andrea Lopes (HCU student) in collaboration with HCU and SRH

Implementation area All sample areas, but with EIS's scale adaptations concerning space availability

Purpose Enabling the valorization of waste and nutrient recovery through young generations to influence the older ones.

Target group Households

EIS Description

Main Idea & Milestones

As defended by the Climate Action Plan of Altona (Bezirk Altona, 2019: p.159), public institutions are of great significance when it comes to their capability of, not only investing on waste awareness and separation actions, but also in regards to their capacity of presenting themselves as a 'best practice' example for private households and the economy. In this manner, the EIS4 aims to support educational institutions for spreading awareness about the value of waste as a resource to feed the local circular economy, with a focus on the value of organic waste.

Furthermore, during Altona's PULL meetings the stakeholders identified the greater potential of kindergartens and schools to effectively bring awareness to a wider number of citizens, by firstly reaching the younger generation to then successfully reach their respective families and therefore the adult generation. If kids learn the value of reducing and recycling organic waste by practicing composting and gardening activities, adults would be convinced to follow the example.

Nevertheless, for a successful implementation, this EIS should have its implementation program and scale adapted to each educational institution. For instance, in kindergartens, the composting method would be of a small scale according to space availability, while in climate-environmental schools (Klima-Umweltschule, schools in Hamburg with a special program dedicated to environmental and climate education), the composting method could be of small to medium scale and include training for students with higher responsibilities for maintenance.

Figure 4.11 Pictures of the courtyard of a kindergarten in Osdorfer Born with the potential and space availability for the implementation of the Educational Composting Program (HCU Team, 2019).

The EIS takes inspiration from two case studies: the Educational Composters Campaign in KITAs at Oldenburg Germany, with the same purpose and similar context (2018 wieder LernKomposter in Kitas eingerichtet, n.d.); and the "Composting in School" practical guide (link) to compost food waste provided by the city of Devon in the UK, which also includes the "The Compost Curriculum" handbook (link) to enable teachers to use the composting process as a teaching resource throughout the school year (Recycle Devon, 2016). See the Section "EIS References" in this Chapter for further details.

The following table exposes the main steps needed for the implementation of the Educational Composting Programs in climate-environmental schools (Klima-Umweltschule), kindergartens (KiTa Kinderzimmer) and other schools. Since such EIS requires a certain level of community engagement, its implementation plan will follow the Spectrum of Public Participation developed by the International Association of Public Participation (IAP2) to help clarify the roles of each one involved directly and indirectly in the planning and decision-making for the implementation of the educational composting program (Stuart, 2017).

Table 4.3 Milestones for the implementation of the educational composting program (Lopes in collaboration with the HCU Team, 2019).

	INPUT PHASE		ENGAGE & IMPLEMENT PHASE			FUTURE REPLICATIONS
Stages	**Inform**	**Consult**	**Involve**	**Collaborate**	**Empower**	**Improve**
Milestones	Meet with principal and staff to promote the EIS and ensure adequate support of the program	Increase interest in the program to establish a student council (with supportive teachers) & perform a school waste audit to assess what types of waste can be diverted	Reflect together on waste audit results & identify barriers and opportunities (ensure that aspirations and concerns are understood and considered)	Start composting and gardening program gradually in collaboration with the partners & gradually integrate the composting activities into the school's curriculum	Transfer responsibilities to the student council to become self-managed and -sustained & completely integrate into the school's curriculum the composting and gardening activities	Feedback from the program for future replications in other schools

Actions

Within each of the defined stages, a set of actions are planned to happen for reaching the milestones necessary for the implementation of the Educational Composting Program.

1. Inform Stage - Promote the EIS to ensure support of the program:

   - Action 1. SRH in collaboration with ZEBAU should have a meeting with the schools that have the potential for discussing the degree of implementing the EIS (e.g. just lecture or practical composting and gardening activities).

   - Action 2. In case the school is interested, SRH should have a workshop section with the pupils, professors, and staff to demonstrate, via media presentations, how composting food scraps benefits the plants and vegetables in the garden. The pupils' parents should also be informed about the program by either attending the meeting or by receiving an informative material from the school.

2. Consult Stage - Establish a student council:

   - Action 3. Interested professors and students would candidate themselves to form a student council which would then have direct contact with SRH for the next steps. The student council will be the first step to give the pupils a sense of ownership. By setting up teams of pupils to lead their composting work (with a mix of ages so that older pupils can pass on their expertise to their younger composting colleagues), with an appropriate adult supervision, pupils can take responsibility for composting tasks.

     Ref. Schools in Devon (UK) are composting successfully with a similar student council supported by teachers, teaching assistants, caretakers, school cooks and even some Head Teachers (Recycle Devon, 2016). Furthermore, the Recycle Devon program (2016) recommends that the composting responsibilities from this supporting staff should be incorporated into their job description and plans should be made for an alternative school staff to carry out composting tasks when they are not at school.

3. Involve Stage - Perform a school waste audit & identify barriers:

   - Action 4. SRH together with the student council would distribute waste sorting buckets throughout the school. SRH would also give instructions on how the waste should be separated into its different categories and how the resulting waste piles should be weighed and the data recorded.

   - Action 5. With the waste sorting set up, the student council would then perform a 5 day food waste audit. Then, a meeting with SRH would be set to give support for the interpretation of the results and challenges identified and to decide which composting system would be most

appropriate for the school's needs.

- Action 6. SRH would then have a second workshop section in the school supported by the student council to present the waste audit results and perform a reflection with the students on the challenges and opportunities to reduce and separate better the waste within the school. Having the discussion together is another step to give the pupils a sense of ownership. Besides, when the pupils see the amount of waste generated by the school, it can spark off a desire to implement waste reduction schemes and SRH will be there to support their reflection about ways to 'reduce' the amount of waste generated in the school; how it can be 'reused' and to set up or improve the existing 'recycling' collections (e.g. Devon's 3R 'How To' Guide: https://zone.recycledevon.org/practical-information/) (Recycle Devon, 2016).

  SRH would also distribute bio waste paper bags to the pupils so they could also improve their waste separation at home. With this measure, pupils would inform their parents about the value of waste separation and how organic bins are also for kitchen waste (in areas with no bio-bins, parents could contact their homeowner to request one).

- Action 7. ZEBAU and SRH would then perform a third workshop together with the school staff and pupils' families to assemble together with the students the Educational Composter Modules at the chosen location within the school. By assembling the composters together, the school, professors, pupils and their parents would build together a sense of ownership and care for the equipment used on the composting practices.

4. Collaborate Stage - Start composting program gradually:

   - Action 8. SRH would meet with the student council and interested pupils' parents to introduce on how to start the composting program based on "The Compost Curriculum" handbook from Devon's schools (the school would choose if it would start composting only garden waste, or if it would compost both garden waste and raw food waste). Besides, interested parents could help in the maintenance of the gardening and composting in collaboration with the student council.

   - Action 9. In parallel, with the support from SRH and a composter specialist, the composting practice would be gradually integrated into the school's class curriculum, based in "The Compost Curriculum" handbook.

   - Action 10. ZEBAU, SRH and a community garden representative (MOTTE/REBAP) or gardener specialist would then perform a fourth workshop to implement the elevated beds for gardening together with the schools' staff, pupils and interested parents. Gardening training would also be provided to the student council and interested parents of pupils while helping with applying the soil conditioner resulted from the compost into the elevated beds for gardening. By assembling the

elevated beds together, the school, professors, pupils and their parents would reinforce the sense of ownership and care for the equipment used on the composting and gardening practices.

- Action 11. In parallel, with the support from a gardener specialist, the gardening practice would be gradually integrated into the school's class curriculum, based in "The Compost Curriculum" handbook. Besides, the gardener specialist (e.g. MOTTE-Garten) could introduce Permaculture principles for composting and organic vegetable production for the school.

- Action 12. ZEBAU, SRH and a community garden representative (MOTTE/REBAP) would then perform a fifth workshop to celebrate the first results and yields from the garden. The pupils' families would also participate in this celebration.

5. Empower Stage - Transfer responsibilities to the student council:

   - Action 13. SRH, ZEBAU and a community garden representative (MOTTE/REBAP) would have a meeting in the school with the student council for final feedback on the EIS and the collaboration practice. The meeting will also serve to handover the responsibilities of management of the Educational Composting Program to be fully managed by the school, the student council and volunteers.

6. Improve Stage - Feedback for future replications:

   - Action 14. A communication panel will be created so that the schools involved in the Educational Composting Program could communicate among themselves and exchange further knowledge on the practice. Additionally, SRH would also be in touch with the schools for annual feedback on how to keep improving the Educational Composting Program.

The following table aims to summarize the main activities previously described for displaying the whole process to implement the Educational Composting Program. According to the "The Compost Curriculum" handbook (Recycling Devon, 2016), the first try of the program should take one school year and the next years should be dedicated for improvements on the program based on the feedback given throughout the implementation process.

Table 4.4 Main Actions for the implementation of the educational composting program (Lopes in collaboration with the HCU Team, 2019).

	INPUT PHASE		**ENGAGE & IMPLEMENT PHASE**			**FUTURE REPLICATIONS**
Stages	**Inform**	**Consult**	**Involve**	**Collaborate**	**Empower**	**Improve**
Milestones	Promote the EIS to ensure support of the program.	Establish a student council & perform a waste audit	Reflect together on waste audit results & identify barriers and opportunities	Start composting program gradually	Integrate the composting activities into the school's curriculum	Feedback for future replications
Main Actions	**[Action 1]** Promote EIS program to schools					

[Action 2] 1st Workshop to present the EIS implementation plan						
[Action 3] Professors and students' application for the student council						
	[Action 4] Waste sorting buckets throughout the school					
	[Action 5] Waste audit					
		[Action 6] 2nd Workshop to reflect on the waste audit results				
		[Action 7] 3rd Workshop to assemble the Composter Modules				
		[Action 8] Meeting with Student Council to start the composting program				
			[Action 9] Gradual integration of composters into the school's class curriculum			
			[Action 10] 4th Workshop to assemble garden beds			
			[Action 11] Gradual integration of gardening into the school's class curriculum			
			[Action 12] 5th Workshop to celebrate first results			
				[Action 13] Meeting for final feedback and handover responsibilities		
					[Action 14] Communication Panel for involvement and feedback exchange	

Requirements for implementation

In order for the EIS actions to be executed and completed, a series of stakeholders should be involved for the provision of expertise, collaboration, involvement, besides physical and financial resources; throughout each stage of the implementation plan, as summarized in the table below.

Table 4.5 Stakeholders to provide for the implementation of the educational composting program (Lopes in collaboration with the HCU Team, 2019).

Stages		**Inform - Promote the EIS to ensure support of the program**	**Consult - Establish a student council**	**Involve - Perform a school waste audit & identify barriers**	**Collaborate - Start composting program gradually**	**Empower - Transfer responsibilities to the student council**	**Improve - Feedback for future replications**
Stakeholders to provide:	**Financial Resources**	SRH	-	SRH & ZEBAU (for the waste sorting buckets & the Educational Composter Modules)	SRH & ZEBAU (for the elevated beds for gardening & specialists' consultation)	-	School & volunteering donators
	Physical Resources	SRH, ZEBAU (EIS promoting/informative material) & School (provides space for meetings/workshops)		SRH, ZEBAU (informative material on waste & the Educational Composter Modules) & School (space for the actions)	SRH, ZEBAU, MOTTE/KEBAP (elevated beds for gardening) & School (classes & workshops)	School & volunteers (for the regular composting and gardening activities and the communication panel)	
	Involvement	Pupils' parents				SRH, Pupils' parents & community	
	Collaboration	Schools, pupils, professors & staff	Pupils, professors & staff		Pupils, professors, staff & Pupils' parents	Pupils, professors, staff, Pupils' parents & other volunteers	
	Expertise	SRH	Student Council (with professors and pupils), SRH		Student Council, SRH & composter and gardener specialists	Student Council & SRH	Student Council

Constraints

One known limitation of the Educational Composting Program refers to the limits of space available in the schools which would be participating on the program. In this manner, for the case of kindergartens and/or other schools with no space available, the composting program would be implemented only in the form of lectures and workshops in which students could go on excursions to visit urban gardens and other schools that perform composting practices. For the case of kindergartens with limited space, the composting method would be of a small scale, while in climate-environmental schools with available area, the composting method could then be from small to medium scale, besides including

training for students which could take higher responsibilities to help maintain the program.

Another known constraint for the implementation of this EIS, would be the weather conditions. However, the case study examples in Oldenburg-Germany and in Devon-UK provide enough knowledge on how to mitigate such limitations (BUND Oldenburg, n.d.; Recycle Devon, 2016).

Compost Troubleshooting

Concerning the risk management of the program, the "Composting in School" practical guide and "The Compost Curriculum" handbook, created by the city of Devon in the UK, may provide enough guidance on how to tackle the possible risks an Educational Composting Program for Schools could face (Recycle Devon, 2016). For instance, "The Compost Curriculum" handbook provides instructions for troubleshooting the composting activities in schools, as shown below.

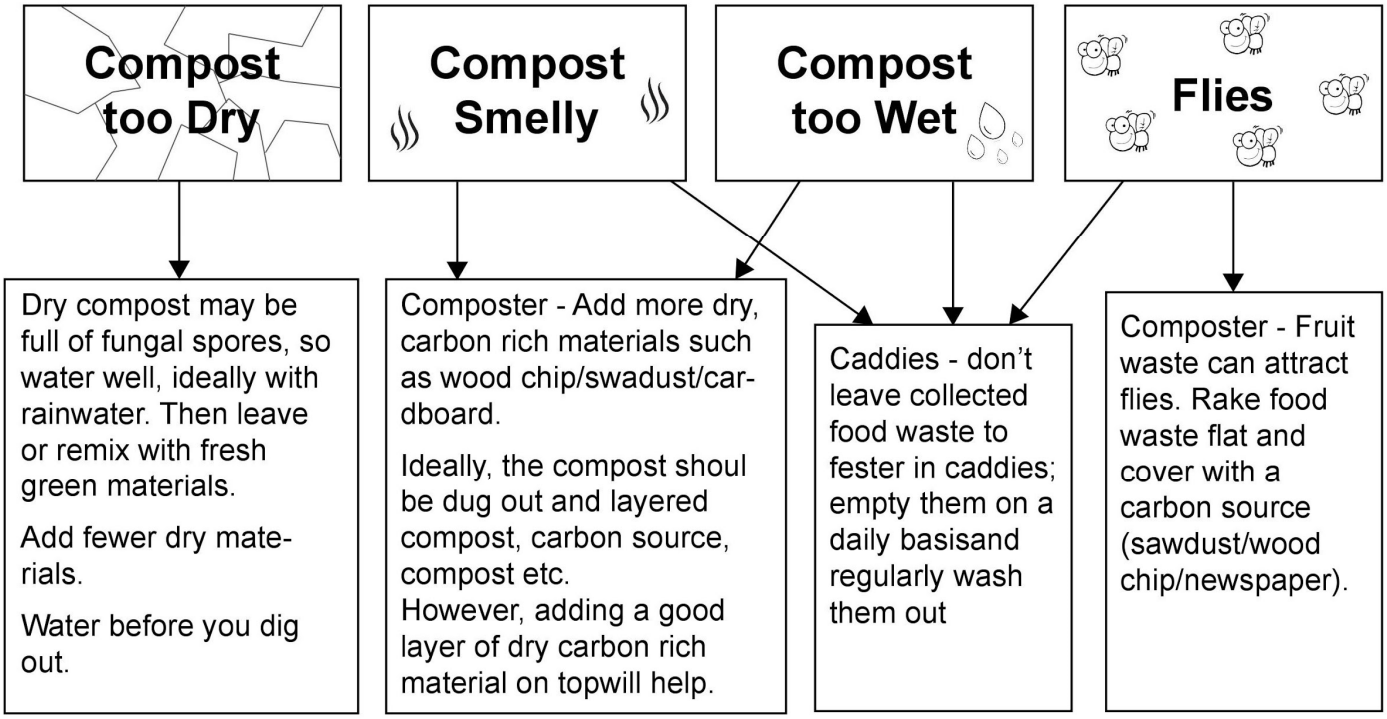

Figure 4.12 Troubleshooting your compost (Composting raw food waste using HotBox, 3-bin System Pallet Bin or New Zealand Box. Source: Adapted from Recycle Devon, 2016: p. 41).

EIS Evaluation Model

Potential Environmental, Social, and Economic Benefits

Potential Environmental Benefits

- Composting food waste cuts down on the amount of waste collected by waste vehicles, thus reducing vehicle exhaust emissions (air pollution) (Recycle Devon, 2016).
- By seeing fruit and vegetable waste recycled into compost and used to grow more healthy food, the culture and understanding of food, and

where it comes from, will be enhanced in the school (Recycle Devon, 2016).

Potential Social Benefits

- Teachers know that many children's behaviour improves the moment they go outdoors (Recycle Devon, 2016).
- Some students learn better outside and school gardens are a fantastic for learning (Recycle Devon, 2016).

Potential Economic Benefits

- Making your own compost will save your school money as you won't need to buy it in for the school's garden (Recycle Devon, 2016).
- Reducing the amount sent for disposal will save your school money by cutting the number of bins you need, or reducing the frequency of their collection (Bradley Barton Primary School, in the UK, with 266 pupils managed to save £ 500 yearly) (Recycle Devon, 2016).

Other Benefits

- If a school has drawn up a climate protection plan, in which the topic of "climate protection" is integrated into teaching in a pedagogically meaningful way, it can apply for the "climate school" seal (Bezirk Altona, 2019: p.54).

EIS Change Model

Possible Location

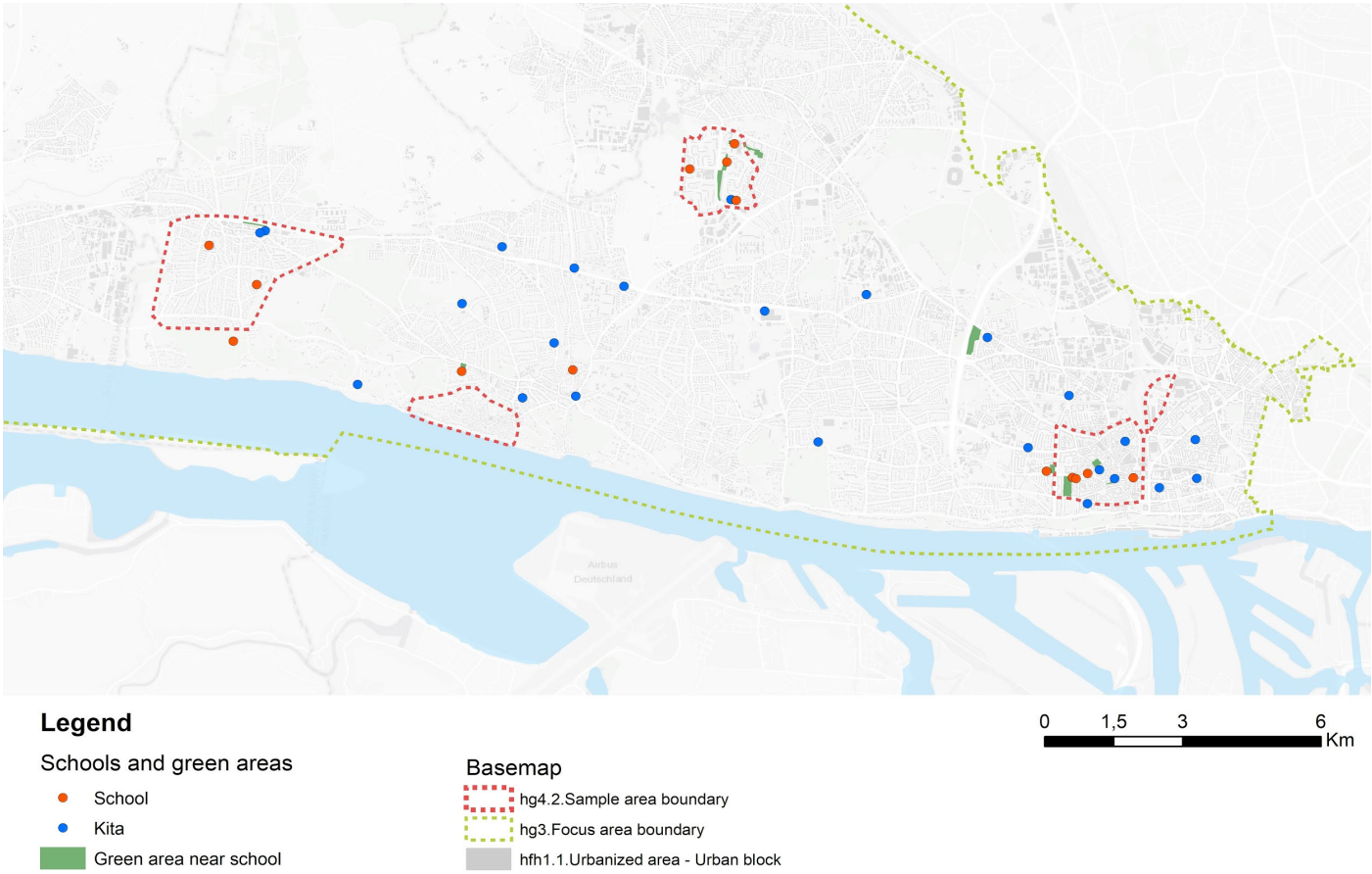

Figure 4.13 Map based on the Enabling Context Concept. It depicts the possible locations for the implementation of the Educational Composting Program within and around the Sample Areas (HCU Team, 2019).

EIS References

Case Study Educational Composters Campaign in KITAs at Oldenburg-DE

Flow Organic waste in Schools

Category of outcome Social / Environmental / Legal

Location of the good practice Oldenburg, Germany

Author of the EIS BUND (Federation for Environmental Protection and Nature Conservation Germany / Kreisgruppe Oldenburg) together with the Waste Management Organization (AWB) of the City of Oldenburg

Actors involved BINGO Environmental Foundation, day-care centers (KITAs), primary and secondary schools, students, and students' families

Specific objective To bring children closer to the natural processes of decay and circulatory systems and to expand the youth education of peat-free life with the construction of composters.

