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Activated Brownfield in Baghdad: Contaminated Site as a Model

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1 ABSTRACT

Many countries encourage brownfield regeneration as a strategy to achieve sustainable development, Because of their environmental, social and economic benefits.

Brownfields are defined as industrial, commercial and residential sites or buildings that are not currently in use or partially occupied with the potential of hazardous or contaminated materials.

The presence of brownfield areas in general and contaminated sites in particular within the city of Baghdad is due to many reasons, including successive wars in Iraq and its effects on cities, weak laws and legislation, lack of awareness of society and local governments about these sites and absence of activation strategies.

Baghdad city has different types of brownfields, such as government administrative buildings, commercial buildings, railways, factories as well as private properties. Most of them are located in the city center in important areas of the city, which can alternatively be used to fill the shortage of projects needed by the city.

The paper highlights the contaminated sites in Iraq that were evaluated by the Iraqi state after the 2003 war and aims to develop a roadmap to activate brownfield areas. The research is based on one of the local experiences, namely, rehabilitation of the Bismayah project as a residential project, which is the largest housing complex in Baghdad.

Keywords: Brownfield, Contaminated Area, Contaminated Site in Baghdad, Sustainable Development

2 INTRODUCTION

Cities suffer from many problems, including the existence of unused areas and spaces (brownfields). The term "unused areas" emerged in Europe as a result of three factors: first is the industrial revolution which left behind cities that should be re-engineered to suit the opportunity of a new life, secondly the two world wars which brought a series of changes to European cities, thirdly impact of natural disasters such as floods and earthquakes. The main vision of these three stages is that there is no need for new cities today or the expansion of existing cities, but development needs to be directed towards undeveloped or abandoned areas within cities.

The existence of brownfields and contaminated areas within the boundaries of the city of Baghdad are due to many reasons, including successive wars in Iraq and their effects on cities, such and weak laws and legislation that affect investment into areas and their redevelopment. Baghdad city seeking strategies to activate brownfields and to promote investment, especially into contaminated areas. This paper offers a remedial strategy to aid interested parties, urban decision makers and designers to help them report on these areas and to achieve faster regulatory decisions to reduce the impact of contaminated areas.

3 DEVELOPMENT OBSTACLES AND CHALLENGES

Many factors are affecting the success or failure of brownfield projects. Essential components of successful Brownfield development include: (Smith, 2010, p. 3)

- “finding financing
- accurate clean-up estimates
- effective community involvement
- successful negotiation with regulators
- Cost-effective and efficient cleanup”

The CLARINET group identified four elements or factors leading to the success or failure of the brownfield development projects including:

- “lack of proactive planning and strategic investment

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- inflexible zoning and unpredictable and time-consuming rezoning process
- land assembly and inconsistent, inefficient and lengthy process of approving permits
- limited financing for infill projects and mixed-use projects, and
- neighborhood opposition to higher density and infill development".

While consistently emphasizing that the costs of pollution and cleaning are the main obstacles to the brownfield redevelopment of the public sector.

Category According to	Types
Position	In the central area.
	In the city's border
	In historic areas
Site	In traditional industrial areas
	in urban areas
	in rural areas
EPA	**Oil and petroleum facilities**; Natural gas manufacturing, Gas stations, Oil production, distribution, and recycling.
	Manufacturing; Chemical and dye manufacturing, Ordnance sites, Cement plants, electronics manufacturing, iron and steel manufacturing, machine tool industries
	Recycling; Automobile salvage and metal recycling.
	Treatment and repair facilities; Metal plating and finishing, Paint shops and automobile body repair, Wood preserver facilities
	Miscellaneous; Agri-business, Asbestos piles, Landfills and dumps, Rail Yards, meat packaging plants, mining sites and wastes, power generating facilities and utilities, quarries, print shops, and radiation mining, refining, and research sites.
Previous use	Industrial areas, warehouses, and warehouses of heavy machinery.
	Military compounds
	Mining facilities and factories and rundown warehouses
	Coastal areas
	abandoned car parks and gas stations.
	Commercial properties that may have been stored or used for toxic substances.
	Public facilities such as previous service stations.

Table 1: Categories of Brownfield by (Authors) according to Resources (Shaaban, 2016, p. 10) (Grimski & Ferber, 2001) (Maribor, Brownfield Revitalisation Methodology, 2012, p. 6)

4 DEFINITIONS AND CATEGORIES

There are different definitions of brownfields depending on countries and their policies. The most commonly used definition in the United States and Canada is the definition developed by the US Environmental Protection Agency (EPA[1]) when it officially launched its Brownfield Agenda in 1995. The Agency identified that unused area as "abandoned, damaged or unused industrial or commercial facilities or facilities development is complex due to real or potential environmental contamination". The definition proposed by CLARINET[2] "brownfields are sites that have been affected by the former uses of the sites and surrounding land, are derelict and underused, may have real or perceived contamination problems, are mainly developed in urban areas, and require intervention to bring them back to beneficial use". (Perovic & Folić, 2012, p. 374) while "brownfield in UK regulations covers unused and underused lands that are previously developed" (Tang & Nathanail , 2012, p. 841).