Method of intervention The BUND Kindertagesstätten together with the AWB offers the implementation of a learning composter for day-care centers, primary and secondary schools which signed up for the program. With an action day scheduled and with the support from the BINGO Environmental

Foundation for the material provision, the construction of the learning composter takes place with climbing-resistant structure of planed wood and a pane of glass. This structure with glass panel allows the children to observe the entire rotting process throughout the year, so they can be introduced to the subject of material cycle as an alternative to the disposable culture.
The children help to assemble the composters from prefabricated parts and then the composters are placed in a suitable location on the KITA or school property, to be filled with branches, leaves and shrubbery. Afterwards, the compost heap will grow with the plant waste from the kita and school kitchen and the children will be able to see how their biowaste will gradually produce ready-made compost. Finally, the compost is then applied in the kita or school garden.
Furthermore, since this campaign is part of the "peat-free living" campaign, some of this compost is also sold during special events - such as the market day - to show Oldenburg garden owners alternatives to the use of peat. On the market day, the compost is filled in ready-to-paper bags with a user manual and some workshops activities takes place to inform, the students' parents, relatives, acquaintances, and whoever is interested, about the compost, its origin, and the difference to other garden products.
Potential for Learning / Transfer Such case study presents a strong compatibility with the case of Hamburg, since it consists of the same objectives and the same group of stakeholders. Not to mention that the case study is located in Germany as well, with a similar context of organic waste management and material flows.

Figure 4.14 Illustration of the Educational Composters Campaign in KITAs at Oldenburg in Germany (BUND Oldenburg).

Further Information http://oldenburg-stadt.bund.net/torffrei/kik_komposter_in_kitas_und_schulen/

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EIS 5_Organic Waste for Urban Gardening: a localized organic waste cycle

Flow Organic waste

Category Outcome Social / Environmental / Legal

Author Andrea Lopes (HCU student) in collaboration with HCU

Implementation area For households mainly located in densely built-up and mixed urban areas

Purpose To recover food waste from the residual bin and repurpose excessive volume of garden waste from fall seasons to compost organic waste locally

Target group Households

EIS Description

Main Idea & Milestones

As mentioned in the description of the sample areas, households mainly located in densely built-up and mixed urban areas, such as Ottensen, are currently challenged by not having space available for the Bio Bin. Consequently, the organic waste share from these households is being disposed directly into the residual waste and, therefore, incinerated instead of being recycled through composting practices.

Nevertheless, Ottensen counts with a strong presence of urban gardening initiatives within and around the quarter, which reflects the sociocultural characteristics found in the Altona District (REPAiR, 2018a). A considerable portion of the citizens is aware and motivated towards reducing environmental impacts and revitalizing urban ecosystems - and the Altona Climate Action Plan strongly manifests such local conscience (Bezirk Altona, 2019).

Therefore, by following the Altona Climate Action Plan, this EIS can relate to a series of different measures defended by the district's Action Plan and has the potential to put them into practice in areas such as Ottensen. The idea of implementing community-based composting programs in urban gardens is to relate the urge for increasing the organic waste recycling, see Altona Climate Action Plan Measure 27 (Bezirk Altona, 2019: p.155). This can be linked with the demand for revitalizing and expanding the few green spaces available in dense urban areas to tackle the heat island effect and flooding issues, while enriching community driven neighborhood projects, see Altona Climate Action Plan Measures: 08k, 17, 19, 28, 29 and 33 (Bezirk Altona, 2019: respectively, pp.68, 141, 138, 130, 145 and 128)[1].

[1] A brief translation of the mentioned measures from the Altona's Climate Action Plan: Measure 08k, Promotion of the implementation of neighborhood service centers; Measure 17, Green roof in

For a successful implementation, this EIS follows a series of case studies and best practices that will be referred to throughout the implementation plan description. Nevertheless, the main sources that supports this EIS implementation plan are the "Miniwaste: Inventory of good practices regarding (bio-)waste minimization in Europe", which presents similar purpose and context (Dohogne, n.d.) as well as community composting guides related to the American Institute for Local Self-reliance, including a series of best practices and practice handbooks (Platt et al., 2014 - link; Brolis & Platt, 2019 - link).

The following table exposes the main steps needed for the implementation of the Organic Waste Composting Program for Urban Gardens. Like the Educational Composting Programs in climate-environmental schools and kindergartens, this EIS also requires a certain level of community engagement. Therefore, its implementation plan will also follow the Spectrum of Public Participation developed by the International Association of Public Participation (IAP2) to help clarify the roles of each one involved directly and indirectly in the planning and decision-making for the implementation of the program (Stuart, 2017).

Table 4.6 Milestones for the implementation of the Organic Waste Composting Program for Urban Gardens (Lopes in collaboration with the HCU Team, 2019).

	INPUT PHASE		ENGAGE & IMPLEMENT PHASE			FUTURE REPLICATIONS
Stages	**Inform**	**Consult**	**Involve**	**Collaborate**	**Empower**	**Improve**
Milestones	Meet with quarter administration and urban gardens to promote the EIS and ensure adequate support of the program so that a Master Composters Council is established	Perform a Master Composters Training Course & kickoff first local composting trial with the urban gardens' current members	Reflect with community on first results, identify barriers and opportunities & involve more households with the Master Composters Training Course	Present results to the whole community & plan expanded model together	Implement expanded model & transfer responsibilities to the Master Composters Council to become self-managed and -sustained	Feedback from the program for future transferability to other urban sectors and other quarters facing the same issue

Actions

Within each of the defined stages, a set of actions is planned for reaching the milestones necessary for the implementation of the Organic Waste Composting Program for Urban Gardens.

1. Inform Stage - Ensure support of the EIS & establish Master Composters Council:

    - Action 1. SRH in collaboration with ZEBAU should meet with

densely populated neighborhoods; Measure 19, Green and water concepts for densely populated neighborhoods; Measure 27, Increase in recycling rate; Measure 28, Green Streets and Squares Campaign; Measure 29, Sponsorships for urban green areas and parks, for the possibility of local residents to issue a "care agreement" with the Altona district office to take over the maintenance of green spaces in the vicinity of their place of residence; and Measure 33, Support for neighborhood projects (Bezirk Altona, 2019b).

representatives from the quarter administration, community center and existing urban gardens that have the initial potential for implementing the EIS around Ottensen (i.e., MOTTE-Garten, Interkulturelle Permakulturgarten Hamburg-Altona and KEBAPgarten).

In this meeting the EIS implementation plan is presented so that feedback on the EIS can be given concerning main challenges and opportunities to implement the program with their collaboration. The interested actors should work together on clarifying goals and deciding which parts of the Organic Waste Composting Program for Urban Gardens to undertake.

- Action 2. Establish a Master Composters Council which should encompass representatives from the interested urban gardens and a representative from SRH and/or the Federal Compost Quality Association (BGK). This Council is based on an existing program implemented in Flanders-Belgium, under the coordination of the Flemish Compost Organisation (VLACO) and (inter-)municipalities, through which citizens are trained in composting and then encouraged to work as volunteers training other citizens and assisting them to compost properly at home and/or in community (Allen C., 2012).

2. Consult Stage - Kickoff Master Composters Training Course & first local composting trial:

- Action 3. The formed Master Composters Council would present the EIS plan to the urban gardens' members and supporters so that the first Master Composters Training Course can be provided to the ones interested in supporting the EIS.

  Ref. The course will be based on the Flanders Master Composters Program and will be following federal and municipal regulations, such as the Law for the Promotion of the Circular Economy and Ensuring the Environmentally Sound Management of Waste (Kreislaufwirtschaftsgesetz KrWG), the Bio-waste Ordinance (BioAbfV), the Fertilizers Law (DÜG) and Ordinance (DüV), as informed by the Federal Compost Quality Association (BGK, 2019).

- Action 4. The Council and the trained staff will then define a space for the first trial at the existing urban gardens, develop a site plan, delegate functions and tasks for each individual, as well as determine whether a planning and/or environmental permission is required for the first phase of the EIS implementation.

  According to the Institute for LocalSelf-Reliance (Brolis & Platt, 2019), to make the volunteer working day more enjoyable, all ages and a diverse professional and cultural background should be considered when defining and training additional managers and recruiting qualified helpers to assist the operating team. Requiring regular compost shifts for participants ensures a smoother and more collaborative effort (e.g., weekly shifts for managers and monthly shifts for other participants)

(Brolis & Platt, 2019).

- Action 5. Start the composting activities in a small scale by collecting organic waste from a limited group of households with no bio-bin, mainly from the current members of the urban garden who will be picking up or bringing the waste to the garden. The program will make use of the existing infrastructure provided by the urban gardens as long as possible.

  The composting method recommended will be the 3-bin system and/or the vermicomposting (an animal-resistant composting system with the use of concrete pads and fully enclosed systems) (Brolis & Platt, 2019). The material for this composting system can be provided partially by SRH and other potential collaborators such as the Nutzmüll association who developed the Hamburger Wurmbank, a practical wooden bin system for the practice of vermicomposting in Hamburg (Bezirk Altona, 2019a: p.127).

Figure 4.15 "When laying out your community composting site, think through the entire composting process and designate space for each step. Make it easy for the community to participate by providing clear instructions and easy access to materials and tools." Source: Institute for Local Self-Reliance (Brolis & Platt, 2019: p.19).

By following recommendations from the Institute for LocalSelf-Reliance (Brolis & Platt, 2019), the compost pile composition should consist of two to three parts browns (garden waste and non-glossy paper) to one-part green (vegetables and non-cooked food). Nevertheless, problematic material will be avoided (e.g., dairy, meat, oils, fats, grease, diseased plants, aggressive grasses, and weeds).

Figure 4.16 Certain materials can be problematic for new composters and sites that lack active management. Meat, dairy, oil, grease, and pet wastes should be avoided in these cases. Diseased or poisonous plants and aggressive weeds are good to avoid, particularly where compost will be used in vegetable gardens. Treated wood and glossy papers may contribute unwanted chemicals. Produce stickers and other pieces of plastic or metal will need to be removed eventually." Source: Institute for Local Self-Reliance (Brolis & Platt, 2019: p.29).

- Action 6. When the first compost production is ready, consult with experts such as SRH and the Federal Compost Quality Association to check the compost quality so that it can be applied for gardening.

- Action 7. On the first yield from the garden where the compost was applied, a quality check on the crops should be done. The Master Composters Council should gather all data measured within the whole composting and gardening process - follow measuring framework provided by the ILSR (Brolis & Platt, 2019) and the Kompost Kids (KOMPOST KIDS INC., n.d.-b).

  This should be presented to collaborators for reflecting on barriers and successful achievements. With that, the council can prepare to the

Involvement Stage and already reason on how the EIS can successfully migrate to the second phase to include all households that cannot have the bio waste bin for the recovery of their kitchen waste.

- Action 8. Meet with the Altona-district administration to present initial results and get an authorization to use part of the Fischers Park for the celebration workshop with the community.

3. Involve Stage - Lessons learned & involve more households:

- Action 9. Launch the first celebration workshop. Promote the event within the neighborhood and gather all actors involved in this first EIS implementation phase. Specially invite new potential collaborators (other urban gardens, zero packaging shop, environmental NGO NABU, and small organic-related shops within Ottensen) and dwellers who do not have the bio-bin at home.

  The workshop will be a tour-like event divided into sections in which all the work done will be explained and demonstrated at the MOTTEgarten, the Interkulturelle Permakulturgarten, and then at the Fischers Park, where the last section will be held with a celebration to display the multiple benefits of the EIS approach. With the support from the KEBAPgarten[2], a cooking together section will be held at the park to demonstrate how the produce from the garden can be directly returned to the neighborhood and how the park will then be transformed to become the future expansion of this EIS as a composting and gardening demonstration site.

  With that comes the last workshop section with a round table discussion so that new interested collaborators and volunteers can join. The participants will reflect together on the challenges and opportunities of the program and on how they envision this expansion model to be implemented at the park and other future locations.

- Action 10. A second Master Composters Training Course will then be performed so that the new interested collaborators and volunteers can prepare for the second phase with a medium to large composting scale. Like the Master Composters Training from Flanders, this training should also encourage the participants to start practicing home composting. And, as suggested on Altona's PULL meetings (REPAiR, 2018a), quick composters for their balconies could be distributed with support from SRH, so the resulting compost could be applied in green areas within the neighborhood including the urban gardens.

4. Collaborate Stage - Plan expanded model with the whole community:

[2] The KEBAPgarten is known to host the 'Climate Kitchen' cooking together meetings every Thursday (KEBAP, 2019).

- Action 11. A series of participatory workshop meetings will be held with the Master Composters Council and other interested members of the community so they can plan together the expanded model at the Fischers Park and other locations within Ottensen. This practice is based on the Planwagen Program from the KEBAP association (KEBAP, 2019 - link).

  The new expanded model should follow permaculture principles (Hemenway, 2015) and should essentially provide infrastructure for local composting (3-bin Composting, Vermicomposting and In-Vessel Composting Systems) and urban gardening with rainwater catchment and storage systems. This allows the EIS program to be more resilient and provides further Ecosystem Services benefits besides only recycling organic waste locally.

- Action 12. With the plan well elaborated, organize the finances, identify potential funding sources and assess project feasibility by following instructions from the practical guides and handbooks provided by the Institute for Self-reliance (Brolis & Platt, 2019 - link), the Kompost Kids (KOMPOST KIDS INC., n.d.b - link) and the European inventory of good practices (Dohogne, n.d. - link).

- Action 13. Meet once more with the district administration to present the complete expansion proposal and to issue a "care agreement" deal, based on Measure 29 from the Altona Climate Action Plan: “sponsorships for urban green areas and parks, for the possibility of local residents to issue a "care agreement" with the Altona district office to take over the maintenance of green spaces in the vicinity of their place of residence” (Bezirk Altona, 2019a: p.145).

5. Empower Stage - Implement expanded model & transfer responsibilities:

- Action 14. Start implementing the infrastructure for the Demonstration Site at the Fishers Park with the support from the Master Composters Council, urban garden members, other collaborators and the community.

- Action 15. Launch the second workshop celebration to inaugurate the Demonstration Site. The event will involve all partners and collaborators who supported the expanded model implementation, as well as local schools, organic shops, and local citizens. Such event could serve as a crowdfunding and for the promotion of what the second EIS implementation phase targets and envisions - this EIS aims to not only recover the VFG waste (vegetable, fruit and garden waste) from households that cannot have bio-bins, but also to provide further Ecosystem Services benefits to the local community on a dense urban context such as in Ottensen in a changing climate.

  As defended by the Institute for Local Self-reliance (Platt et al., 2019: pp.7-8 - link) and a series of scientific studies (Camps-Calvet et al., 2016; Cabral et al., 2017a; Cabral et al., 2017b; Tappert et al., 2018) providing multifunctional green infrastructure with local composting, urban

gardening and rainwater catchment will guarantee its land use worth in a highly-demanding housing urban context since it enables a series of Ecosystem Services benefits and, consequently, a significant climate adaptation measure for the quarter.

- Action 16. With the Demonstration Site ready, the activities from the EIS expanded model can start. Regarding the provision of greens and browns for composting: the garden waste (i.e., wood chips and branches, leaves and shredded paper) will come from the local green areas, small organic shops and local community; and the food waste (i.e., non-cooked and dairy food) will come from small organic shops and all households without a bio-bin and home composting. Concerning the collection, residents can drop off their VFG waste at the urban gardens, some small organic shops, and at mobile drop off stands. Residents can also be elected for a bike pickup service, in exchange for a small fee or volunteering services at one of the urban gardens (Brolis & Platt, 2019: p.26 - link; McSweeney, 2019: p.339).

  Regarding the urban gardening activities, for the ones actively bringing the VFG waste and volunteering at the composting practice and gardening, they will have the right to harvest a share of the cured compost and the crops. For the ones paying a fee for the bike pickup service, they can also upgrade the service with a subscription for the delivery of fruit and vegetables from the urban gardens.

Figure 4.17 "10 common steps for community-based composting." Source: Institute for Local Self-Reliance (Brolis & Platt, 2019: p.40).

- Action 17. With the first yield from the Demonstration Site, a final workshop celebration should happen for presenting the community the EIS accomplishments. This should include a feedback section in which the involved ones will reason on the main challenges and successful aspects of the EIS program.

  Furthermore, the event should include a voting section for defining official representatives of the Community Compost Program for Urban Gardens in which the full responsibility for managing the EIS will be handover to the Master Composters Council, urban gardens and volunteers.

6. Improve Stage - Feedback for future transferability to other urban sectors:

- Action 18. A communication panel will be created so that the urban gardens involved in the Composting Program could communicate among themselves and the community to exchange further knowledge on the

practice. Additionally, SRH, ZEBAU and other former interested collaborators would be in touch with the urban gardens for annual feedback on how to keep improving the Program.

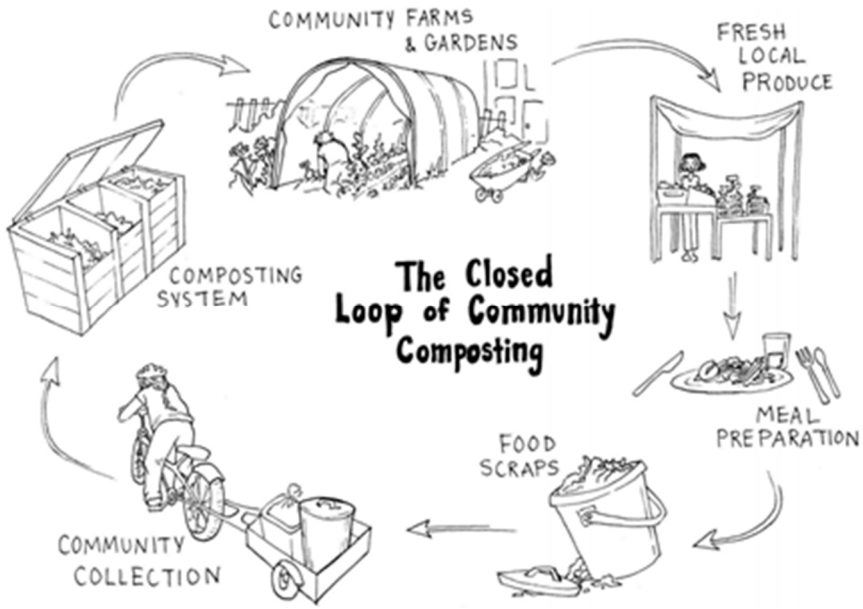

Figure 4.18 "Community composting helps close the local food loop. Food scraps can be transformed into compost, which can be added back to the soil to help grow more fresh food." Source: Institute for Local Self-Reliance (Brolis & Platt, 2019: p.5).

For future expansions to close the organic waste loop locally in Ottensen and in other quarters, there is the opportunity of including other sectors in the program such as small shops, restaurants and restaurants. These could have their own composting practices on site or in collaboration with urban gardens with the capacity to process their waste streams. This approach has been implemented by a Belgian supermarket chain in which they use their roof for composting their food scraps for the cultivation of some vegetables and berries to be sold on site (Benadjaoud, 2018 - link). This case illustrates the wide possibilities to integrate the circular economy of organic waste in all sectors, from residential and institutional to the retail/commercial sector.

The following table aims to summarise the main activities previously described for displaying the whole process to implement the Community Compost Program for Urban Gardens. Concerning the time scheduling that each stage should take, it is recommended to decide it closely with the local stakeholders involved and the decision makers, so that the program implementation is employed harmonically.

Table 4.7 Main actions for the implementation of the Organic Waste Composting Program for Urban Gardens (Lopes in collaboration with the HCU Team, 2019).

	INPUT PHASE		**ENGAGE & IMPLEMENT PHASE**			**FUTURE REPLICATIONS**
Stages	**Inform**	**Consult**	**Involve**	**Collaborate**	**Empower**	**Improve**
Milestones	Ensure support of the EIS & establish Master Composters Council	Kickoff Master Composters Training Course & first local composting trial	Lessons learned & involve more households	Plan expanded model with the whole community	Implement expanded model & transfer responsibilities	Feedback for future transferability to other urban sectors

Main Actions	**[Action 1]** Promote EIS program to urban gardens					
	[Action 2] Establish a Master Composters Council					
	[Action 3] Kickoff 1st Master Composters Training Course to members and supporters from urban gardens					
		[Action 4] Plan for the first trial and delegate functions and tasks				
		[Action 5] Composting activities in a small scale				
		[Action 6] Consult with experts for a quality check on the compost for gardening				
		[Action 7] Consult with experts for a quality check on the fruit and vegetables yield				
		[Action 8] Present initial results to Altona-district and get authorization for using part of the Fischers Park				
			[Action 9] 1st Celebration Workshop to present results and engage more inhabitants			
			[Action 10] 2nd Master Composters Training Course for new collaborators			
				[Action 11] Participatory workshop meetings for planning expanded model		
				[Action 12] Organize finances, identify potential funding sources and assess project feasibility		
				[Action 13] Issue a "care agreement" deal with the Altona district office		
				[Action 14] Start implementing the infrastructure for the Demonstration Site at the Fishers Park		

					[Action 15] 2nd workshop celebration to inaugurate the Demonstration Site at the Fischers Park	
					[Action 16] Start composting and gardening activities at the Fischers Park	
					[Action 17] Final workshop celebration to present the EIS accomplishments and get feedback	
						[Action 18] Communication Panel for involvement and feedback exchange

Requirement for implementation

Table 4.8 Stakeholders to provide for the implementation of the Organic Waste Composting Program for Urban Gardens (Lopes in collaboration with the HCU Team, 2019).

	Stages	**Inform - Ensure support of the EIS & establish Master Composters Council**	**Consult - Kickoff Master Composters Training Course & first local composting trial**	**Involve - Lessons learned & involve more households**	**Collaborate - Plan expanded model with the whole community**	**Empower - Implement expanded model & transfer responsibilities**	**Improve - Feedback for future transferability to other urban sectors**
Stake-holders to provide:	**Financial Resources**	-	SRH & ZEBAU (Training Course + material)	SRH, ZEBAU & Altona-district administration (celebration workshop)		Altona-district administration (Measure 33) & Master Composters Council (raised money)	Master Composters Council (raised money), Members of community & organic shops (subscription fees)
	Physical Resources	SRH (Informative Material)	MOTTE-Garten & Interkulturelle Permakulturgarten (space + OW + 3-bin syst.) & Nutzmüll association (Wurmbank)	KEBAPgarten, MOTTE-Garten, Interkulturelle Permakulturgarten & Fischers Park		KEBAPgarten, MOTTE-Garten, Interkulturelle Permakulturgarten & Fischers Park (space + OW + 3-bin syst.) & Nutzmüll association (Wurmbank)	Master Composters Council (communication Panel) KEBAPgarten, MOTTE-Garten, Interkulturelle Permakulturgarten & Fischers Park (space + OW + 3-bin + Wurmbank syst.s)
	Involvement	KEBAPgarten	Altona-district administration	Neighborhood, NABU & organic shops	Altona-district administration, Neighborhood & organic shops	Neighborhood & organic shops	

	Collaboration	MOTTE-Garten & Interkulturelle Permakulturgarten	MOTTE-Garten, Interkulturelle Permakulturgarten & KEBAPgarten	MOTTE-Garten, Interkulturelle Permakulturgarten, KEBAPgarten & Altona-district administration	Members of community, Altona-district administration, MOTTE-Garten, Interkulturelle Permakulturgarten & KEBAPgarten	Master Composters Council, Fischers Park, MOTTE-Garten, Interkulturelle Permakulturgarten & KEBAPgarten	
	Expertise	SRH, ZEBAU & BGK	SRH, ZEBAU, BGK & Master Composters Council	SRH, ZEBAU, BGK, NABU & Master Composters Council	Altona-district administration, SRH, ZEBAU, BGK, NABU & Master Composters Council	Master Composters Council, Altona-district administration, SRH, ZEBAU, BGK & NABU	Master Composters Council, Altona-district administration, SRH, ZEBAU, BGK & NABU

Physical resources

Space estimation for the second phase of the EIS

The Table 4.9 shows estimations on households and inhabitants within Ottensen that cannot have the Bio-bin:

Table 4.9 Estimation of households and inhabitants within Ottensen sample area that either cannot have the Bio-bin or could have it[3]. The table presents the calculations based on KOMPOSTKIDS[4] (HCU Team, 2019).

Population in Ottensen sample area that cannot have the bio waste bin	5 337 (31% of the total population in Ottensen sample area 17 397)
Total OW (KW + GW) in the mixed RW bin from households that cannot have the Bio bin in Ottensen Sample Area	KW: 428 388,47 Kg/y GW: 271 31,40 Kg/y Total OW: 455 519,87 kg/y (8 760 kg/week)
Total Potential OW to be sent to composting projects after deducting meat and dairy[5]	387 191,89 kg/y 7 446 kg/week (7 1/2 tonnes/week) 1,40 kg/person/week

The Kompost Kids case study example has the capacity to process 45 722,11 kg/year (907 kg/week) of OW (KW and GW) with nine 1.20 m x 1.20 m pallet bins (3 sets for the 3-bin-system). Therefore, it can be assumed that to process 387 191,89 kg/year of OW (7 446 kg/week), 78 1.20 m x 1.20 m pallet bins would be needed (26 sets for the 3-bin system). From such calculation, it is possible to estimate the minimum area needed for the implementation of the second phase of this EIS, which is 1 000 m2. At the Fischers Park, two different areas were identified as a potential space for the implementation of the Demonstration Site,

[3] *The figures are drafted from several sources (mainly SRH) and will be reported in the Deliverable 4.7 for the Life Cycle Assessment.*
[4] *Platt, McSweeney, J. & Davis, 2014, p.47.*
[5] According to one *study* done in England, it is estimated that 10 to 15 percent of food scraps were meat and dairy (Quested, Ingle, & Parry, 2012).

one area having 4 200 m2 and the other with 2 250 m2, which may be more than enough (consultation with experts and local stakeholders is needed to define a clearer area needed for the implementation of the Demonstration Site. For future expansions of the EIS, the top floor of the garage building by the Altona train station with approximately 2 046 m2 available.

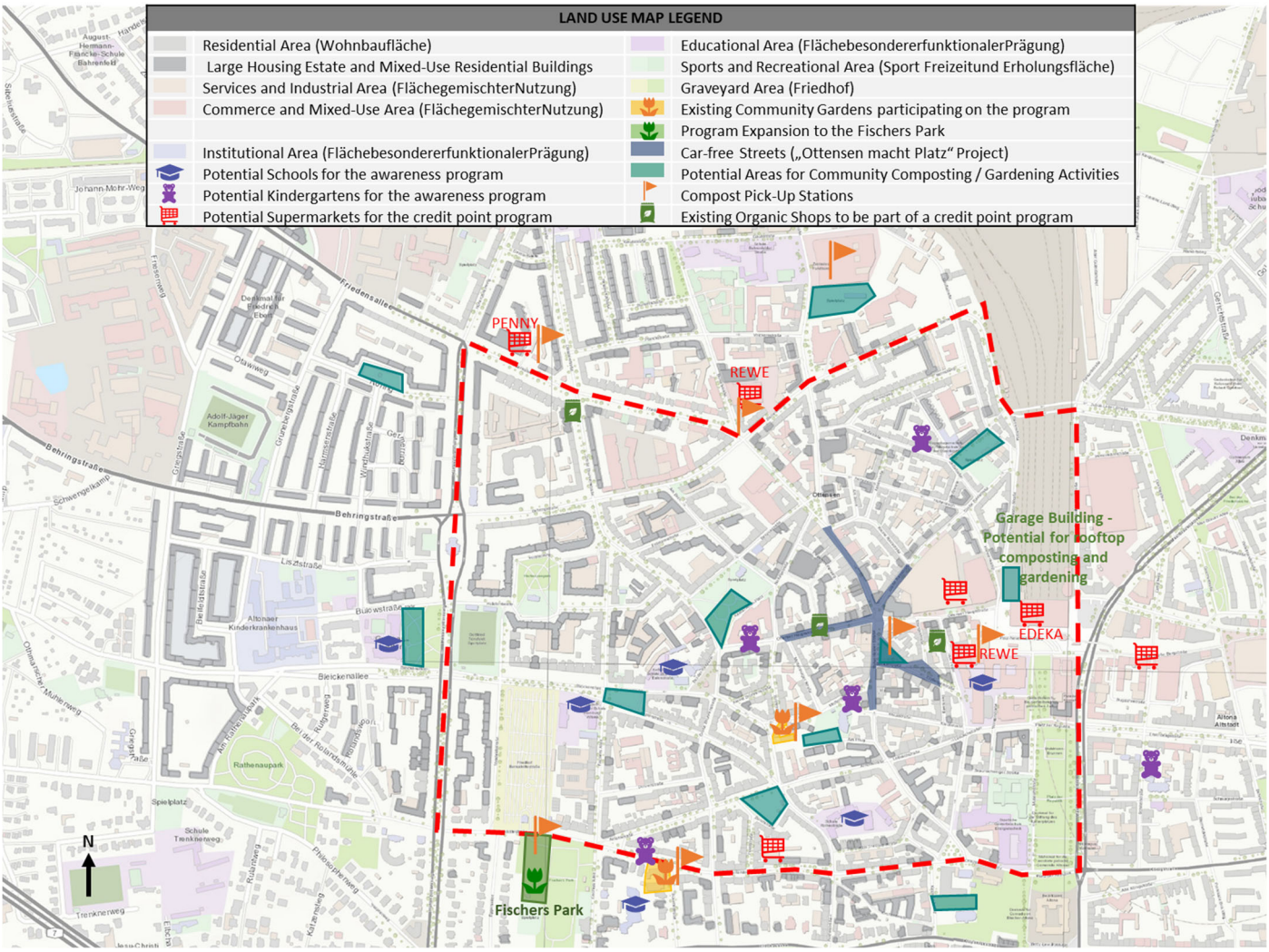

Figure 4.20 Illustration of the EIS 5 program implementation and potential expansions (HCU Team, 2020).

Main tools and resources needed for the composting practice

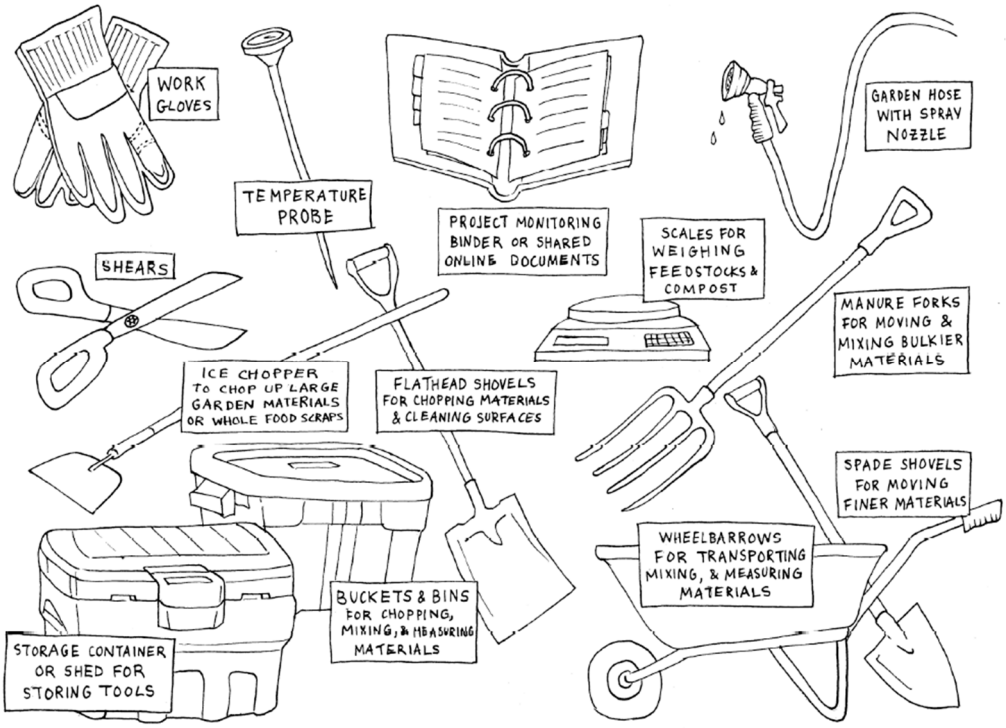

Figure 4.21 "The basic tools of community composting." Source: Institute for Local Self-Reliance (Brolis & Platt, 2019: p.24).

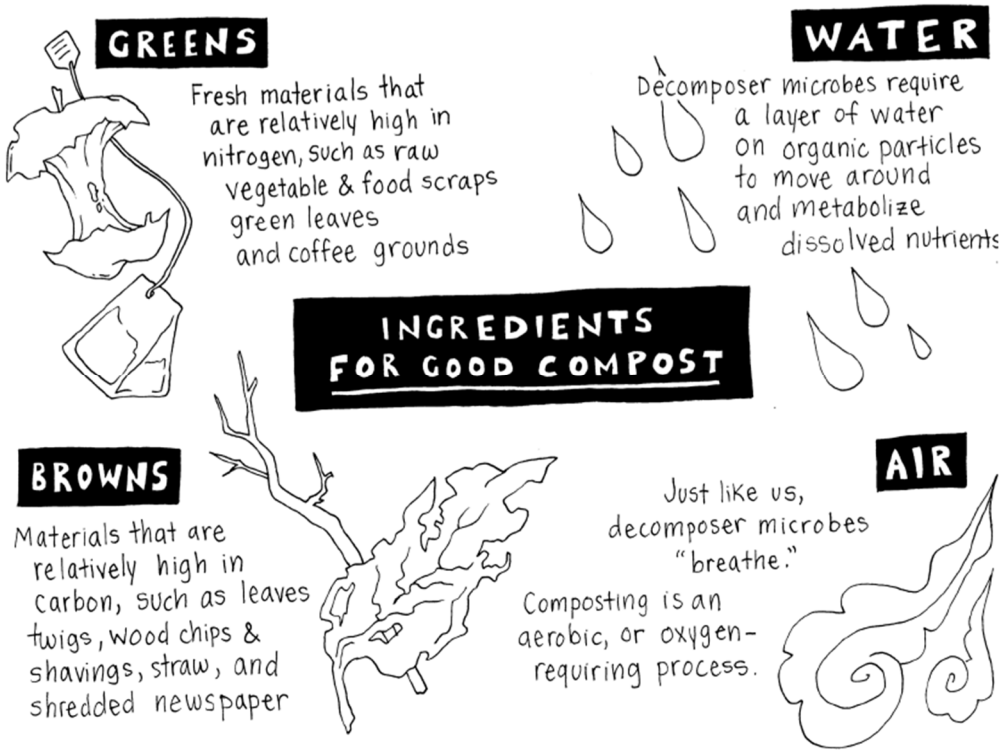

Figure 4.22 "Four key ingredients are needed to create a composting pile that provides a hospitable environment for our composting microbes." Source: Institute for Local Self-Reliance (Brolis & Platt, 2019: p.12).

Constraints

One known limitation of the Composting Program for urban gardens refers to the weather conditions. However, the case study example of the Institute for Self-reliance (Brolis & Platt, 2019 - link) and the KOMPOST KIDS Program

provide enough knowledge on how to mitigate such limitations. The last one with their "Soil Generation Maximization Packet" (KOMPOST KIDS INC., n.d.-b - link) and further information available on their website (KOMPOST KIDS INC., n.d.-a - link).

Risk Management

Please consult the troubleshooting table for maintaining a community composting program provided by the Institute of Local Self-Reliance (ILSR) in collaboration with the NRAES On-Farm Composting Handbook (Brolis & Platt, 2019, Appendix C: pp.64-66 - link). In addition, this EIS can use the Compost Pile Monitoring Log also provided by the ILSR for the monitoring of the composting activities (Brolis & Platt, 2019, Appendix D - link).

EIS Evaluation Model

Potential Environmental, Social, and Economic Benefits

> *"**Increased Local Economic Vitality** Locally-based composting circulates dollars in the community, promotes social inclusion and empowerment, greens neighborhoods, supports local food production and food security, embeds a culture of composting know-how in the community, sustains local jobs, and strengthens the skills of the local workforce.*
>
> ***Community Engagement** Composting is a direct way to be active in caring for the earth and our community. Participants learn firsthand how garden trimmings and food scraps can be recycled into compost to grow more food. Neighbors come together for a common cause, improving the social fabric of the community.*
>
> ***Improved Soil** Compost enhances soil structure to better withstand droughts and floods. It helps soil hold more water, reducing the need for watering. Compost also improves soil fertility and health, and the ability of plants to fight pests and diseases. Without healthy soils, we cannot have healthy foods.*
>
> ***Pollution Mitigation** Amending contaminated soils with compost reduces the bioavailability of lead and arsenic. Compost also filters pollutants from urban stormwater.*
>
> ***Waste Reduction** Composting diverts organic materials from landfills and trash burners, which are highly polluting.*
>
> ***Climate Protection** As organic material decomposes in landfills, it emits methane, a very potent greenhouse gas. But when added to soil, compost sequester carbon. It's a win-win!*
>
> ***Applied Learning** In projects that are located at schools or otherwise engage youth, soil-food-web curriculum goals can be reinforced in an active learning environment."*
>
> Brolis & Platt, 2019: p.7

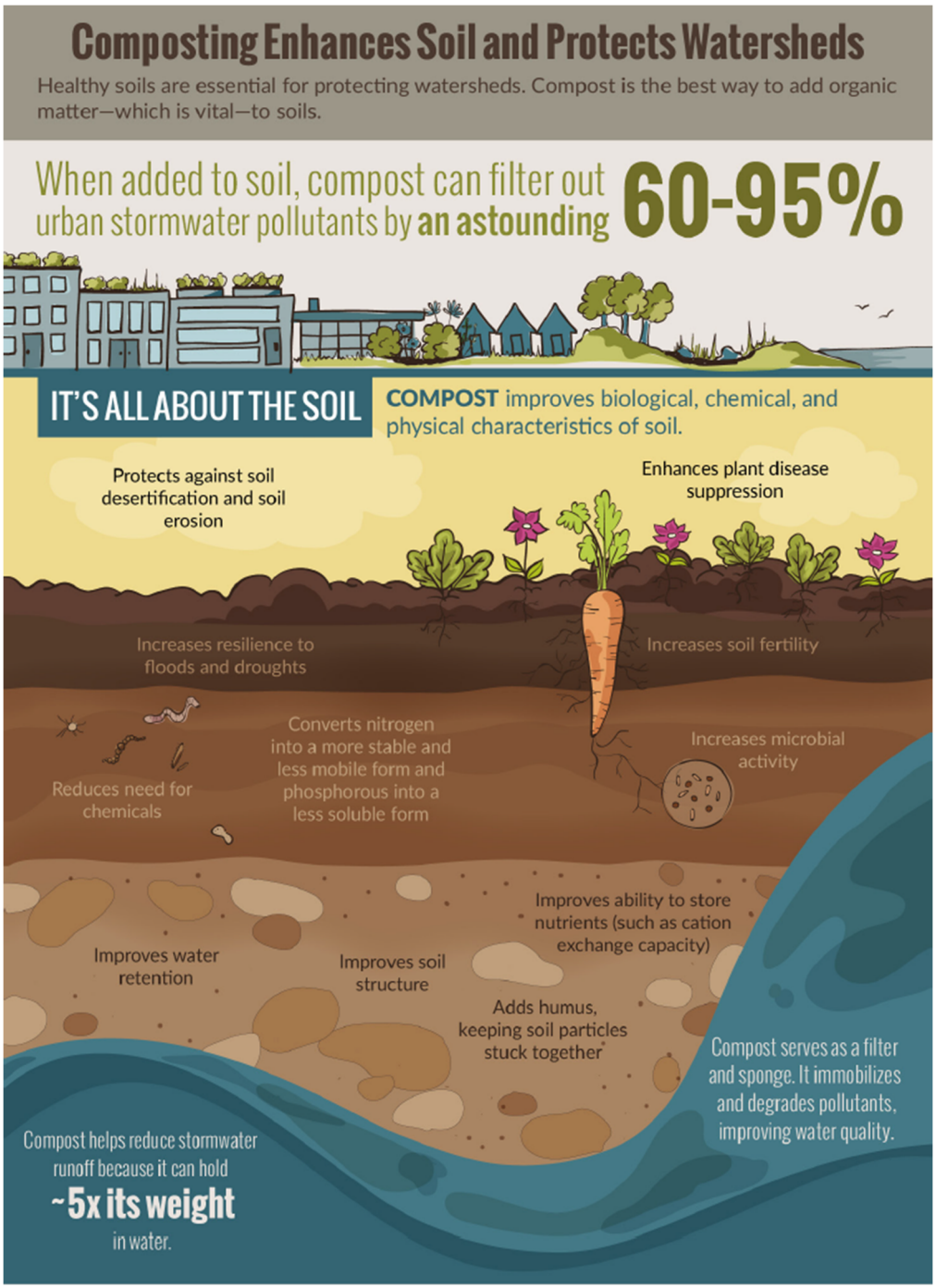

Figure 4.23 The benefits of Compost. Source: Institute for Local Self-Reliance (Brolis & Platt, 2019: p.8).

EIS Change Model

Possible Location

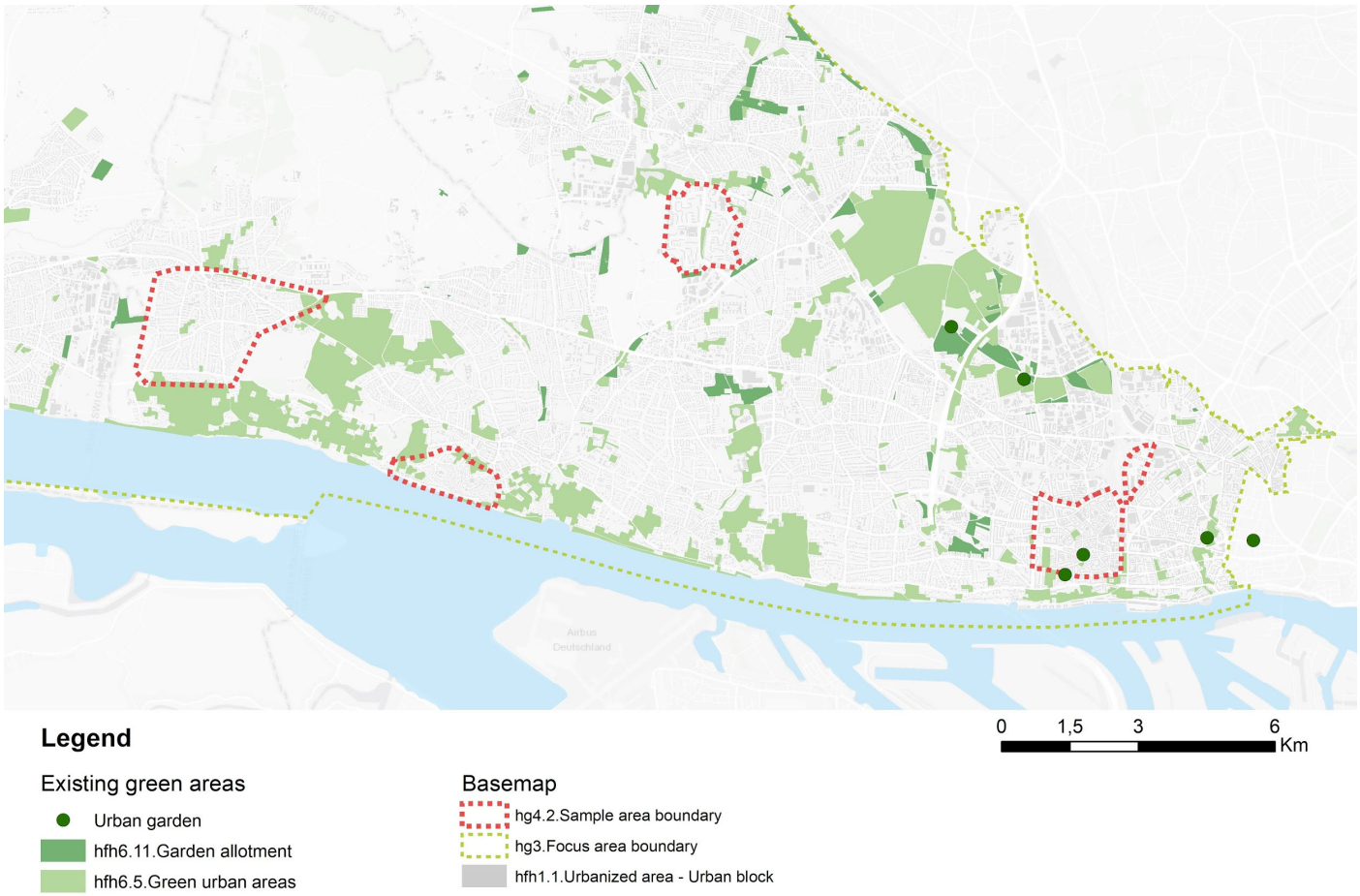

Figure 4.25 Map based on the Enabling Context Concept to identify the possible locations for the implementation of the Community Composting Program for Urban Gardens (HCU Team, 2019).