[1] EPA: Environmental Protection Agency: is an independent organization of the United States federal government for environmental protection. Founded by Richard, operation on December 1970. https://www.epa.gov/
[2] CLARINET: Contaminated Land Rehabilitation Network for Environmental Technologies.

There are many reasons for appearances of brownfields, such as changes in the economic structure of the state as a result of changes in the policies of local and regional governments, neglect of traditional industries. Another factor that brought about changes in the cities are the two world wars that caused emerging brownfields due to industrial change specifically in traditional industrial areas.

There are different categories of brownfields (Table 1) related to their position, site, prior use and according to EPA classification (Shaaban, 2016, p. 10) (Grimski & Ferber, 2001) (Maribor, Brownfield Revitalisation Methodology, 2012, p. 6). EPA mentioned that in addition to brownfields, whether contaminated or not there are many different types of contaminated sites such as Superfund[3], RCRA[4],UST[5] (underground storage tank (USTs) site.

5 DEVELOPMENT STRATEGIES

The objectives of redeveloping brownfields in the cities were different in each governorate according to its needs and policies. Many special development programmes include key objectives relating to structural policy, spatial and urban planning and environmental restoration. (Grimski & Ferber, 2001, p. 145).

Initially, an assessment of the potential contamination of any previously developed site is initiated when a new development is proposed and the treatment requirements are determined based on the results.

"A key tool for the assessment of clean-up is the development of a conceptual site model and a quantitative risk assessment, using clear risk-based decisions and logic built on the intended future use of the affected and adjacent land". (Doak, 2004, p. 8)

Depending on many studies in brownfield development with contamination there are many strategies used for this purpose as shown in the table (2). There are also many strategies, including urban regeneration (urban infill), re-zoning strategy and tactical urbanism.

There are many types of contaminated projects depending on previous use, also there are different strategies for reactivating these sites related to community and city needs so reactivating with entertainment, cultural, residential, commercial use, city policy, and Financial facilities.

6 CONTAMINATED SITES IN IRAQ

The issue of brownfield cleanup and redevelopment is emerging as central to the overlap between environmental protection and economic redevelopment. It is necessary to refer to the concept of contaminated sites mentioned in previous studies and reports. In 1990, EPA defined it as "any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that

a) significant harm is being caused or there is a significant possibility of such harm being caused.

b) significant pollution of the water environment is being caused, or there is a significant possibility of such pollution being caused." Where "harm" means harm to the health of living organisms or other interference with the ecological systems". (South Lakeland District Council, 2016, p.5)

In Iraq, there are many sites that are suffering from contamination caused by wars and environmental problems. More specifically, the presence of this contaminated site in the cities of Iraq is due to many reasons, including successive wars on Iraq especially the 2003 war. As a result of rocket fire, many buildings and lands were contaminated with radioactive materials such as the Turkish restaurant in Baghdad and the large halls at Baghdad International Airport, also many factories and facilities belonging to the Ministry of Defense and Military Manufacturing were left with their contaminated machines and other substances.

[3] Superfund "the worst contaminated sites are designated on the National Priorities List or 'Superfund' list, or sites are uncontrolled or abandoned sites or properties where hazardous waste or other contamination is located".)https://www.epa.gov/enforcement/types-contaminated-sites)

[4] RCRA (Resource Conservation and Recovery Act) "facilities where reuse or redevelopment is slowed due to real or perceived concerns about actual or potential contamination, liability, and RCRA requirements".

[5] USTs (Underground storage tank (UST) sites that "contain contamination from petroleum products or Superfund hazardous substances that were released from underground storage tanks".

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Project name	Previous use	strategy	Current use use	type
Gasometer, Vienna	**Industrial** An industrial complex consisting of four gas storage units (A, B, C, and D). The containers were used to assist Vienna in providing gas, each of which had a storage capacity of 90,000 m3. at that time. But, with the introduction of modern gas storage techniques that involve storage under pressure, this storage capacity became too large for maintenance and use. It was dismantled and abandoned in 1978	public-private partnership	**Mixed use…** In 1995, the Vienna authorities began to renovate the abandoned industrial complex in order to create a new residential area. The storage units have been renovated and converted to apartments on the upper floors, offices on the middle floors and many recreational facilities and shopping centers on the lower floors, accommodating a concert hall from 2000 to 3000 spectators, theater, student accommodation, and various other amenities, completed the entire renovation process in 2001	Building
Eden Project, Cornwall, United Kingdom	**Industrial** Previously is mainly concerned with fishing, agriculture, mining (tin, copper, arsenic).	Support from local authorities public-private partnership	**Entertaining and cultural** has six main buildings: The Rainforest and Mediterranean Biomes, the Link building between them, the Core, Stage and Visitor Centre	
Olympic Sculpture Park—Seattle	**Industrial** It was an industrial zone (oil industry and storage) unused with 8.5 acres	public-private partnership	**Entertaining…** is apparent as a continuous Z-shaped folded landscape that bridges the railroad tracks and road, use as urban space and platform for future use. The project includes an exhibition pavilion, a public runway for many permanent and transitional artworks and three distinct gardens.	Open Area
Minneapolis, Minnesota—Pure Oil Company and Gas Farm	**Industrial contaminated** The site of the former pure oil company	tax increment financing (TIF) plan	**Educational** FMC has constructed a research and development facility on the site which has since been closed, currently leased to the Computer Department at the University of Minnesota	