EIS References
Study case Kompost Kids Community Composting and Garden
Flow Organic waste
Category of outcome Social / Environmental / Legal
Location of the good practice Milwaukee, U.S.A.
Author of the EIS Melissa Tashjian
Actors involved Wisconsin Department of Natural Resources, White Fish Bay Middle School, Lulu Cafe, and Community Gardens and volunteers

Specific objective The Kompost Kids Program aims to maintain a decentralized composting model by using community gardens as conduits for people and businesses to manage food waste sustainably (Platt, McSweeney, J. & Davis, 2014: pp.47-48). Their mission is to educate the citizens, businesses, and institutions about the benefits of compost and to recover organic materials to create soil for community-based agriculture practices (KOMPOST KIDS INC., n.d.a).

Method of intervention The Kompost Kids Program is a volunteer-run, nonprofit organization created in 2008 after a group of inhabitants manifested the desire to have a place for composting their VFG waste (vegetable, fruit and garden waste) to create soil for community-based agriculture projects (Platt et al., 2014: pp.47-48). Hence, residents can drop off food scraps for free at fifteen different community compost sites which can be found on their searchable map at Kompost Kids' webpage (Platt et al., 2014: pp.47-48). Additionally, there are compost pickup services also available at restaurants in which their volunteers work in, live near, or frequent. Some of the composting sites (7 to 9) also collects pre-consumer food scraps from twenty restaurants - 8 venues pay for the service and the other ones provide complimentary snacks to the pick-up drivers (Platt et al., 2014: pp.47-48). Besides, the program receives funding from private organizations and donations from its webpage (KOMPOST KIDS INC., n.d.-a).
Their main composting method is the 3-bin system and they currently compost 40-45 tonnes of VFG and brown sources (Platt et al., 2014: pp.47-48). Kompost Kids' main location is the Bay View Demonstration site which processes around 907 kg/week of green material by hand once a week; there are a total of nine 1.20 m x 1.20 m pallet bins on the site (Platt et al., 2014: pp.47-48). The Kompost Kids Program accepts: fruit and vegetable scraps; egg shells, baked goods, rice and pasta; paper towels, napkins and paper plates; tea leaves and bags; coffee grounds and filters (Platt et al., 2014: pp.47-48). Material not allowed includes: Meat, seafood, bones, and dairy products; and weeds that have gone to seed, diseased plants and anything treated (e.g., with pesticides) (Platt et al., 2014: pp.47-48). For monitoring purposes and logistic maintenance, residents are asked to weigh their material before disposal on the program' composting bins (Platt et al., 2014: pp.47-48).
The core part of the Kompost Kids Program includes compost pile maintenance and composting education (Platt et al., 2014: pp.47-48). Every Saturday, the program offers up to 3 hours of free education and training at their demonstration site (Platt et al., 2014: pp.47-48). Their participants can learn about the basics of composting, see the process of an active community garden scale composting facility, as well as helping to transform garbage into healthy living soil (Platt et al., 2014: pp.47-48).
Potential for Learning / Transfer This case study presents a strong compatibility with the case of Hamburg, since it presents relatable objectives and a similar group of stakeholders. Not to mention that the case study also includes some retails on the compost pick up and some restaurants on the collection program which could also be transferred to the Hamburg case: The compost pick up can be done in collaboration with retailers to facilitate the user's participation at its daily routine; and, when the EIS becomes well implemented, restaurants and supermarkets could also be included in the community composting program so that more stakeholders can engage in the practice.

Further Information
https://kompostkids.org/

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EIS 6_ZRE - Centre for Resources and Energy

Flow Municipal waste from households, bio and garden waste from households, woody waste and biomass not coming from households

Category Outcome Economic / Technological / Environmental

Author SRH

Implementation area Municipality level / All sample areas. The ZRE is going to serve the area of North-West Hamburg, this means also the entire District of Altona.

Purpose Improved waste separation from household and treatment

Target group Households, SRH

EIS Description

Main Idea & Milestones

The EIS6 concerns the realisation of an infrastructure able to host several processes simultaneously in order to:

- concentrate and control effectively inputs (waste fractions), outputs (biogas, compost …) and emissions (CO2 …); and to
- reduce transportation distances.

The new "Centre for Resources and Energy" (in German: Zentrum für Ressourcen und Energien - ZRE) is the new project of SRH to deal with badly separated waste. The new centre will be realized on the same location of the old incinerator MVA.

The incinerator MVA Stellinger Moor, located in Stellingen (North-West part of Hamburg), opened in 1973, with a max capacity of 180 000 t/a (Aschhoff, 2016). In 2003 it was receiving around 123 000 t of residual waste, equal to one fourth of the entire residual waste generated in Hamburg (SRH, n.d.). Since 1997 the MVA was connected to the electricity and heat grid, generating almost 29 Mio. kWh/a (SRH, n.d.). However, the plant was completely closed in 2015: the main reason was the improved separation of the waste at household level and the consequent reduction of residual waste generated (Witte, 2015).

Since 2017, SRH, exclusive owner of the plant, decided to reuse the area for realising the so called ZRE - Zentrum für Ressourcen und Energien (centre for resources and energy) to be completely finished by 2025 (Mineur, 2019). On a surface of ca. 40 000 m2, this new plant park will be provided with a mechanical waste sorting technology able to separate the residual waste coming from households (Peters, 2018). The plant will be able to separate and treat up to 140 000 t/a of municipal waste; together with this kind of waste, bio and green waste

(ca. 45 000 t/a - Aschhoff, 2018; Mineur, 2019), woody waste and other biomass waste are inputs of the ZRE (SRH, 2019).

As mentioned previously, the plant in Stellinger Moor will take the form of a plant park including the following services:

- Mechanical sorting: this process will be able to separate the municipal waste into fermentable biogenic waste, recyclable materials and residual waste. Recyclables to be sorted out of the municipal waste are paper, cardboard, cartons, glass, metal and polyolefins.
- Fermentation: the biogenic waste and the bio and green waste are fermented to obtain biomethan.
- Drying: the output of the fermentation of sorted biogenic waste which is not sent to the fermentation process together with other biomass waste are dried in order to obtain biomass as input for incineration processes.
- Composting: bio and green waste together with the woody waste are sent in the composting plant after the biogas generation (composting only for separately collected bio and garden waste).
- Energy production: output of the process of fermentation will be biomethan used to generate heat to be delivered to the district heating system and electricity to be integrated into the electricity grid; the output coming from the drying and sorting - which are too dirty to be recovered - and the residual from composting are incinerated to generate electricity and heat *in situ* (SRH, 2019, p.38; Mineur, 2019).

Figure 4.26 Current aerial view of the ZRE (Aschhoff, 2018).

Summing up, the plant park is able to receive different input materials for a total capacity of 320 000 t/a of input waste and to treat them accordingly. Thanks to

the different aforementioned treatment processes, the ZRE will be able to produce 60 MW of thermal energy and 15 MW of electricity per year (Peters, 2018).

Actions / background explanation

This EIS is already under implementation but it has been included in this report as an example for other partners. Further, this solution will serve as comparison scenario for the upcoming impact assessment in WP4. For this comparison it will be assumed that the ZRE could theoretically be used to sort residual waste in general and therefore could potentially substitute any efforts on waste separation awareness as described in the other solutions. However, in reality SRH is not planning to sort all residual waste in the ZRE and is not seeing it as an alternative solution to the waste separation at household level. The residual waste separation at ZRE is planned by SRH to treat the waste of those households who still do not separate correctly.

Requirement for implementation

No particular requirements were needed, since the structure and the plot is owned 100% by SRH. For the implementation, the ZRE GmbH was founded (Peters, 2018).

Financial resources

The costs for the implementation are around 325 Mio. € (Mineur, 2019) against 235 Mio. € initially foreseen (Peters, 2018).

Actors to be involved

Actors involved were SRH (as owner of the plot and developer) and the City of Hamburg.

EIS Evaluation Model

Potential Environmental, Social, and Economic Benefits

The park plant is planned to open partly in 2022 and to run for 20 years. The facility will contribute to a better separation of the household waste fraction and allow for the best treatment possible accordingly. It is foreseen, that the recycling quota will increase and the outputs such as compost and energy will contribute to reduce the use of fossil materials for the incineration and virgin soil for agriculture. It is planned that 14 000 households will be served by electricity produced in the ZRE. Further, the new location of the plant will drastically reduce the distances to be covered by the waste trucks, leading to a saving in CO2 emissions but also hours in travelling and reduction of traffic jam. The gas cleaning system will assure the least emission possible. The plant will provide jobs for approximately 100 people (Aschhoff, 2018; Peters, 2018).

EIS Change Model

Planned Location

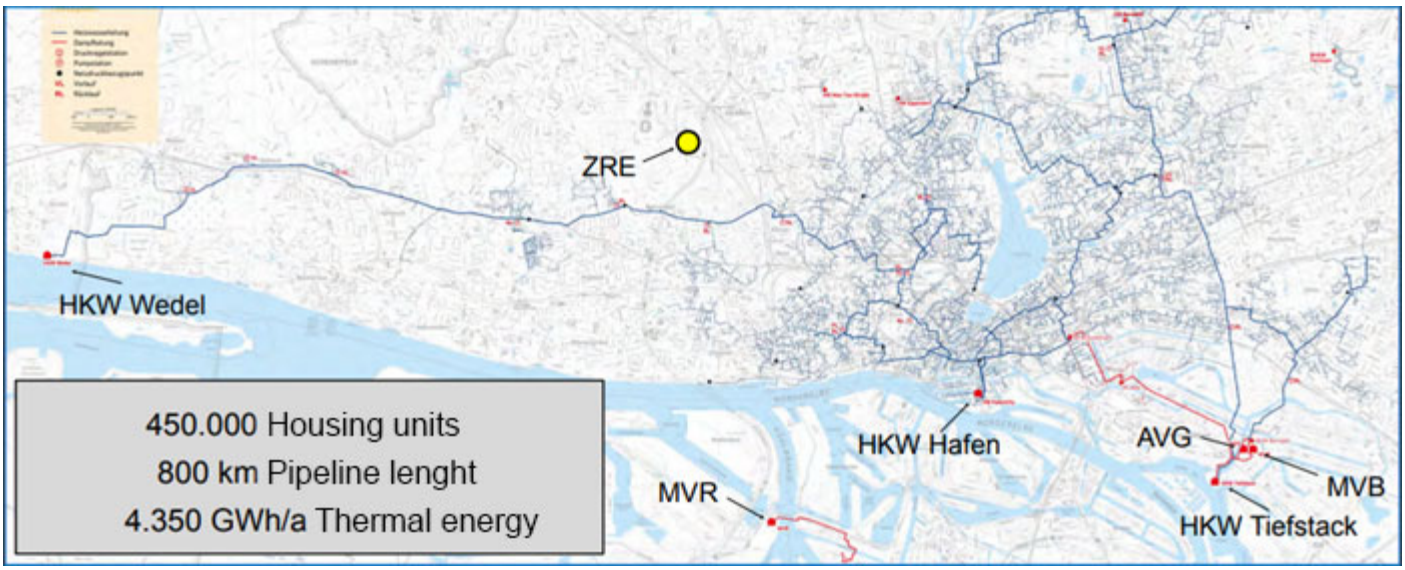

Figure 4.27 ZRE location compared with the other two incinerators (MVB and MVA) and the heat and electricity network in Hamburg (translated from Mineur, 2019).

The ZRE Plant will be located in the former incinerator in Stellinger Moor. As shown in Figure 4.27, the new location will drastically reduce the distances to be covered by the waste tracks.

Examples of possible implementations

Figure 4.28 Rendering of the ZRE by Gottlieb Paludan Architects (Peters, 2018; Mineur, 2019).

The plant will be implemented in different phases. First the bio waste handling hall will be completed. Then the ZRE will be ready to deliver heat to district heating system, the sorting plant will be partly completed. In 2024 the following parts are forecasted to be completed:

- Composting facility
- Biogas generation facility
- Sorting facility complete
- Incinerator
- Drying facility

Within the last year final works will be completed, such as parking lots and the biogas container (Mineur, 2019).

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4.3. Circular Waste Management into Urban Planning & Governance

EIS 8_ Guideline to improve the integration of waste management in urban planning

Flow All waste flows in households and small businesses and retail

Category Outcome Social / Environmental / Legal

Author Carla Tortelli (HCU student) in collaboration with HCU and SRH

Implementation area For all new urban development projects in the city of Hamburg. In particular attention will be paid to new developments in the district of Altona.

Purpose To promote a better communication between urban planning and waste management authorities, improve the accessibility to waste containers, and support on closing material loops in the existing neighbourhood scale (refurbishment).

Target group Planners, architects, District of Altona, Ministry of Urban Development and Housing (Free and Hanseatic City of Hamburg)

EIS Description

Main Idea & Milestones

Even though planning for a correct waste management is crucial, according to Zaman & Lehmann (2011), city planners often do not look at it with the same consideration as other infrastructural sectors such as water and energy, for example. Thus, gaps between waste management and city planning have become an evident issue (Zaman & Lehmann, 2011) and are crucial for the project REPAiR in Hamburg (see REPAiR, 2018).

Therefore, the planning guideline will be a tool with design recommendations for architects and urban planners to address the waste management earlier in the development phases, in a holistic way. It will aim to answer questions such as how buildings and quarters should be designed in order to allow an efficient material flow management and how to integrate waste management in the daily life of people, with a special focus on public spaces in between.

The planning guide will look like a toolbox, with practical recommendations and inspiration for improving the quality of life of the inhabitants and simultaneously pursue sustainability within the built environment. The designed solutions will differ from scale and will range from the micro planning for a proper waste separation in the individual households, to the macro collective solutions in the community level and public spaces. Furthermore, the catalogue of modular tools

will enable planners to adapt the different solutions accordingly to the size and typology of their envisioned project.

In this EIS, the process of the development of the guideline itself is the solution, and therefore, the project stages and milestones are limited to the strategic phases until the final product would be available for architects and urban planners to implement it. It is foreseeable that, after the implementation, the guideline will be constantly revised and updated with lessons learned from its use.

Great part of the actions to develop the guideline occur following an intensive desktop research on current local regulations, practices and main stakeholders involved in the draft processes. After understanding the situation and identifying the key actors, interviews and collaborative workshops should be conducted to gather different perspectives from the several facets of planning and waste management.

The workshops are an important tool to identify possible gaps in the current system, and at the same time, find new solutions that could only work with multidisciplinary cooperation. For a holistic approach to the guideline, the participation of stakeholders from several segments of the building and environmental sector is crucial.

Table 4.10 Events and Milestones for the implementation of the guideline (Tortelli in collaboration with HCU Team, 2019).

Stages	Research	Interviews	Workshops	Design	Interim Present	Implement
Events	Initial research on local regulations, practices, stakeholders, good practices	Interviews with different and relevant actors of planning processes	Interdisciplinary workshops with project partners, to involve different perspectives to the topic	Compilation of all the information collected in the other stages, and translation of the solutions into a design catalogue	Event where the first draft is presented to those who helped shaping it	Promote guideline to authorities and designers. A team will be available to explain the guide and provide consulting
Milestones	Base document to insert new solutions to improve current system	Overview of the technical issues regarding the topic	Collection of inputs from different actors and from different stages of a project.	First draft of the design guideline	Feedback session with inputs to conclude the guideline	Constant follow-up with revisions and improvements of the guideline

Actions

According to some best practice examples of cities that have already advanced on this topic, the procedure to develop a framework for improving waste management in urban and building planning should follow the subsequent steps:

- Research: Desktop research on local regulations, current practices, map of stakeholders, case studies and good practices. Additionally, field analysis should be done to better understand the current situation in buildings and public spaces, and what are the strengths, weaknesses and opportunities in reality. Besides, at this stage the strategic planning of the subsequent procedures should be established. A clear plan of the interviews, workshops and stakeholders' engagement, and the evaluation of the whole process should be made.
- Interviews: Individual interviews with different actors of the planning and building sectors, waste management representatives, building and district managers. The interviews can be a strategic source of information, when they are conducted with key players, that are able to provide up to date and relevant information. The interviews should be prepared in advance, in order to direct to the questions to fill the gaps of the desk research.
- Workshops: At this stage, the main issues of the current system should be clear, as well as the potential opportunities for improvement. By involving an interdisciplinary group of project partners, the collaborative workshops aim to obtain different perspectives to the topic, to complement the earlier phases of research and interviews. The workshops should bring together people from different sector and promote fruitful discussions and collaborative brain-storming. The workshops are also a good opportunity to consolidate partnerships among the different stakeholders that are willing to shape a new way of working in collaboration in sustainable planning.
- Compilation and Design: After intense data collection from research, interviews and workshops, it is time to organise all the information gathered and translate it to framework and design. The new framework must combine the existing regulations with the new findings, and it should be detailed in written tables and technical drawings.
- Interim Presentation: Before publishing the guideline, the result will be shown to those who participated in the process, for a feedback session. After the feedback, and possible modifications, the document will become available to the public.
- Implementation and Evaluation: After the new planning guide is published, a team should be available to present the guideline to the target group and provide consulting on how to better use the toolbox. The design guideline for architects and urban planners should be regularly revised during its use, to be updated with improvements and additional innovative solutions.

Requirement for implementation

Physical resources

Meeting rooms with materials to accommodate the workshops, office with basic structure to perform desk research and software to create graphic designs.

Actors to be involved

The following table shows the main actors that could collaborate with the development of the planning guide for waste management in the built sector. They are categorised by their function, potential contribution to the project, and why is important for them to be involved in such a project.

Table 4.11 Main actors that could collaborate with the development of the planning guideline (HCU Team, 2019).

Stakeholder	Role	How can this SH contribute?	What is important for this SH?
Stadtreinigung Hamburg	Waste management authority	Knowledge and technical support, implement Design guideline	Having a practical guideline that agrees with the company´s practices and values
Ministry of Environment and Energy	Regulatory, Financial support	Legal support, financing Eco Innovative Solutions through Hamburg Climate Plan, implement Design guideline	Having a practical guideline that promotes sustainable infrastructure that are aligned with the city´s Climate Plan
Ministry of Urban Development and Housing	Regulatory	Legal support, knowledge, implement Design guideline	Having a practical guideline that promotes sustainable infrastructure that are aligned with the city´s Climate Plan
Sustainability consultants	Environmental Consultation	Knowledge and technical support on Eco Innovative Solutions,	Visibility and networking opportunities
University researchers	Research	Innovative solutions derived from research and empirical work	Opportunity of applying research and innovative projects into the real context
Real Estate Developers	Project Management – From beginning to end	Knowledge of the construction practices and financial implications	Optimise sustainable solutions with economic profitability
Architects, Urban Planners and Engineers	Plan and design	Manage interdisciplinary team and integrate inputs into waste management solutions into design guideline. After implementation, as active promoters and users of the solutions	Have a clear guidance for including sustainable waste management infrastructure in the building and urban design
District and Building Managers	Building Management	Knowledge of the real situation regarding daily waste management logistics in the building scale	Improved logistics for managing and moving the waste through the buildings
Residents	Waste producers and final users	Give insights of waste separation behaviors from the resident perspective	Convenient and accessible solutions for separating and disposing their waste properly

Constraints

The Planning Guide is a Conceptual Waste Management framework, and it is not regulated by law. Its application can be highly recommended by authorities, but since it is not mandatory, it will be done on a voluntary basis.

EIS Evaluation Model

Potential Environmental, Social, and Economic Benefits

Environmental Improvement of the waste management in new districts, better logistics, and increase of waste separation rates.

Social More convenient waste management system, better accessibility to waste containers, improvement of liveability in quarters.

Economic More efficient infrastructural solutions.

EIS Change Model

Examples of possible implementations

The population of the city of Hamburg is expected to grow continually until 2030. And to accommodate the projected urban growth, Hamburg has signed the "Alliance for Housing in Hamburg "- a house building program in collaboration with the housing industry, where their aim is to ensure the building of at least 6,000 new apartments in each of the coming years (The Free and Hanseatic City of Hamburg, 2014). The Alliance contract binds the cooperation between the housing industry and the city, respecting the targets that were defined together with the tenants' association.

The urban growth predicted to the city of Hamburg is challenging, but can also be an opportunity for innovation in urban planning. More than ever, the city will need strategies that will lead the growth of the city efficiently, such as frameworks and guidelines for the conservation of resources and sustainable development, which should be incorporated in the processes as soon as possible (Bürgerschaft der Freien und Hansestadt Hamburg, 2015).

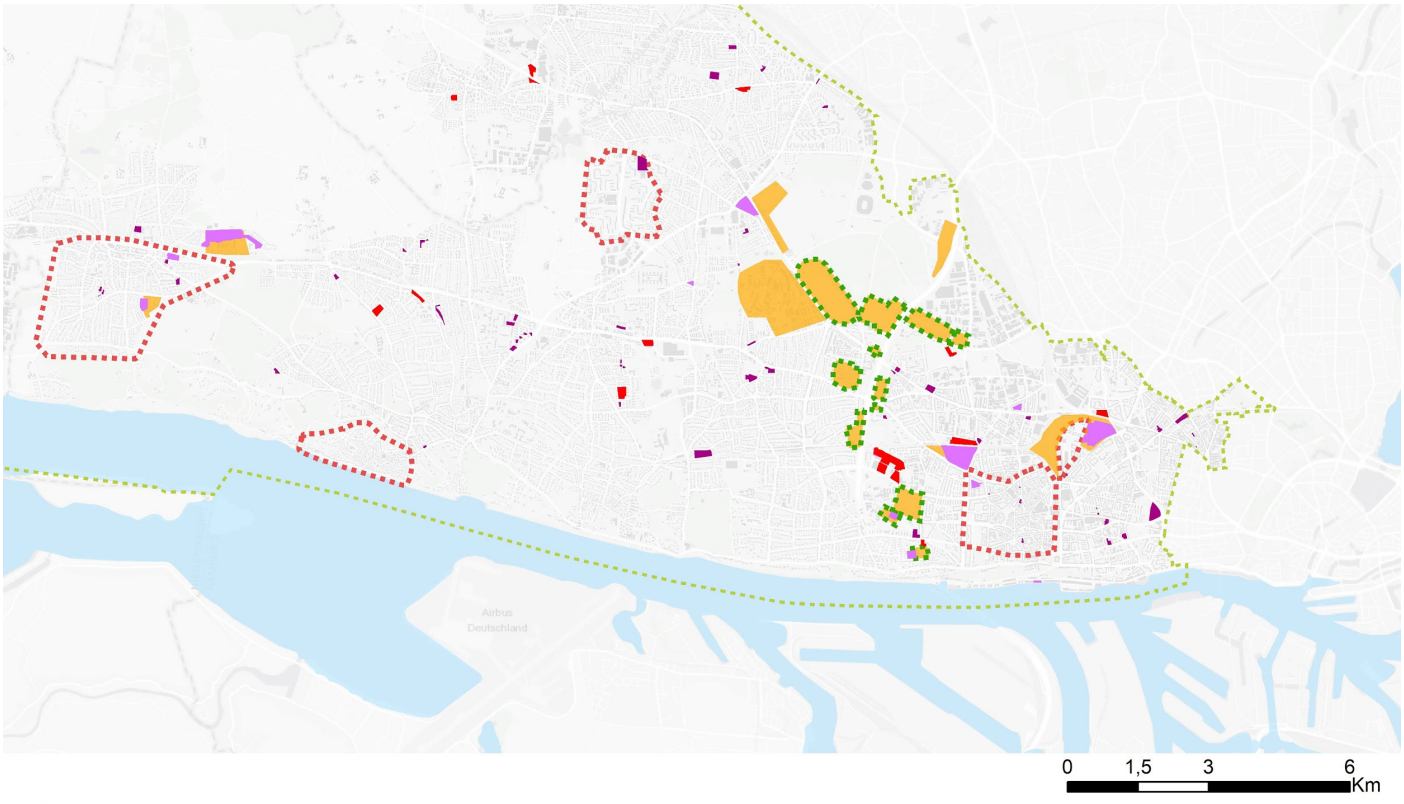

Figure 4.29 Map of potential urban development in the focus area (HCU Team, 2019).

Hamburg has established a Climate Plan, with measures to adapt the city to climate change (Bürgerschaft der Freien und Hansestadt Hamburg, 2015). The Hamburg Climate Plan 2020 will support and fund innovative projects that will promote climate change mitigation in the city.

The current situation is a favorable setting for the Planning guide to be established, since many housing developments are planned for the next years, and they should demand for sustainable infrastructure. The following picture shows the planned growth of Hamburg until 2030, and on which of these developments the planning guideline could be potentially be used (large-scale house-building projects, and new urban districts).

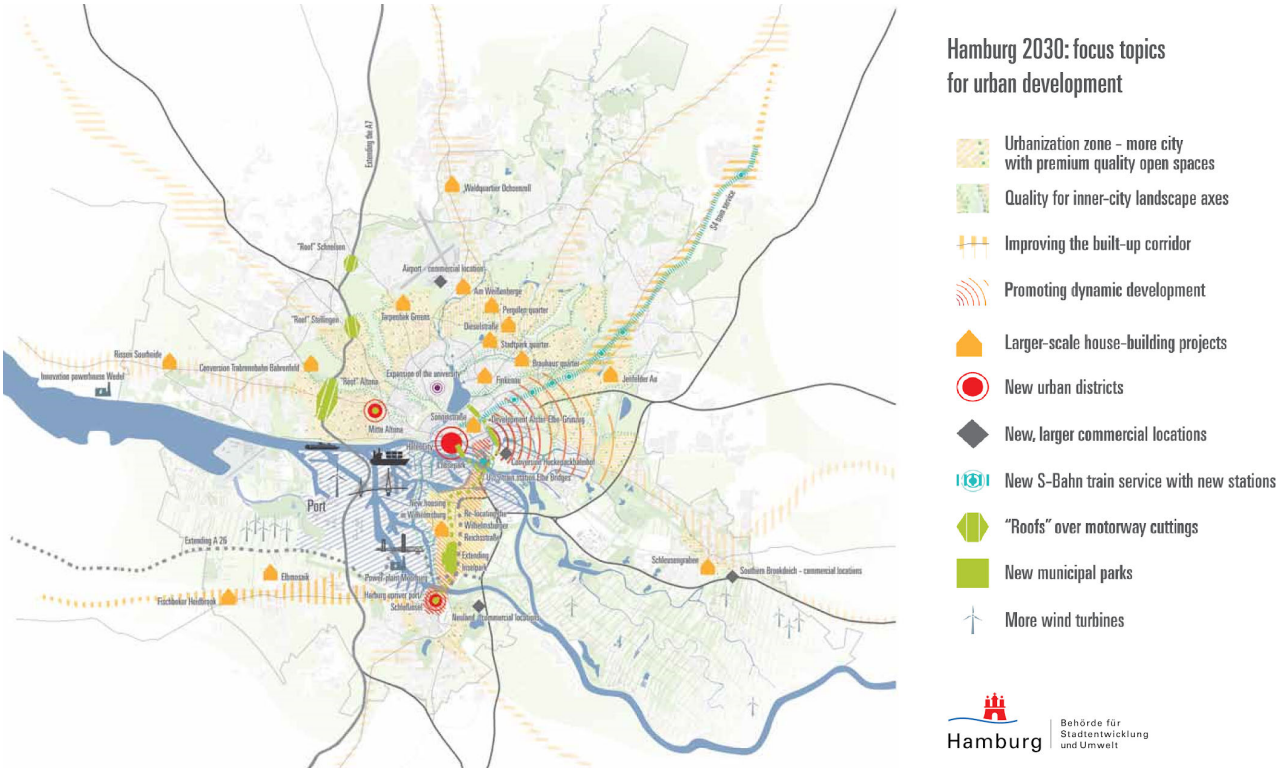

Figure 4.30 Map of Future Urban Development in Hamburg (The Free and Hanseatic City of Hamburg, 2014).

EIS References

Study case NY Zero Waste Design Guidelines. Design Strategies and Case Studies for a Zero Waste City.
Flow Several Materials
Category of outcome Economic / Social / Technological / Environmental / Legal
Location of the good practice New York, United States of America.

Author of the EIS AIA New York, the Center for Architecture, Kiss + Cathcart, Architects, Foodprint group, ClosedLoops, and The Rockefeller Foundation.
Actors involved the advisory committee included city agency representatives, developers, architects, engineers, building managers, waste management professionals, sustainability consultants and university researchers.

Specific objective: The NY Zero Waste Design Guidelines is a tool to be used by those responsible for planning, constructing and managing the cities' buildings, streets and neighbourhoods, as it becomes clear that the correct design and planning of the building sector is crucial to achieve zero waste goals (Miflin et al., 2017).
New York city has an ambitious goal of zero landfilling by 2030, which is a policy driver for rethinking the way the buildings are designed. Moreover, the guideline integrates the OneNYC's goal: "to be the most sustainable big city in the world and a global leader in the fight against climate change" (Miflin et al., 2017).
Method of intervention: the development process of the New York zero waste guideline included visits to more than 40 buildings in the city, discussions with building managers (porters and supers), and six collaborative workshops, that addressed to different topics: 1) scope setting, 2) multifamily residential buildings, 3) commercial and institutional buildings, 4) collection of urban issues, 5) construction and demolition roundtable, and 6) guidelines review and implementation.
The Zero Waste Design guidelines is a complete document, that provides the tools to calculate the amount of waste of a variety of potential scenarios, infographic illustrations with of the NYC regulations in spatial terms, case studies of best practices, and policy recommendations.
Potential for Learning / Transfer Even though the setting of the zero-waste guideline is in New York, the document has measures that can be easily adapted and implemented in different cities. The structure of the guideline is very clear, and the development process transparent, which makes it transferable to other contexts.

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EIS 9_Design manual for spaces dedicated to waste bins and recycling containers in public spaces

Flow All waste flows in households and small businesses and retail

Category Outcome Economic / Social / Technological / Environmental / Legal

Author HCU Team

Implementation area Municipality level / All sample areas

Purpose The EIS aims to give guidelines and examples to improve the quantity and the quality of the waste bins and containers in public spaces.

Target group Planners, architects and the District of Altona

EIS Description

Main Idea & Milestones

In the sample areas there are 23 public recycling container sites with at least one container for paper and two for glass (white and green glass), in some of these locations there are also containers for textile, packaging and electronic devices. Each point shown on the map of Figure 4.35 consists of 3 to a maximum of 11 containers. They occupy a part of the public space and in many cases contribute in causing an unpleasant perception of the urban space. Comparable problems can also be observed in areas where private waste bins or containers are located in an open space, constituting *de facto* part of the urban environment (e.g. Figures 4.28: such spaces are named private-open spaces in the following text.

Figure 4.31 Examples of public bins in the Sample areas. From the top left to the bottom right (HCU - TUD students Summer School in Hamburg 2018).

A key problem is the limited access to some of the public containers for older people and people with disabilities. Furthermore, the analyses carried out have highlighted a lack of containers in some places and a bad visual impact in others. Moreover, the spaces inside the houses are often not suitable to accommodate all the necessary waste bins for a proper separation.

A reason behind some of these practical problems is the limited cooperation between urban planning and waste management.

This EIS is developed based on an analysis in the sample area, but it could be extended to the area of the whole district or even at the entire City of Hamburg as part of a general strategy to requalify such degraded spaces.

Final result of the solution is a design manual for spaces dedicated to waste bins and containers (waste types: residual, biowaste, packaging, paper, very rarely glass) in private spaces (especially in large housing estates) and recycling container parks in public spaces (waste types: glass, paper, textiles, WEEE etc.). The design manual offers standards that would be requested by architects on tendering and before approving the construction of a new building. For instance, the design manual would require the provision of accessible and multifunctional public spaces with the public waste containers (integrating waste collection daily activities with community positive awareness on waste management).

Actions

The manual will contribute to the following main points:

- define standards according to the number of inhabitants, the morphology and the accessibility of each area;
- suggest designs for public bins with low visual impact, integrated into the urban environment;
- give advice and ideas to promote citizens' participation in the redesign of these public spaces.

Figure 4.32 Possible graphics and contents of the manual (HCU Team, 2019).

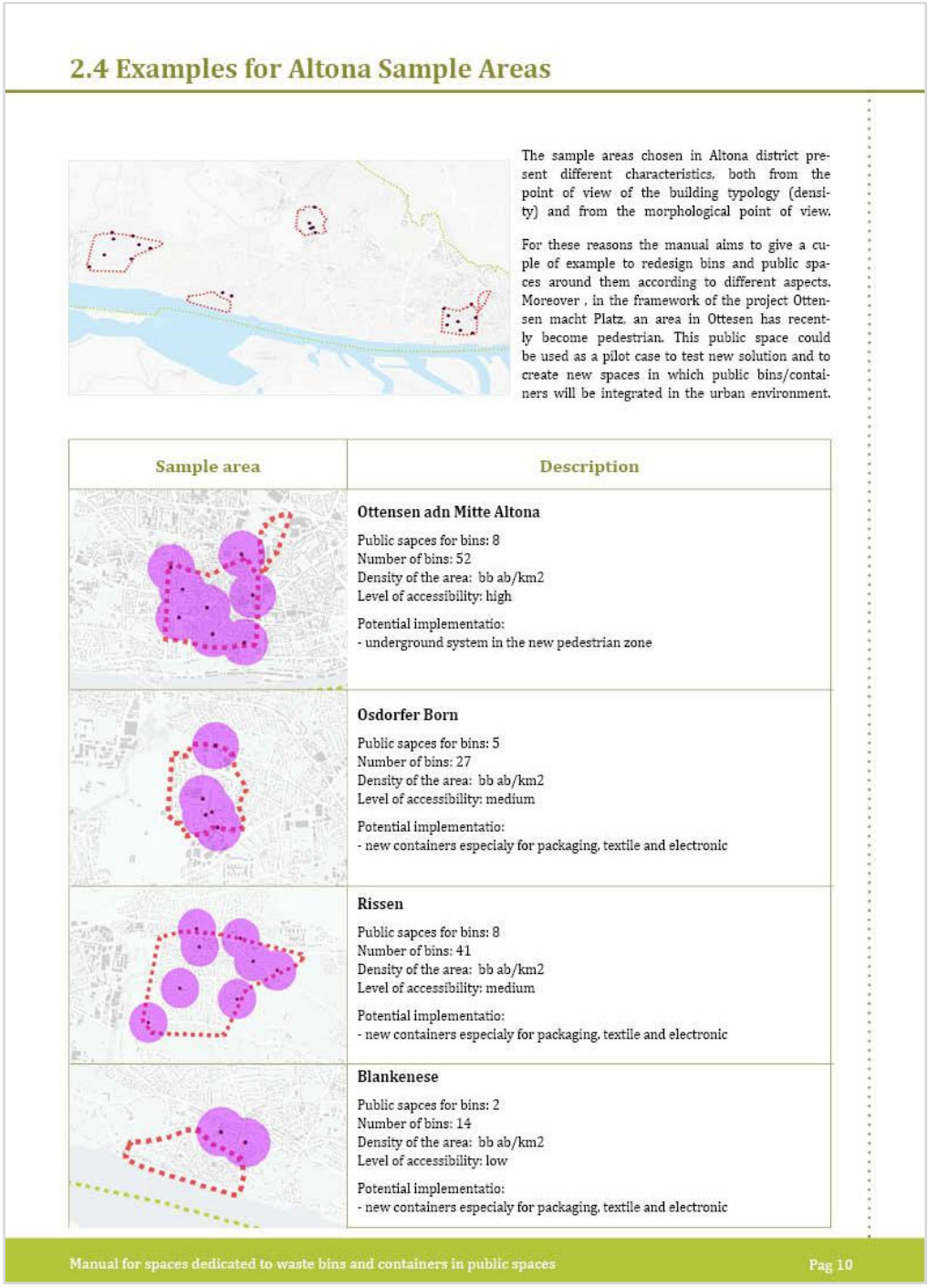
1. Standard requirements

Maximum walking distance from public containers

The manual will define the maximum walking distance from the public bins and, accordingly, the new possible location for them.

In the USA, 400 m or 5 minutes represent the walking accessibility (Gumtow, 2016). In a research done on waste collection in Ottawa city, 60 m are considered to be the maximum distance from the public bins (Corporation of the City of Ottawa, 2012).

Based on these researches, a maximum distance of 300 m has been used to analyze the accessibility in the sample areas.



2.4 Examples for Altona Sample Areas

The sample areas chosen in Altona district present different characteristics, both from the point of view of the building typology (density) and from the morphological point of view.

For these reasons the manual aims to give a cuple of example to redesign bins and public spaces around them according to different aspects. Moreover , in the framework of the project Ottensen macht Platz, an area in Ottesen has recently become pedestrian. This public space could be used as a pilot case to test new solution and to create new spaces in which public bins/containers will be integrated in the urban environment.

Sample area	Description
	Ottensen adn Mitte Altona Public sapces for bins: 8 Number of bins: 52 Density of the area: bb ab/km2 Level of accessibility: high Potential implementatio: - underground system in the new pedestrian zone
	Osdorfer Born Public sapces for bins: 5 Number of bins: 27 Density of the area: bb ab/km2 Level of accessibility: medium Potential implementatio: - new containers especialy for packaging, textile and electronic
	Rissen Public sapces for bins: 8 Number of bins: 41 Density of the area: bb ab/km2 Level of accessibility: medium Potential implementatio: - new containers especialy for packaging, textile and electronic
	Blankenese Public sapces for bins: 2 Number of bins: 14 Density of the area: bb ab/km2 Level of accessibility: low Potential implementatio: - new containers especialy for packaging, textile and electronic

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Figure 4.33 Possible contents of the manual regarding the walkable distance (HCU Team, 2019).

Dimension for bins and containers

According to the density of each area the manual will define standard dimensions in order to ensure an adequate service. Moreover, to reduce the visual impact, they should be sized in relation to the number of inhabitants to be served.

It will also provide some suggestions for bins in private spaces.

In houses/flats with limited space in kitchens, a system of three stacked bins is proposed, while, where more space is available, a bin with different compartments could be a solution.

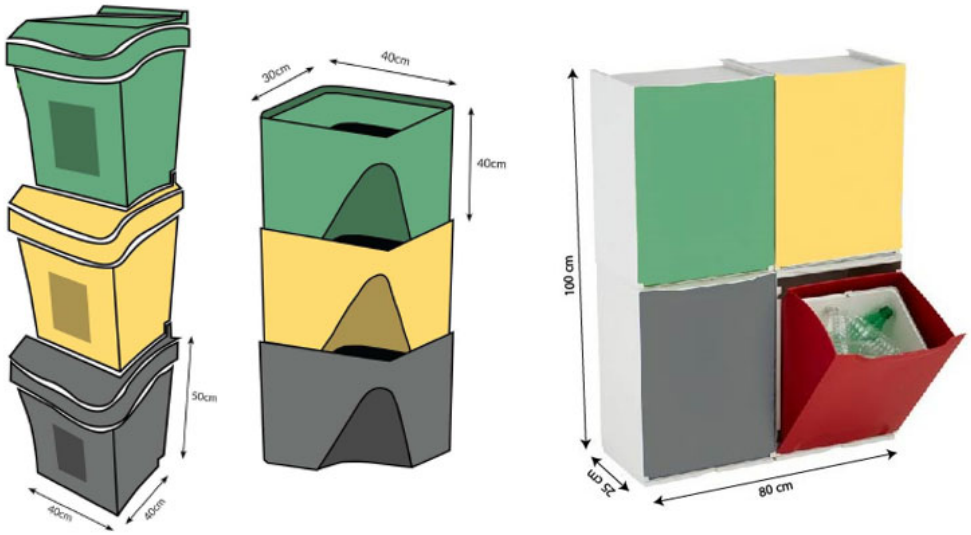

Figure 4.34 Possible dimensions and design for private bins (HCU Team, 2019; adapted from HCU-TUD students, 2018).

In some specific areas, with hilly topography, (e.g. Blankenese) new technologies should be introduced to simplify the transport of waste from households to the point of collection.

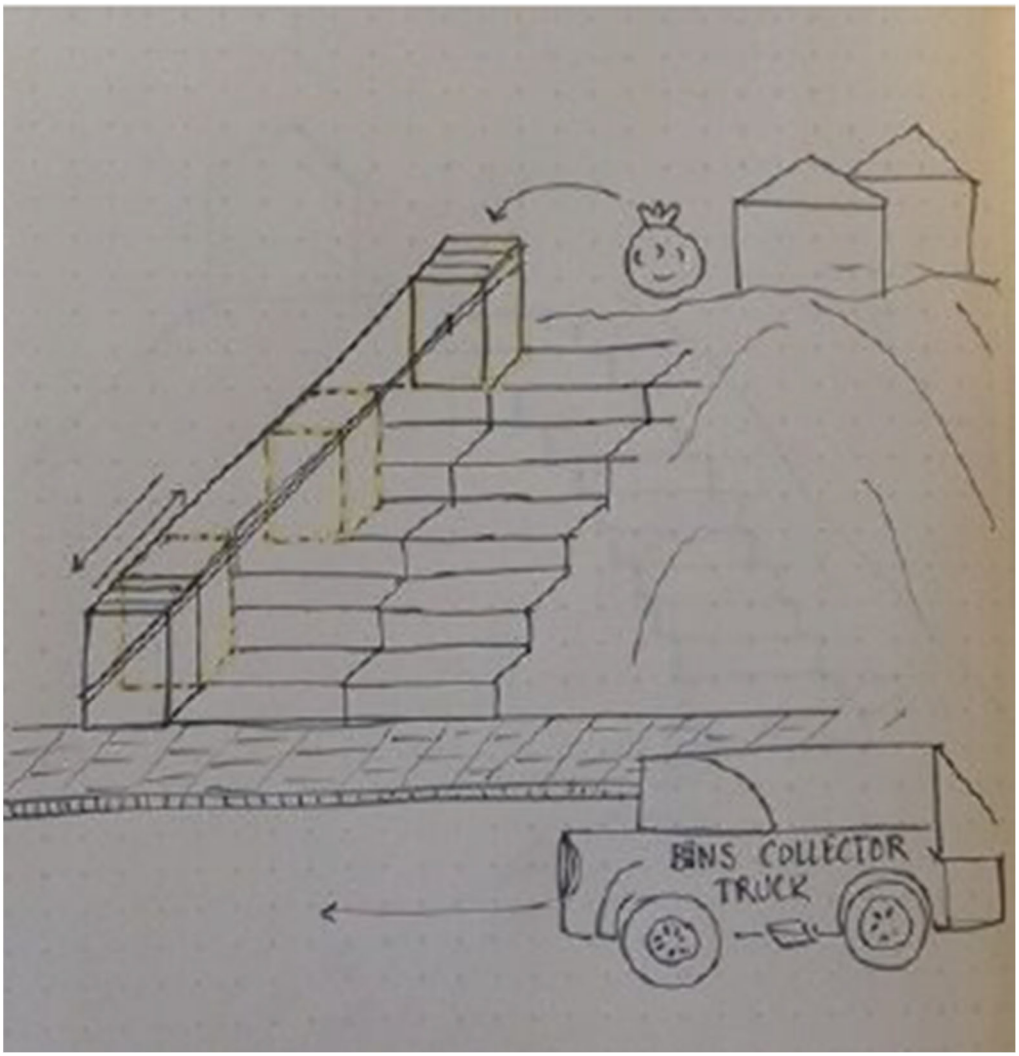

Figure 4.35 Example of new technology to collect waste (HCU - TUD students Summer School in Hamburg 2018).

Underground containers system

Where there is enough space, or in the case of new urban development projects, a system of underground containers should be included. Alternatively, a semi-underground system could be proposed.

These containers are 2-3 m deep and could have a volume capacity ranging from 0.6 to 5 cubic meters. The advantage is that the top portion of such underground containers occupies a relatively small area on the pavement (above ground), usually for the semi-underground 2 square meters and for the underground even less (Kaliampakos & Benardos, 2013).

Different typologies of containers will be analyzed in the manual in order to offer a set of solutions during the planning phase of new areas.

2. Design requirements

Four aspects are crucial in the design of the new bins/containers:

- *Capacity*: the dimension of the bins affects the public space around them,

therefore the local context (e.g., land use) should be considered before defining whether that area should be served with big container capacity or not.

- *Construction material*: the choice of the material is crucial for the bins' integration in the urban environment;
- *Shape and form*: in addition to contributing to improve the perception of the space and facilitate the collection, shape and form are a means of communication that can support correct waste separation;
- *Color*: the use of different colors helps the citizens to understand how to use the right bin for each kind of waste.

The manual will define the adequate capacity of bins and containers according to the number of inhabitants that these will serve. The type of material of the bins and containers needs to be chosen according to the area and the type of waste (e.g. a transparent container could facilitate the understanding of the waste's type but spoil the surrounding environment). Shape, form and color could be chosen with the residents of the area (this could be done in synergy with the service centers - EIS 3).

3.2 Examples for Altona Sample Areas

Typology	Proposed design	Description
Flexible/Modular		Modular containers could be assembled together according to the demand to be met. Around them aromatic plants, as lavander, violets, lilac, rose and jasmin, should be insert in order to improve the livability of the space and reduce unpleasant odours.
		Public containers should be integrated with existing urban furniture, like bench es. This example shows a plastic container under a banch, dedicated to papers collection. the construction matirial should be transparent, preferably plastic, in order to allow the user to see which kind of matirial they should leave here.
Permanent		More permanent solution could be adopted. Near existing park there is the possibility to install new containers. This is a strategic position because user can leave their waste on their way to the park, morover aromatic plants will be insert in order to coverodour and visual of the bins, but also to improve the biodiversity of the park.
		New bins could be insert inside urban garden, this would help to improve the rate of bio-waste separation in order to make composta and, in the other and, would be a smart solution to use the space around the public containers that is usual-
		Each container/bin should have a color linked to the material it collect to be easly recognizable. in the example the glass container has a glass pavimentation around to show what the user can deposit there. the paper container is sourron-

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Figure 4.36 Possible contents of the manual regarding proposed design (HCU Team 2019; adapted from HCU-TUD students, 2018).

3. Citizens' participation

The manual will describe methods to include the population in the redesign of public spaces.

Figure 4.34 shows an example that could be used as a tool in a survey to present various choices. Through surveys citizens will choose color and shape of the bins according to the material to be recycled. Colors and shapes with high scores will be used in the redesign of public bins and containers.

Figure 4.37 Possible contents of the manual regarding citizens' participation (HCU Team, 2019).

Requirement for implementation

In order to implement this EIS the manual should be available and accessible to all. Furthermore, in the development of new areas, planners and architects should pay attention to the design of public space dedicated to the waste containers, providing data and analysis in accordance with the manual.

Actors to be involved

The city of Hamburg, in cooperation with the waste management company SRH, should be the main drivers in the drafting of the manual and in its diffusion.

Architects, planners and engineers as well as public and private housing companies should become aware of this tool and can contribute on its improvement with their expertise. Finally, also the citizens should get involved in the design or redesign of the bins/containers.

Risk Management

The main risk is that, since the manual is a set of guidelines and not a normative text, there is not its recommendations will not be applied and followed. To avoid this risk a minimum standard, at least for the new development, should be set and imposed.

EIS Evaluation Model

Potential Environmental, Social, and Economic Benefits

Environmental benefits:

- The improved design and the better accessibility will lead to a better usage of containers and bins. Consequently, the correct separation and the recycling rate will increase, while the littering will decrease;
- reduction of odor;
- improvement of environmental quality through the inclusion of aromatic plants or bushes;
- better / recycled materials for the construction of the containers / bins

Economic benefits:

- a friendly design of the bin in both private and public spaces could have positive economic effects. In fact, if the design facilitates the user to recycle better, also the waste system management will benefit from its positive effects.

Social benefits:

- a redesign of the spaces will make these areas more livable and could also became a point of social aggregation (e.g. in the case of urban gardens around the public bins, see *Figure 4.33*);
- reduction of visual impact on the urban space.

EIS Change Model

Possible Location

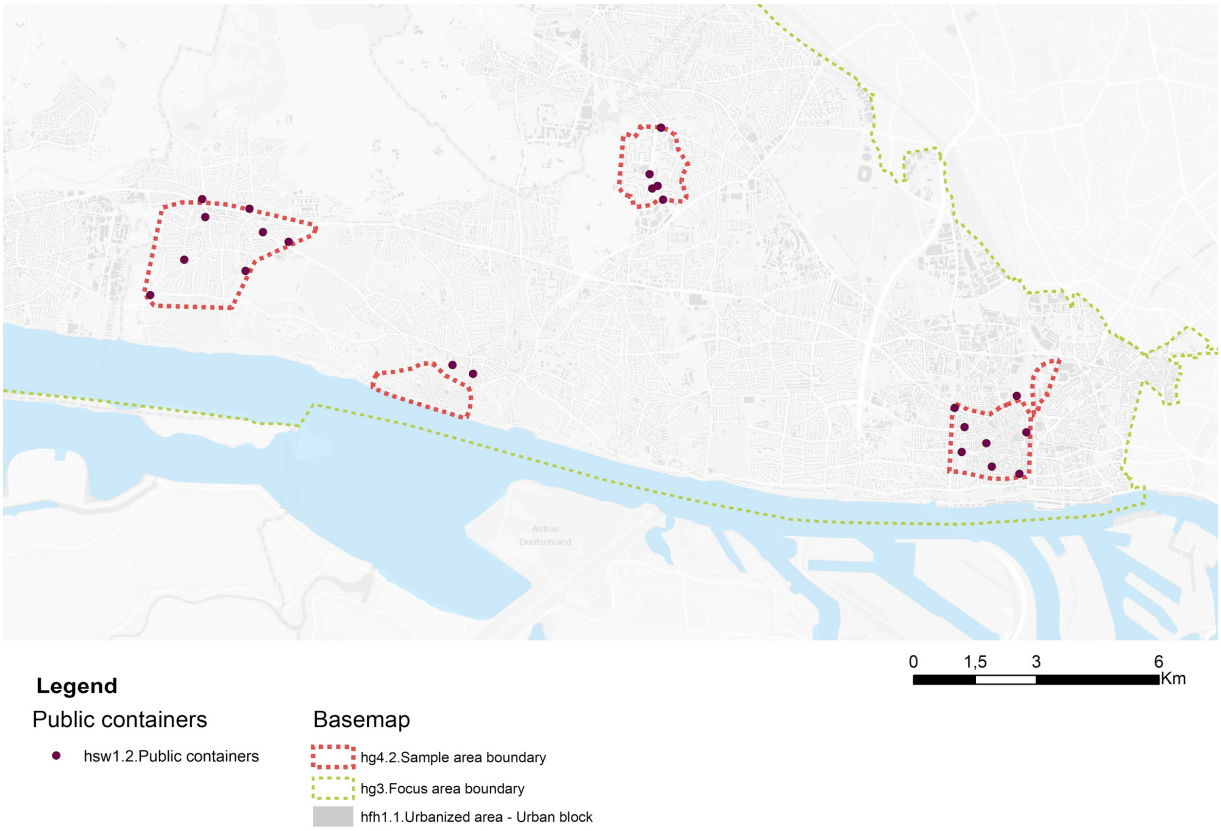

Figure 4.38 Map based on the Enabling Context Concept to identify the possible locations for the implementation of the public bins/containers (HCU Team, 2019).

Figure 4.38 shows the public container sites in, respectively next tom, the sample areas that could be redesigned with the support of the design manual.

Examples of possible implementations

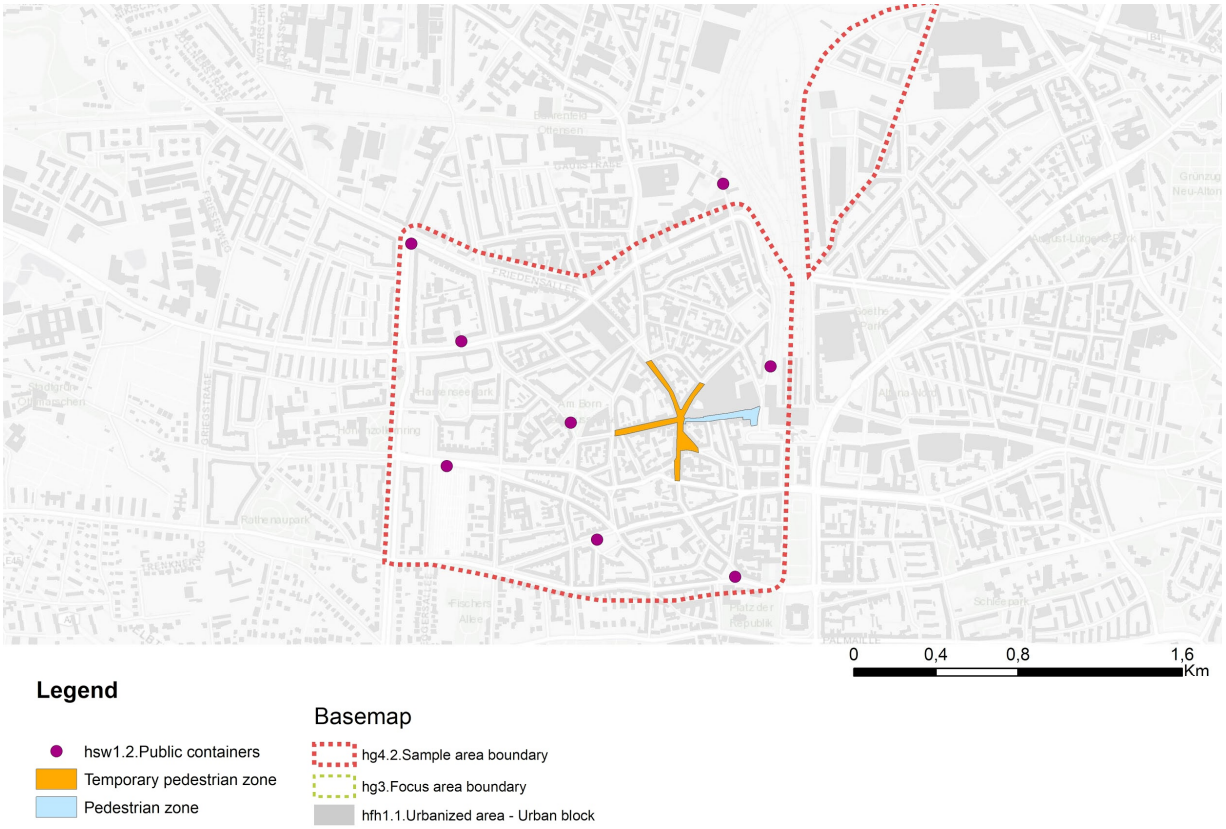

Figure 4.39 Map based on the Enabling Context Concept to identify the possible locations for the implementation of the underground bin system (HCU Team, 2019).

In Ottensen in the framework of project called *Ottensen macht Platz*, (Ottensen creates space) some streets in the neighborhood have been temporarily declared pedestrian, respectively care reduced, zones. The city and the district of Altona wanted to test for several months how mobility and use of public spaces changes. If the pedestrian, respectively care reduced, zones will become permanent, the use of the newly won car free public space will be discussed. Besides potentially using the public space for additional public green, outdoor seating of restaurants, it also could be used as a "pilot case" to test new solutions and to create new spaces in which public bins/containers will be integrated in the urban

environment. The map below shows the temporary pedestrian area in orange color.

EIS References
Study case Public Participation in Designing the Recycling Bins to Encourage Recycling
Flow Several Materials
Category of outcome Political / Economic / Social / Technological / Environmental / Legal
Location of the good practice Thrace, Greece

Author of the EIS Kiriaki M. Keramitsoglou and Konstantinos P. Tsagarakis
Actors involved Democritus University of Thrace, residents of Thrace

Specific objective The Department of Environmental Engineering of Democritus University of Thrace has examined the citizen's participation and involvement in design recycling bins. They defined a set of design issues that a bin should have in order to encouraging and making recycling more intuitive. The bin should:

- be easily handled by users
- not pose a risk to human health and safety
- be attractive
- protect the recyclables
- be easily handled by the staff of the waste management system

Figure 4.40 Set of design issues for the bins (Keramitsoglou & Tsagarakis, 2018).

Method of intervention

Their method was divided into two phases: first they selected randomly 757 participants who were asked to define design variables, i.e., shape, colour, and type of lid and insert slot. Subsequently, the research team, based on the participants' ideas, designed six new typologies of bins which were printed in a card in a random order. This card has been submitted to the residents, who have expressed their preferences.

"The results highlight the public preference for specific lids and insert slots, and a rectangular shape for all the materials apart from glass and compostables for engaging in recycling. In addition, the results suggest that a connection might exist between the colour of the recyclable material and the colour of the bin". (Keramitsoglou & Tsagarakis, 2018: p.1).

Potential for Learning / Transfer

The methodology used in this research could be transferred in the manual as one of the options to involved citizens' participation, not only in the redesign of public bins, but also in the redesign of public spaces.

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EIS 10_Guideline for new quarters towards Circular Bioeconomy

Flow Organic waste

Category Outcome Political / Economic / Social / Technological / Environmental / Legal

Author Andrea Lopes in collaboration with HCU

Implementation area New developments within Altona as a pilot and, later on, it should be adapted to new quarters in Hamburg.

Purpose To close the organic waste loop within the nexus of food, energy, water, soil and social planned behavior for increasing resilience capacity in the city while limiting pollution of the environment.

Target group Planners, architects and the District of Altona

EIS Description

Main Idea & Milestones

The latest studies on Urban Metabolism towards Circular Economy have shown that urban planning has long ignored the flows that shape cities (Roggema, 2019), which hinders a holistic advancement of sustainable and resilient urban systems (GIZ & ICLEI, 2014). Moreover, concerning urban metabolism-related projects, they generally emphasize on performance-oriented technical and entrepreneurial approaches, which hardly makes meaningful connections to social, economic and spatial contexts (Marin & Meuler, 2018).

Hence, synergetic thinking should become a priority and different urban flows, such as organic waste/food, energy and water, should be considered and integrated into governance and urban planning processes to address all organic waste-related actors and reprogram urban infrastructure and social behaviour towards a regenerative Circular Bioeconomy[6] (McConville et al., 2015; Roggema, 2019).

The EIS10 will therefore reflect on the latest scientific studies and compile best practice guide examples of cross-sectoral planning and policy guidelines such as: 1) A Policy and Program Toolkit to tackle food waste in cities, recently developed by the Natural Resources Defense Council (NRDC) in the U.S. (Mugica et al., 2019 - link); 2) The Circular Economy for Food strategies, provided by the Ellen MacArthur Foundation (2019); and 3) A framework developed by McConville et al. (2015), which is based on the concepts of food loops, multi sector approach,

[6] Circular Bioeconomy refers to the renewable segment of circular economy and it covers all sectors and systems that rely on biological resources (animals, plants, micro-organisms and derived biomass, including organic waste). The Bioeconomy Strategy set by the EU aims for a more innovative and low-emissions economy, reconciling demands for sustainable agriculture and fisheries, food security, and the sustainable use of renewable biological resources for industrial purposes, while ensuring biodiversity and environmental protection. Source: European Union, 2018.

and the waste hierarchy. With the compilation of these cross-sectoral best practice guides, the EIS10 aims to provide guidance for stakeholders and decision makers in Hamburg to adapt and implement this EIS in the context of Altona and Hamburg. Thus, the EIS10 will follow the Climate Action Plan of Altona (Bezirk Altona, 2019a) to identify which measures can be related to the actions from the compiled Cross-sectoral Guideline so that strategies can be created. These strategies should be integrating spatial, governance and appraisal through participatory processes to increase accountability in strategic planning towards a cross-sectoral food-energy-water nexus (McConville et al., 2015; Marin & Meulder, 2018; Petit-Boix & Leipold, 2018; Yan & Roggema, 2019; Zengerling, 2019).

> *"Integrated urban flows should be designed to lead to attractive places, in which the brilliance of the systems has become visible, can be witnessed and experienced by residents, and where new resources are celebrated."*
>
> (Roggema, 2019, p. 108).

Actions

Figure 4.40 depicts the compiled Cross-sectoral Guideline for improving nutrient management in the food chain (Mugica et al., 2019; Ellen MacArthur Foundation, 2019; McConville et al., 2015). This Cross-sectoral Guideline aims to guide technology and policy development within key sectors to improve nutrient management. As already mentioned, local stakeholders and decision makers may consult the compiled guideline as a base to define which of the suggested actions would be best suited for the context in which they aim to act upon.

Functional Criteria

Waste Hierarchy Actions	Key Sectors: Food Producers → Food Industry → Consumers → Waste Management			
Rethink	▪ Estimate Baseline level of food waste (e.g., NRDC measurement templates) [1] ▪ Assess potential to increase food rescue (e.g., NRDC rescue calculator) [1] ▪ Set short-term and long-term food waste reduction targets & develop a plan for ongoing measurement[1] (e.g., Measure 27 – Altona Climate action Plan, p. 155) ▪ Lead by Example[1] (e.g., public sector as a role model - Altona Climate action Plan, p. 159)			
Source Reduction	▪ Grow food using practices that help regenerate the environment[2] ▪ Increase fertilizer use efficiency[3] ▪ Minimize use of hormones & chemicals[3] ▪ Use no harmful chemicals[3]	▪ Minimize food waste within industry[3] (e.g., conduct food waste audits[1]) ▪ Optimize package design & size for sale to minimize waste[3] ▪ Minimize nutrients in food additives, unless proven health benefits[3] ▪ Use no harmful additives in food or packaging materials[3]	▪ Increase public awareness and provide concrete strategies for how households can prevent food from being wasted in the first place[1] ▪ Minimize meat & dairy consumption[3] ▪ Minimize purchase of products with food additives (without proven health benefits) [3]	▪ Minimize dilution-mixing of waste streams[3] ▪ Minimize harmful chemicals entering waste streams[3]
Rescue of non-processed nutrients	▪ Maximize reuse of food and crop waste for soil improvement or fodder[3] ▪ Connect with local consumer markets[2]	▪ Assess food rescue system capacity[1] ▪ Maximize recovery of food residues for reuse as food/fodder or fertilizer[3]	▪ Separation of food waste and reuse at home, whenever feasible and safe[3] ▪ Sort leftover medicines and harmful chemical in separate waste streams[3]	▪ Maximize systems reuse of nutrient-rich waste products[3] ▪ Leverage the latest innovations for separate collection and valorization of organic waste[2]
Recycling of processed nutrients	▪ Use organic fertilizers made from urban by-products[2] ▪ Return recycled food- and crop-waste products to agriculture whenever safe and feasible[3]	▪ Recycle non-reused food waste into productive products whenever safe and feasible[3]	▪ Maximize purchase of items produced from recycled waste[3] ▪ Recycle food waste at home, whenever feasible and safe[3] ▪ Separate food waste for further processing[3]	▪ Cooperate with public and private sector to develop valuable bioeconomy products whenever safe and feasible (e.g., fertilizers and biomaterial)[2] ▪ Create/expand infrastructure for organics recycling (e.g., Identify local food scrap recycling capacity and large generators of organic waste; & Provide funding and technical assistance for onsite/self-managed food scrap recycling for businesses and community organizations)[1]

Main requirements for implementation: Planning; Program; Funding; Partnerships

Figure 4.41 Cross-sectoral Guideline with waste hierarchy actions for improving nutrient management in the food chain. Adapted from: [1]Policy and Program Toolkit to tackle food waste in cities (Natural Resources Defense Council in U.S. - Mugica et al., 2019); [2]Circular Economy for Food strategies (Ellen MacArthur Foundation, 2019); and [3]Framework for improving nutrient management in the food chain (McConville et al., 2015).

At some point, decision makers should be encouraged to integrate water and energy flows into this Cross-sectoral Guideline by relating it with national and regional climate action plans. For instance, in the context of Altona, the EIS10 can relate this Guideline to a series of different measures from Altona's Climate Action Plan[7] (Bezirk Altona, 2019a) (e.g., neighborhood service centers; green streets and squares campaign; and increase in recycling rate) and put them into practice in new urban development areas such as the Science City Bahrenfeld (FHH, 2019 - link).

The idea is to explore the synergistic potential of green infrastructure to relate European Circular Economy and Bioeconomy strategies with the Cross-sectoral Guideline and the regional and local climate action plans for meeting new urban development demands in Altona, such as:

1. Demand for Green Infrastructure –
   The Altona Climate Action Plan states in the chapters of 'Green and open spaces' and 'Climate adaptation' (Bezirk Altona, 2019a: pp.129-146), that current and future urban development areas must be adapted to urban climatic problems such as urban heat island effects and flooding. In critical areas, such as Altona Old Town, Altona North, Ottensen and the southern Bahrenfeld, the focus should be on creating new green and water areas whereas densification with soil sealing should be avoided wherever possible (Bezirk Altona, 2019a, p.135). Such measures should also include private areas (e.g. backyard, façade or roof greening), besides public areas where the municipality can act directly (Bezirk Altona, 2019a, p.135).

[7] The referred measures from the Altona's Climate Action Plan (Bezirk Altona, 2019a) are already mentioned in the description of EIS5 - Organic waste for urban Gardens.

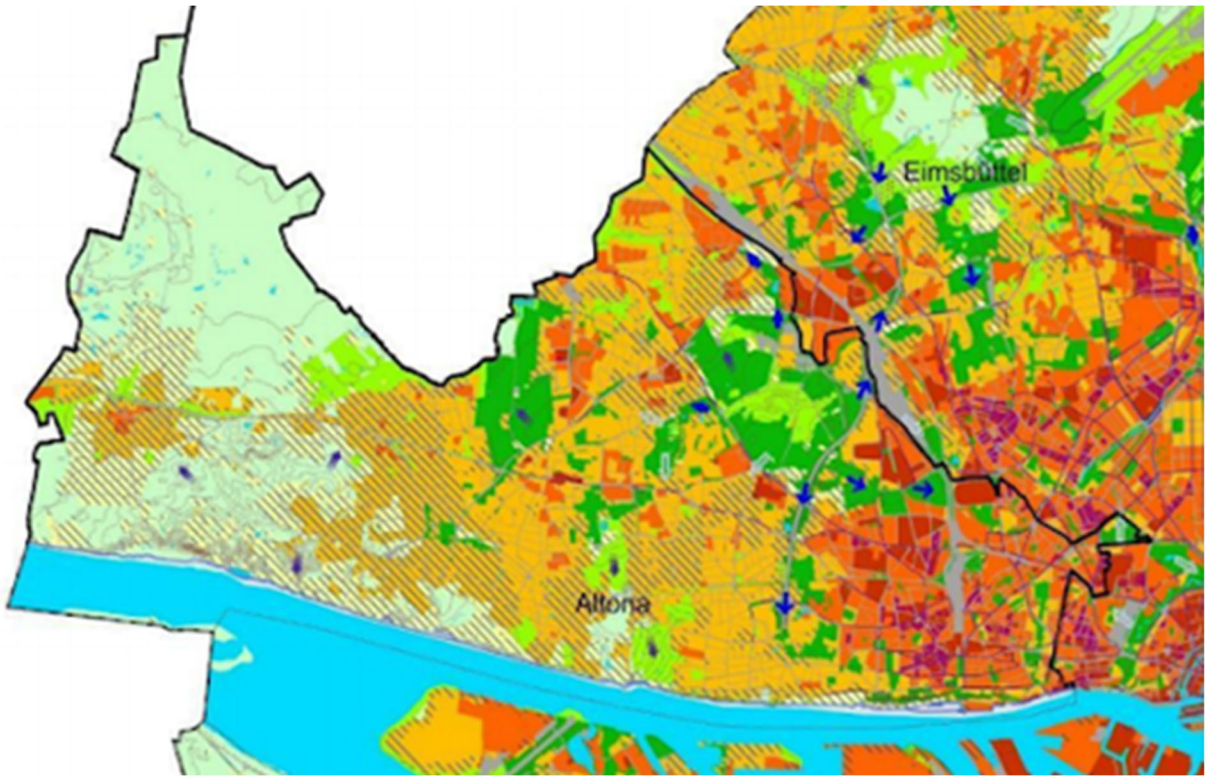


Figure 4.42 City climate map Hamburg. Source: Bezirk Altona, 2019a.

In such a scenario, from the urban metabolism perspective, the highly demanded Green Infrastructure (GI) gives the opportunity to integrate organic waste, water and energy flows, as well as maintaining their lifecycle loop closed locally (Hansen et al., 2017; Marin and Meulder, 2018).

The wood waste share of garden waste from public green areas, allotment gardens and urban gardens has the potential to be transformed into biochar through the pyrolysis process, as done in Sweden by the Stockholm Biochar Program (C40 Cities & EIT Climate KIC, 2018, pp. 124-127)[8].

The leaves waste that is highly generated during the fall could supply local urban gardens and the ZRE Plant (EIS6) to feed their composting activities and generate soil conditioner for existing and planned GI.

The food waste should supply urban gardens, the ZRE Plant, and possibly micro-scale anaerobic digestion plants, as it has been successfully tested by the DECISIVE Research Project (Thiriet et al., 2020). Therefore, the processed food waste would provide compost and fertilizer for existing and planned GI.

By treating the organic waste stream locally, the urban gardens, the ZRE Plant, as well as future micro-scale anaerobic digestion and biochar plants, should be the ones providing compost, biochar and other landscape resources to prevent the use of peat and mineral fertilizers, as advised by the

[8] "Residents provide garden waste to the city, which is turned into biochar – a charcoal-like product that can sequester carbon in soil for thousands of years. This biochar is used as a soil conditioner in public and private plant beds, therefore creating a vast carbon sink. The by-product of the biochar production process, pyrolysis gas, is used to help generate energy for the city's district heating system." (C40 Cities & EIT Climate KIC, 2018, p. 125).

German Climate Action Plan 2050 (BMUB, 2016, p. 71). In other words, the material resources needed to implement the planned GI should come from local sources as much as possible. Furthermore, when compost and biochar are generated locally and incorporated into GI, rainwater can be better absorbed, reducing the risk of flooding; and energy can be generated from the ZRE and future micro-scale anaerobic digestion and biochar plants, to feed the local energy grid (Hansen et al., 2017; Marin and Meulder, 2018).

2. Demand for food security –
Half of the world's population currently lives in cities and by 2050 it is expected that 80% of the world's food will be eaten within cities (Ellen MacArthur Foundation, 2019). Such demand calls for a holistic approach to include the entire food cycle from production and distribution to consumption and resource recovery (McConville et al., 2015). For that, with the support of stronger guiding principles and actions, cities, businesses, and governments have a unique opportunity to trigger a transformation towards a circular economy for food, since their citizens, retailers, and service providers are all in close proximity, making new types of business models (Ellen MacArthur Foundation, 2019).

   A good example is the Biointensive micro-farming program which has been implemented throughout France (C40 Cities & EIT Climate KIC, 2018, pp. 100-101)[9]. In addition, the Circular Economy for Food strategies from the Ellen MacArthur Foundation (2019) defends that new urban developments should incentivize local composting and food production through all key food-related sectors whenever possible. Therefore, in the context of Hamburg: A) Farmers from the peri-urban areas should use compost from the ZRE and BKW (Biogas and Compost facility) plants; B) Retailers should send unsold food to food-rescue restaurants and animal farms, expired food should be composted locally in combination with urban farming practices, which would allow the retailers to produce some of their products whenever possible[10]; C) Consumers should reduce and recycle their food by either separating well, composting at home and in the community gardens so that local nutrient recovery is well established (Mugica et al., 2019; Ellen MacArthur Foundation, 2019).

   In other words, when GI incorporates circular bioeconomy strategies, it provides a high range of ecosystem services, such as organic waste recycling, rainwater catchment, renewable energy and community interaction. Consequently, GI with applied circular bioeconomy strategies enables a high land use value to a neighborhood, capable of fairly competing with the demand for new housing and schools so that re-densification without

[9] "Biointensive micro-farming uses the principles of permaculture to produce high quality products on a very small area. The objective is to maintain an intensive production while keeping the soil alive and fertile without chemical entrants, during all seasons. It also has a social impact as it provides employment and training opportunities to the neighboring communities to work on the farm, prepare and sell food locally." (C40 Cities & EIT Climate KIC, 2018, p. 101)

[10] As in the case example of a Belgian store, which tries out 'farm to table' growing on its own roof (link - Echikson and Olsen, 2018).

considering the need for multifunctional green areas is avoided (Hansen et al., 2017; Bezirk Altona, 2019a).

3. Demand for policies for adapting urban infrastructure to facilitate Circular Bioeconomy -
   New neighborhoods should have mandatory quarter service centers to address community collaboration practices and even for nurturing startups to measure and develop innovative strategies to close the loop of specific organic waste products (Bezirk Altona, 2019a; Mugica et al., 2019; Ellen MacArthur Foundation, 2019). For instance, by using orange peels for the production of textiles before composting its residuals (should be done in collaboration with private, educational and retail sectors) (D5.2, REPAiR, 2018a).

4. Demand for citizen engagement and behavioural change -
   For changing citizen behaviour towards circular bioeconomy, the EIS10 will take support from the NRDC's Policy and Program Toolkit (Mugica et al., 2019) and from the social planning behaviour theory defended by a PhD study on "Closing the Food Systems Loop: Leveraging Social Sciences to Improve Organic Waste Policy" (Geislar, 2016). Besides, the blockchain and voucher economy has great potential for supporting behavioural change towards a more circular society, thus further studies should be realised in this field in the context of Hamburg (Abudheen, 2018 - link).

Requirements for implementation

The following Figure 4.42 provides suggestions for translating into policy the actions presented in the Figure 4.41 (Mugica et al., 2019; Ellen MacArthur Foundation, 2019; and McConville et al., 2015). Many of the actions suggested here are guidelines, standards, and certification systems, some of which are sector-specific. Those that require input and action from multiple sectors, highlighted in bold (Mugica et al., 2019; Ellen MacArthur Foundation, 2019; and McConville et al., 2015).

Supporting policy actions for improving nutrient management within key sectors	
Agriculture	▪ **Register of safe agricultural fertilizers & chemicals (including those from food waste)[2]** ▪ Guidelines for reuse/recycling food waste within agriculture[2] ▪ **Certification of "reuse" agriculture products[2]**
Food Industry	▪ **Vision for food-loop management, including collaboration points and standards for reuse/recycling[2]** ▪ Register of food additives, including nutrient content, toxicity, persistence, and health effects[2] ▪ **Certification & product labeling to promote reuse/recycling[2]** ▪ Address policy barriers to safe donation of food (Streamline, clarify and disseminate health department regulations that pertain to food donation with the goal of ensuring food safety without imposing undue barriers to donation)[1]
Consumers	▪ **"Sustainable lifestyle" guidelines, including advice on purchasing, preparation, & storage[2]** ▪ Incentives for household-level reuse/recycling of food products[2] ▪ **Guidelines for home reuse, separation of food waste & safe disposal of harmful chemicals[2]** ▪ Lead by example (e.g., public sector as a role model - Altona Climate action Plan, p. 159)[1]
Waste Management	▪ Technical standards & organizational norms for designing systems for nutrient reuse/recycling[2] ▪ **Monitoring standards & norms for tracking nutrients and harmful chemicals in waste[2]** ▪ Lay groundwork for broader food waste prevention and reduction efforts through changes in waste system collection and financing (e.g., Evaluate your waste system to identify opportunities for policy changes that boost prevention, donation and recycling efforts, incorporating as many of those identified as BEST as is feasible)[1]
	Best waste policy examples (Mugica et al., 2019, p. 22)[1]
	▪ TIPPING FEE. Alter landfill tipping fee so that it is higher than tipping fee at organics management facilities ▪ FINANCING. Transition to Pay-As-You-Throw or other unit-based pricing for garbage service ▪ COLLECTION FREQUENCY. Change garbage collection to every-other-week and recycling/organics to weekly ▪ PREVENTION FUNDING. Enact a trash disposal surcharge that funds prevention efforts ▪ COMMERCIAL/MULTI-FAMILY. Require businesses and multifamily buildings to submit organics/recycling collection plans to the city ▪ COLLECTION SERVICES. Require that recycling/organics collection be offered to all trash subscribers
	Good waste policy examples (Mugica et al., 2019, p. 22)[1]
	▪ FINANCING. Include garbage service as a line item on property tax bill or as separate bill ▪ COMMERCIAL/MULTI-FAMILY. Require new commercial and multi-family buildings to have adequate space for onsite recycling/organics collection ▪ COLLECTION SERVICES. Ensure garbage haulers are allowed under city code to also offer recycling and organics collection (even where service is not currently available)

Figure 4.43 Supporting guidelines and policy actions for improving nutrient management within key sectors based on the waste strategy that they support. Adapted from: [1]Policy and Program Toolkit to tackle food waste in cities (Natural Resources Defense Council in U.S. - Mugica et al., 2019); and [2]Framework for improving nutrient management in the food chain (McConville et al., 2015).

Actors to be involved

Even though the main sectors to be involved were already mentioned, the Ellen MacArthur Foundation (2019) provides further details on the role that the food industry, city governments, learning institutes and financial institutes should play for building a circular economy for food in cities:

Food Industry	Food Brands	▪ Source regeneratively grown ingredients ▪ Prevent food waste along supply chains ▪ Design healthy food items and us marketing to increase their popularity
	Retailers and commodities/food buyers and traders	▪ Prevent food waste through improvement logistics ▪ Valorize unavoidable organic waste or by-products ▪ Source food items to provide consumers with the right options ▪ Use marketing to increase popularity of circular products
	Restaurant and other food providers	▪ Source regeneratively grown ingredients ▪ Prevent food waste and valorize unavoidable food waste and organic by-products ▪ Design meals that provides consumers access to circular food options
Learning Institutes		▪ Integrate the food system into curricula ▪ Advance research and establish private-public partnerships to establish innovation hubs ▪ Apply circular economy principles in learning institution campus
City Governments		Collaboration is needed across all levels of government to implement policies that: ▪ Support farmers in adopting regenerative practices ▪ Incentivize food waste prevention and separate collection and valorization of organics ▪ Support businesses for taking action on circular economy principles
Financial Institutes		▪ Provide financial tools to de-risk and stimulate the transition from linear to circular activities in the food system ▪ Steer capital towards businesses leading the shift towards a circular economy of food

Figure 4.44 Further stakeholders to be involved for building a circular economy for food in cities. Source: Ellen MacArthur Foundation (2019).

Constraints

> *"Closing the food loop is possible if all stakeholders apply thinking from the waste hierarchy, minimizing waste within their own sector and assuring that waste flows to other sectors are in optimal condition for reuse. No sector can do it alone, but together we can achieve sustainable nutrient management."*
>
> (McConville et al., 2015, p. 10.)

EIS Evaluation Model

Potential Environmental, Social, and Economic Benefits

As mentioned before, by integrating Circular Economy practices into Green Infrastructure, a series of Ecosystem Services can be enabled, which consequently brings with them a series of environmental, social, and economic benefits (Hansen al., 2017; Marin and Meulder, 2018). Most of them were previously mentioned in the description of the EIS4, EIS5 and now at the EIS10 actions section. Nevertheless, by implementing the Circular Economy for Food strategies proposed by the Ellen MacArthur Foundation (2019), other benefits can be reached, such as:

"Macroeconomic benefits. Achieving these three ambitions[11] would allow cities to move from passive to active catalysts of change, and generate annual benefits worth USD 2.7 trillion by 2050, that can be enjoyed by people around the world.

Environmental benefits. Avoiding the degradation of 15 million hectares of arable land per year; and saving 450 trillion liters of fresh water.

Health benefits. Health benefits include lowering the health costs associated with pesticide use by USD 550 billion, as well as significant reductions of antimicrobial resistance, air pollution, water contamination, and foodborne diseases.

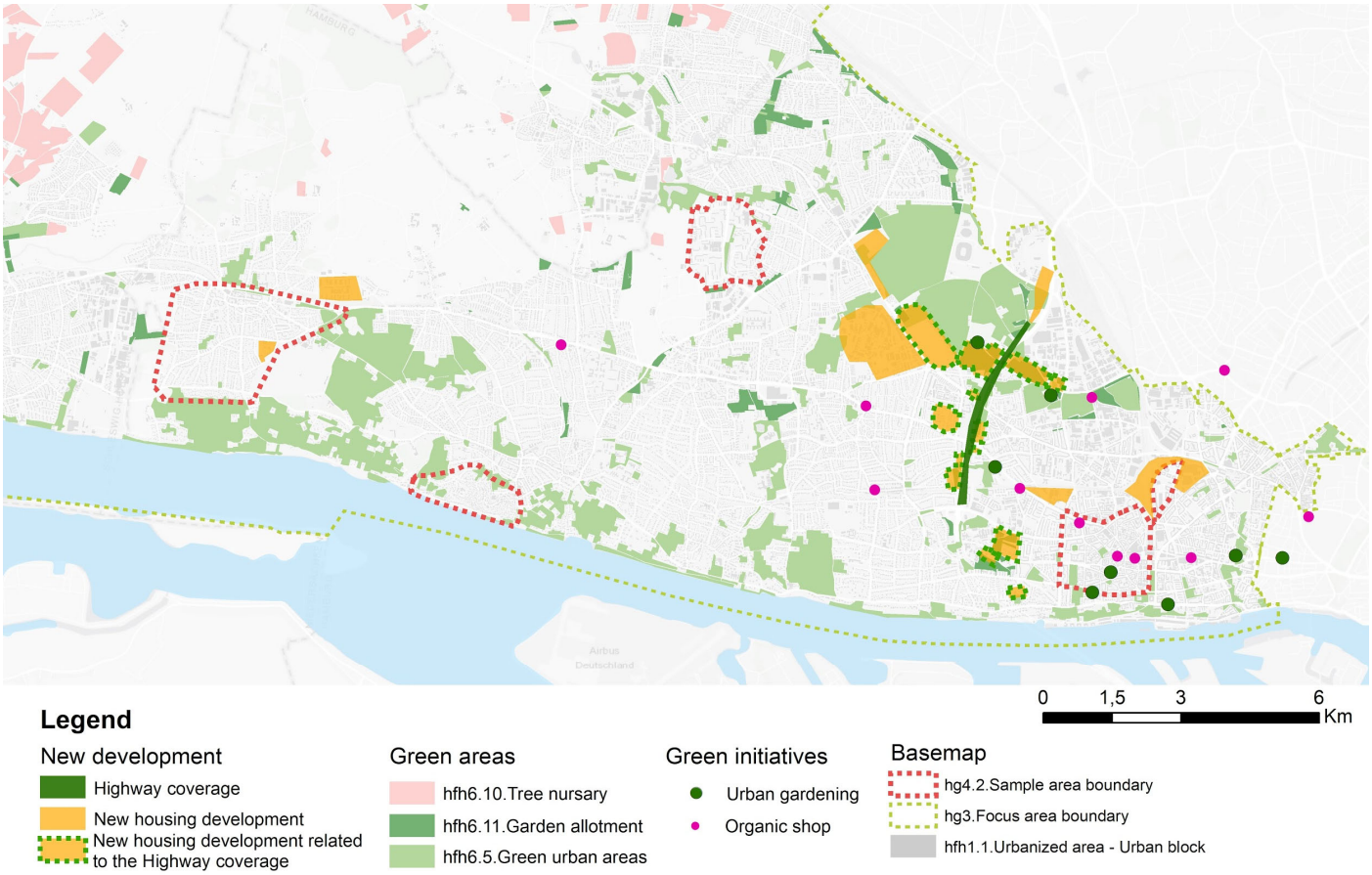
Economic opportunities. Cities can also unlock an economic opportunity upwards of USD 7 000 billion by reducing edible food waste, using nitrogen and phosphorus from food by-products, and organic materials for new cycles.

Business opportunities. From producers and brands to processors and retailers, businesses across the food value chain can tap into high-growth sectors such as biomaterials or delicious plant based protein products."

(Ellen MacArthur Foundation, 2019)

EIS Change Model

Possible Location



[11] 1)Source food grown regeneratively, and locally where appropriate; 2) Make the most of food; and 3) Design and market healthier food products (Ellen MacArthur Foundation, 2019).

Figure 4.45 New housing developments, new and existing green areas as enabling contexts to implement circular bioeconomy following the guideline (HCU Team, 2019).

Examples of possible implementations

The coverage of the A7 highway will demand a considerable amount of soil and part could be provided by the local quarters with their urban gardening and the ZRE Plant with composted material. Besides, the Science City Bahrenfeld, which will also demand soil for new green areas, requires a stronger interaction between the local community and the university - Biology and Chemistry are one of the departments that will be part of this new Hamburg University Campus (*FHH*, 2019, p. 19).

Therefore, the Quarter Service Centers have the potential to be even more innovative in this context by serving as an incubator for exploring new ways each food waste type could be managed throughout its life cycle. For instance, as already mentioned by REPAiR's Pilot Cases (2018a), coffee beans, orange peels and even bread waste could be turned into new products before being composted. Furthermore, as part of this incubator, the presence of community-based composting and urban gardening should be a promising instrument to promote this envisioned community-university interaction.

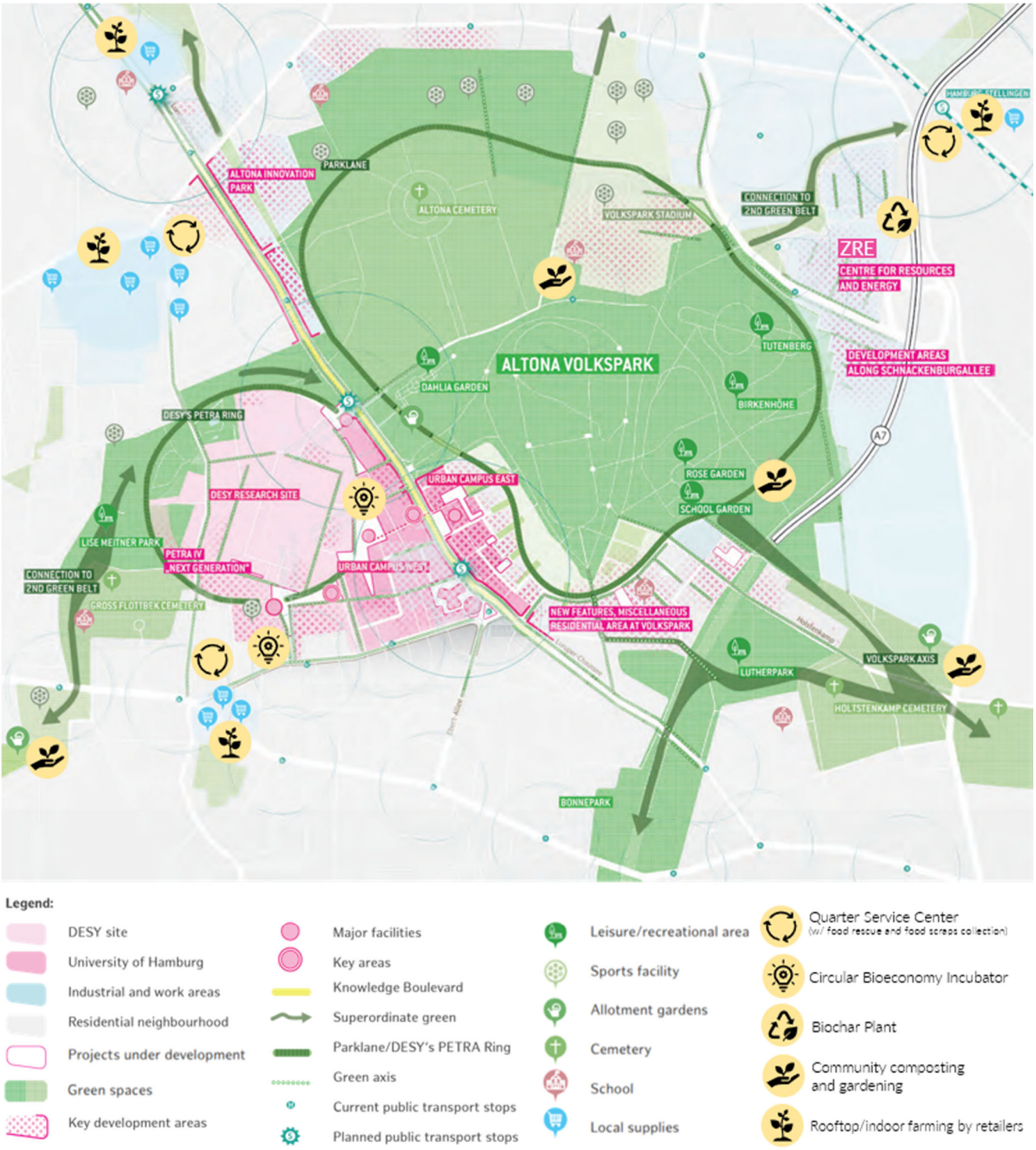


Figure 4.46 Example of possible implementation of the EIS10 at the Science City Bahrenfeld. Adapted from 'SCIENCE CITY BAHRENFELD' (FHH, 2019, p.13).

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5. Eco-Innovative Strategy for Osdorfer Born Sample Area - The Pilot Case

Although the implementation of EIS was not intended to take place during the lifetime of the REPAiR project, it was possible to test and partly implement some of the EIS or at least comparable ideas in Hamburg. This was possible, because Stadtreinigung Hamburg SRH was in parallel to REPAiR active in the Horizon2020 project FORCE that could financially support the implementation.

In the summer 2019 SRH started a participatory process in the frame of FORCE with the aim to involve different stakeholders to specify problems and to choose solutions to be implemented in the sample area Osdorfer Born. Involved stakeholders were Hamburg's public housing company SAGA, the neighborhood management ProQuartier and CHANCE Beschäftigungsgesellschaft mbH Hamburg. ProQuartier and CHANCE are subsidiary companies of SAGA and both have been active in Osdorfer Born for many years. CHANCE is an employment company that aims to reintegrate long-term unemployed persons into the job market. The employees of CHANCE work as concierges, the are contact persons for the tenants and support the facility management.

The participating stakeholders then together developed a concept how to implement the chosen solutions and how to combine them. From August 2019 until September 2020 the following activities in Osdorfer Born took place that were partly inspired by ideas from the EIS 1, 2, 3, 4, 9:

- Information and training of the concierges working for CHANCE as contact persons for questions on waste
- Development of new stickers on the four-bin system with larger self-explanatory pictograms to avoid the language barriers; placement of stickers on some of the four-bin systems
- Renovation of some of the containers (this was already planned in the frame of renovation of the houses, but the accessibility of the containers was taken more into account)
- Redesign and installation of public bins
- Conversion of one concierge office into a waste information point that also showcases second hand furniture from Stilbruch second hand store and varieties of bins suiting to different apartments respectively kitchens
- Information campaign reaching circa 1000 households that were offered free little bins for bio-waste and free paper bags for organic waste
- Composting project in one of the day care centers
- A neighborhood festival with different activities (quizzes, puppet theatre for children explaining correct recycling in cooperation with the public library, showcase of modern bins for the apartments)
- Bio waste recycling weeks in two streets to inform inhabitants in a playful way on correct bio waste separation

- Bulky waste service: tenants can contact the concierges; bulky waste is then transported with a trolley to a container or a garage in the neighborhood and then collected by SRH
- All activities are monitored by SRH by measuring the amount of the different waste fractions before and after the activities and by conducting interviews

The activities will be evaluated by SRH. The aim is to understand which of the solutions were successful and why. Besides SRH also the other participating stakeholders SAGA, ProQuartier, CHANCE, but also the district of Altona are interested in the outcomes. Successful solutions might be replicated in other parts of Altona respectively Hamburg.

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6. Eco-Innovative Solutions for Pinneberg

As already anticipated, the case study within the County of Pinneberg had followed a different logic and therefore is here considered separately. Of course, connections between tree nurseries activities and general agriculture can be found: this solution might work also for other parts of the agricultural sector. The EIS for Pinneberg is not as detailedas some of the EIS for Altona, also no LCA was conducted for this EIS mainly due to the lack of data.

6.1. Enabling Environment for Circular Economy

EIS 7_Collection system for green waste from tree nurseries

Flow Organic waste from tree nurseries

Category Outcome Political / Economic / Technological / Environmental / Legal

Author HCU REPAiR team in cooperation with County of Pinneberg

Implementation area County of Pinneberg, Tree nursery areas

Purpose Improved management of biowaste from tree nurseries

Target group Tree nurseries

EIS Description

Main Idea & Milestones

Description of the Status Quo: The county of Pinneberg is characterised by a mosaic of land uses (e.g. villages centers, detached house areas, social housing, retail, logistic) and open spaces (agricultural land, largest European area of tree nurseries, garden plant production, recreation areas, and natural preservation areas). The concentration of circa 200 tree nurseries and garden plant producers is rather unique. However, due to their proximity to Hamburg, many municipalities in Pinneberg County are attractive for new housing. Therefore, some tree nurseries are threatened by urban development of the surrounding settlements (see REPAiR, 2018b). In 2017 the 199 then existing tree nurseries in Pinneberg County had a total surface of 2 720 ha (Statistisches Amt für Hamburg und Schleswig-Holstein, 2017).

The main waste fraction produced by the tree nursery is biowaste (others include pots, plastics). It has been calculated by the HCU REPAiR team that the tree nurseries produce approximately 40 832 tons of green waste per year. This calculation was made based on data on green waste on regional level in Schleswig-Holstein (BWS, 2011). According to the law the tree nurseries are responsible for the disposal of their biowaste and they have the right to do the disposal on their area. The disposal respectively further treatment is done in different ways: storage on the site, creation of compost, composting and

production of gas, incineration. The biggest part is currently stored or incinerated directly on site, which is a rather problematic practice in terms of sustainability and energy recovery. It is also a problem due to the fact that many tree nurseries are located in the peri-urban tissue of municipalities and their burning activities disturb the neighborhood (REPAiR, 2018b).

Figure 6.1 Example of a tree nursery next to build environment (HCU Team, 2018).

The current land use situation and the problems generated by the incineration activities have created a need for solutions to improve the situation and to make the waste management of tree nurseries more sustainable. The tree nursery association has an interest to support its member enterprises to become more ecological. The county of Pinneberg has the same interest; the county wants to keep the tree nurseries active and to support them for future challenges. The problematic behind this is, that once tree nurseries close down, their former areas could be changed into housing areas. The county would like to avoid this to prevent further urban sprawl (REPAiR, 2017a; REPAiR, 2018b).

The main ideas of the solution are:

- The collection and treatment of green waste from tree nurseries is organized to avoid on-site incineration and to make use of the green waste for production of energy and compost, respectively for reuse of wooden material.
- The newly organized collection and treatment has a moderate price and is feasible from a logistic point of view for the tree nurseries.
- The compost that will be produced during the process is of high quality avoiding the risk of plant illnesses when it is used in tree nurseries.

The milestones are:

- Involve the tree nurseries and convince them of the advantages of a more circular way of waste management.
- Collect more information about the waste management of the tree nurseries; so far only selective cases are known showing the huge variety of how they treat their waste.
- Consider the governance setting: neither the county nor the tree nursery association have legal power to change the situation, but they can cooperate and work as moderators and multipliers. The willingness of the tree nurseries and other actors to cooperate is thus crucial.

Actions

The following actions were respectively are to be taken:

- Kick-off PULL meeting with relevant stakeholders (county, waste management company of the county GAB, tree nurseries association, representatives of tree nurseries): identification of problems, discussion of relevance of the problematic, brainstorming on ideas for solutions, agreement on next steps
- The tree nurseries association, representatives of the tree nurseries and the waste management company of the county Pinneberg (GAB) agree to run tests on the possibility of composting the biowaste from tree nurseries. Laboratory tests and tests in the bio waste treatment plant of GAB are conducted

Figure 6.2 Biowaste treatment plant of GAB (HCU Team, 2018).

- The laboratory tests have positive results; the quality of the compost is good. The tests in the bio waste treatment plant of GAB show that a separated treatment of biowaste from tree nurseries and biowaste from households can be conducted. This is important in order to have separated final products: high quality compost that is free of plant diseases and the compost from biowaste from households that generally has a lower quality.
- The single tree nurseries will be contacted and asked if they are interested in cooperating with GAB to have their bio waste treated in the plant.
- More detailed quantitative research on the exact amount and typology of the biowaste needs to be conducted.
- A logistic concept to transport the biowaste from the tree nurseries to the biowaste treatment plant needs to be developed. The plant is situated quite central inside the tree nurseries area. There are several logistic options: the tree nurseries organise themselves the transport to the plant, or GAB is collecting the biowaste from the sites of the tree nurseries, or the biowaste is brought to intermediate stockage sites from where it is then transported to the plant.

Requirement for implementation

The single tree nurseries need to be contacted and convinced to cooperate with GAB to have their bio waste treated in the plant. A contract between the tree nurseries and GAB about the conditions and the price of the bio waste treatment needs to be set up.

Physical resources

The bio waste treatment plant of GAB has the capacity to treat the bio waste from tree nurseries in a separated treatment line. The resources for transport and stockage of the bio waste need to be examined.

Financial resources

The price for the treatment will depend on the number of tree nurseries that participate and the quantity of the treated bio waste. Also, the different logistic options will influence the overall cost. According to the tree nurseries that participated in the kick-off workshop, the price for treatment was increasing, therefore the solution provided by GAB might be an interesting alternative.

Actors to be involved

Tree nurseries, tree nursery association, county, waste management company of the county.

Constraints

The solution is depending on the participation of tree nurseries. If their number is too small, the cost for GAB offering the service might be too high. It is necessary to reach high enough economies of scale, but the exact number cannot be calculated now. As mentioned before, neither the county nor the tree nursery association have legal power to change the situation, so their volunteer cooperation is necessary.

Risk Management

The law on the treatment of bio waste on the site of the tree nurseries might be changed and on-site incineration and stockage might be forbidden. This would then force the tree nurseries to find solutions for bio waste treatment and this could make the described EIS more attractive.

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7. Transferability of the Eco-Innovative Solutions

In this Chapter the EIS that have been transferred from or to other REPAiR case studies are presented.

7.1. Transferred EIS from other REPAiR Cases

Transferable solutions from Ghent related to waste prevention:

1. FOOD WASTE SCAN FOR SCHOOLS

   "Several apps developed to reduce food waste in professional kitchens have proven to be successful to avoid food waste during the conservation and preparation process. The aim of this EIS is to test/adapt these tools to the school context during lunch time.

   A user-friendly tool helping kitchen personnel to keep track of the amount and nature of the avoidable food waste on a daily basis, is a first step to raise awareness for the problem and look for adequate solutions. In the same way, measuring and communicating the amount of food waste as the result of lunch in the canteen, is a way of making students aware of the problem". (REPAiR, 2019).

2. MOBILE APP FOR FOOD WASTE REDUCTION

   "This EIS focuses on households, aiming at reducing the food ending up in the (residual or VFG) waste bin. Providing a user-friendly app/tool to facilitate the registration of the amount and nature of food waste is an essential step to change behaviour.

   The app should focus on:

   - Giving insights in our waste behaviour: measuring
   - Tips to change shopping habits: stop buying food we do not need/use, look for alternatives
   - Look for possibilities to use food leftovers: recipes, other destinations…
   - Keep track of stock and expiring dates" (REPAiR, 2019).

3. APP FOR THE INTELLIGENT USE OF 'USE BY/ BEST BEFORE' EXPIRING DATE ON FOOD PRODUCTS

   "This tool, combining a tracking system to register expiring dates with a shopping assistant app, can help households to keep track of their stock, prevent unnecessary purchases and avoid wasting food.

   The app should:

   - keeps stock of supplies, taking into account date expiring information,

- automatically suggest use dates for fruit, vegetables and frozen items.

The app keeps track of the expiring date of food. Food that has reached its 'use by' date is no longer considered as part of the stock, and should be disposed of, either in the residual or VFG waste. A suggestion is made to buy new supplies. For food nearing its 'best before' date, suggestions are made for their preparation and use. By preventing food waste, household can reduce their amount of residual and VFG waste" (REPAiR, 2019a).

These EIS from Ghent will be discussed in the upcoming PULL process in Hamburg. There are already APPs in use in Hamburg (e.g. Zero Waste APP created by SRH) that might be inspired by the APP ideas from Ghent.

7.2. Transferable EIS to other REPAiR Cases

The main EIS that is transferable from Hamburg is related to waste prevention:

4. CREATING AWARENESS ABOUT WASTE (EIS 1)

This solution was selected by Pécs and was discussed during a knowledge transfer event in Naples in May 2019.

The following comments were provided by the Pécs team on this solution:

The EIS was regarded as transferable to Pécs, it could be transferred to the large housing estates in Pécs.

As the barriers for transferability of this EIS were considered: Education (like in Hamburg) and the attitude of the citizens not to read information from the city, furthermore information leaflets were estimated as not efficient.

To enable the transfer of the EIS to Pécs, the adaptations of the waste taxation in Hungary was regarded as necessary, as it prevents people from separation by giving no incentives.

The actors that should be involved are: Waste management, students from IT studies to develop an APP, the municipality.

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8. Design towards circularity: positioning the EIS

To sum up, the EIS developed in Hamburg are addressing different stages of the material cycles. As represented in Figure 8.1 below, the solutions of Hamburg are classified according to Typology of EIS. based on the study of Hermosilla et al. 2009 (see REPAiR, 2018).

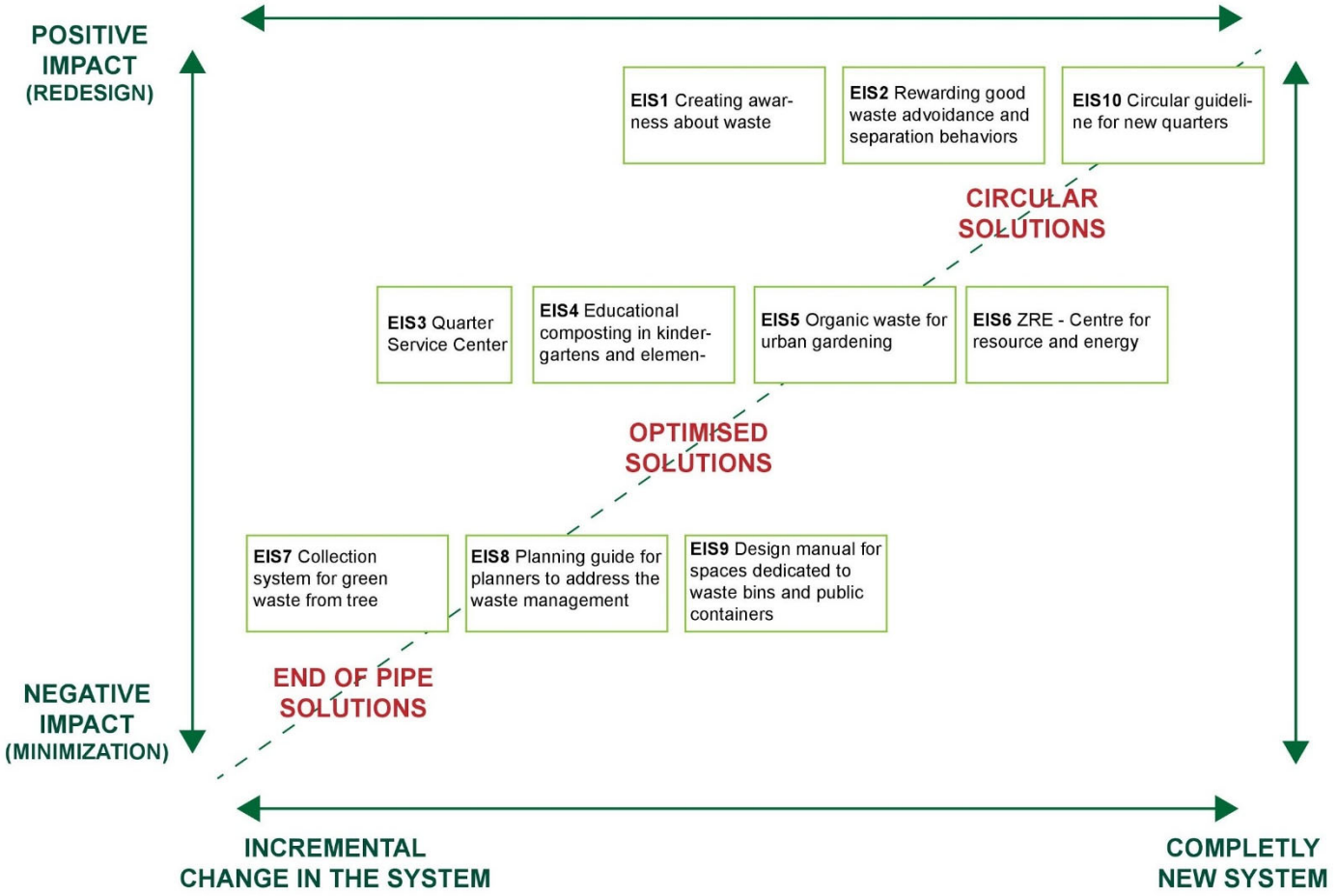

Figure 8.1 EIS from Hamburg according to their Typologies (adapted from REPAiR, 2018).

Most of the solutions are characterised as 'Optimised solutions', which are "tending to change one or more systems [or part of it]. These actions are designed with a view to shift from linear systems [...] to circular systems in which wastes become inputs for new processes." (REPAiR, 2018: p.19).

Circular solutions are related to those solutions "in which products, processes and systems are designed taking into account the entire life cycle of the product, process and system optimizing material health, 'recyclability', renewable energy use, water efficiency and quality, and social responsibility" (REPAiR, 2018: p.20). For this category, three solutions can be found: two solutions related to awareness (EIS 1 and EIS 2) and one related to the planning guide (EIS10). These three are a core topic for the stakeholders in Hamburg and big effort will be put in the pursuit of these results.

Figure 8.2 is instead providing a characterisation of the EIS according to the Waste Hierarchy Pyramid from Simon (2019). This pyramid offers a more

detailed categorisation of the EIS in relation to the degree of material management.

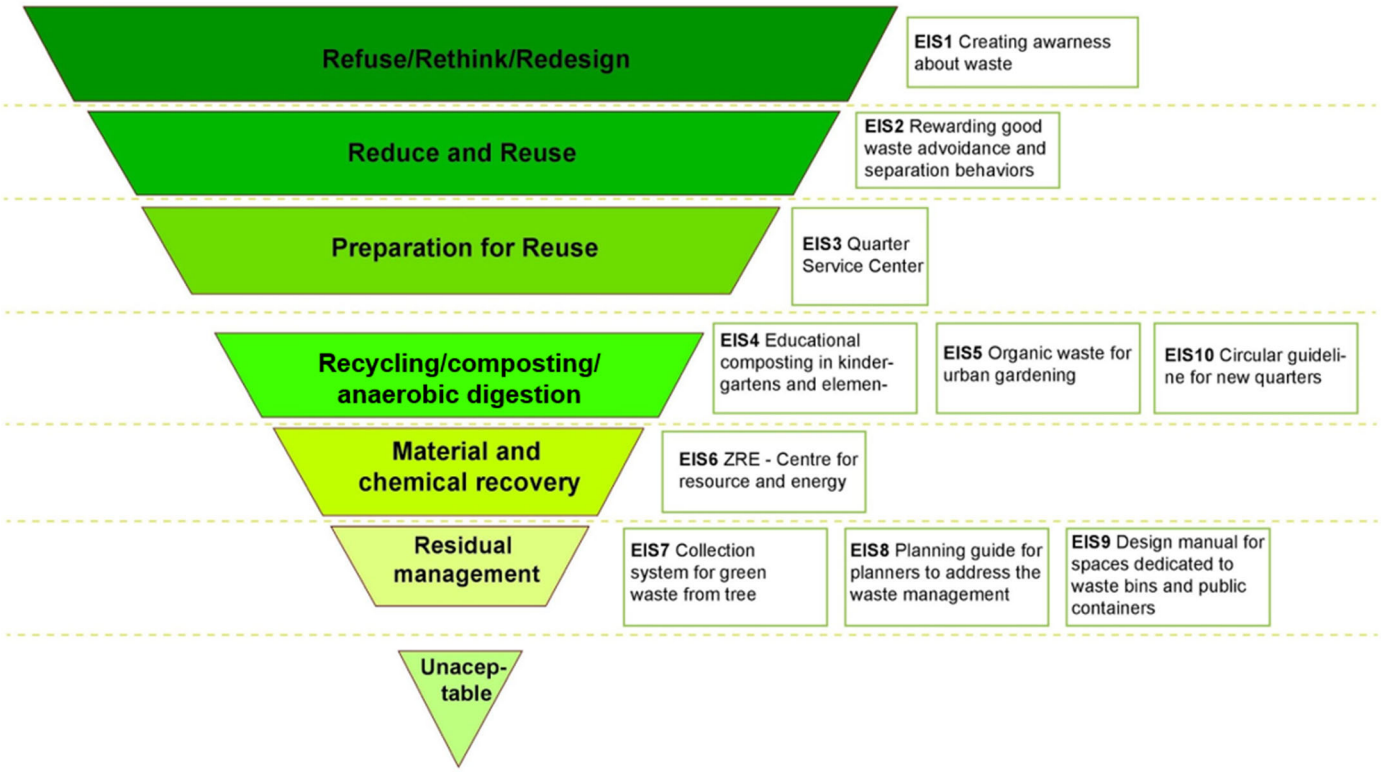

Figure 8.2 Waste hierarchy pyramid (HCU team, adapted from Simon, 2019).

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9. Reflection and Conclusion

Since the beginning of the project, all Hamburg stakeholders were particularly interested in the Circular Economy topic. The more the concept was deepened throughout the participatory process, the better CE principles could be brought together with the needs of the stakeholders.

Thanks to the opportunity offered by the FORCE project (link) that runs in parallel in Hamburg, it was possible to use synergies between the projects and to combine the resources at disposal in both projects to start a pilot action in Osdorfer Born (see Chapter 6) based on the EIS that were developed in REPAiR.

The EIS number 8 to 10 aim at inserting the concept of CE and its principles at the administration level attempting to design a systematic methodology that could serve as an example for the entire City of Hamburg. Some of the involved partners are already acting to prepare the transfer of solutions in certain areas and a later upscaling of the EIS might be reasonable.

During the PULL events it could be observed that the more stakeholders were present the less it was possible to achieve a determined answer. Conducting an additional PULL focused on EIS development with the involvement of a restricted number of the most important stakeholders, was a good opportunity to set a first list of ideas with which we could talk to other secondary (although necessary) stakeholders. The course held in 2018 was also relevant to provide initial feed for the local stakeholders to further develop the EIS.

One of the main limitations that were encountered is the fact that the stakeholders wanted to proceed rather independently from the PULL series, especially in the case of Pinneberg. In fact, this has partly slowed down the process of data and information acquisition, because the stakeholders did not feel part of the project. On the other hand, the independent acting of the stakeholders showed that they take the development of solutions serious and not just as an academic exercise. Therefore, the initial input of the PULL process can be regarded as successful.

Concerning the methodology of developing EIS the stakeholders preferred to start thinking from problems related to waste management and material flows. The role of the space was then discussed in a next step, when these problems had been identified. Furthermore, the stakeholders preferred to develop EIS on a smaller, more precise spatial level. In the case of Altona this led to the choice of working in Sample Areas with the aim of understanding specific situations in different types of neighborhoods and quarters. The developed place-specific EIS could then be transferred respectively adapted to comparable areas.