Table 2: types of Brownfield projects and their strategies (by Authors) according to (shamusoconner, 2011), (Huber & Nicole, 2008)

7 CASE STUDY: BISMAYAH

Bismayah is one of the most distinguished and important residential cities in Iraq and the first major project of the National Housing Programme. Lack of urban development projects and population increase in particular in Baghdad (which reached seven million people, according to statistics issued by the Central Bureau of Statistics and Information Technology of the Ministry of Planning), as well as the high cost of real estate for low-income people, made it necessary to resolve the housing problem. One solution to accommodate the increased population was to construct more housing, such as the housing complex Bismayah.

There are many reasons for choosing the project location. Located near the main international road linking Baghdad with Kut and southern cities, Bismayah is located about 10 km away from the border of Baghdad. Sufficient land is available which amounts to the 750 ha required for the construction of the project; water and electric power sources were also available as the site is located near a high-tension project and high-pressure lines. With a total area of 1.830 hectares), the project aims to accommodate about 600'000 people in a total number of 100,000 housing units is of different sizes (100m², 120m², 140m² per unit).

On May 30, 2012, Hanwha Company of South Korea signed the official contract for the construction of the new city Bismayah with the Iraqi state, whose location is shown in fig (1). The infrastructure of residential units consists of 6 sectors, 839 buildings in 58 complexes.

The Department of chemical monitoring of the Environment Ministry of Iraq carried out an environmental assessment of the site and produced models to ensure that it is free from any contaminants from its previous use as shooting fields.

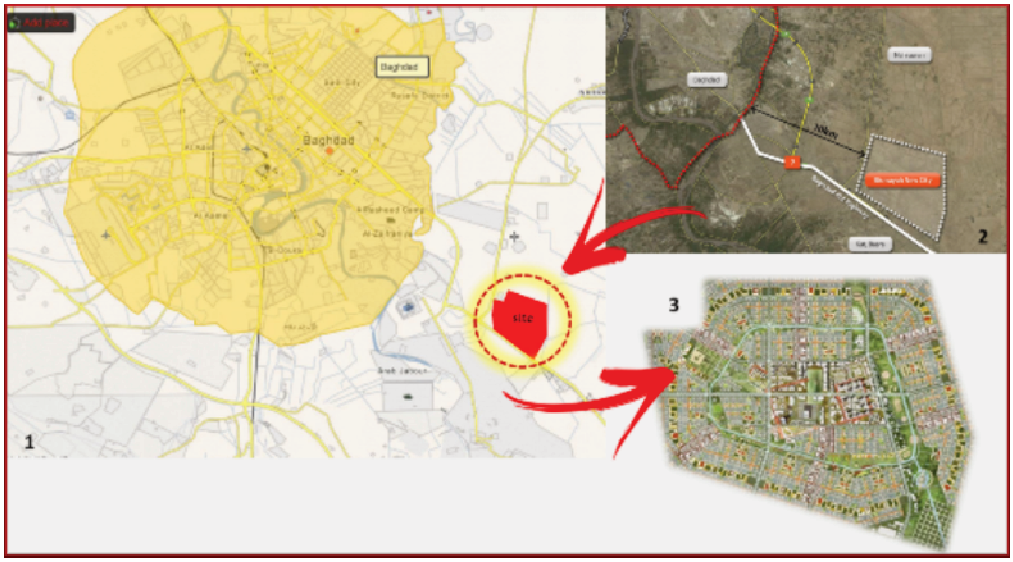

Fig. 1: Location according to Baghdad & site plan for Bismayah city Sources: (Authors) from Google maps

487 samples were taken from the site within an area of 650 ha to ensure that it was free from contaminants Due to the vast area of the site, these polluted points were divided into three levels depending on intensity and type of pollution (Fig 2 and Table 3).

class	No.of points	material	Intensity of pollution
A	4	heavy metals cadmium, copper and nickel.	high values
B	7	nickel, copper, and nitrates.	lower values
C	25	nitrates and sulfates	less pollution than the previous two categories.

Table (3) classification of polluted points (Authors) according to (Ministry of Environment and Health of Iraq)

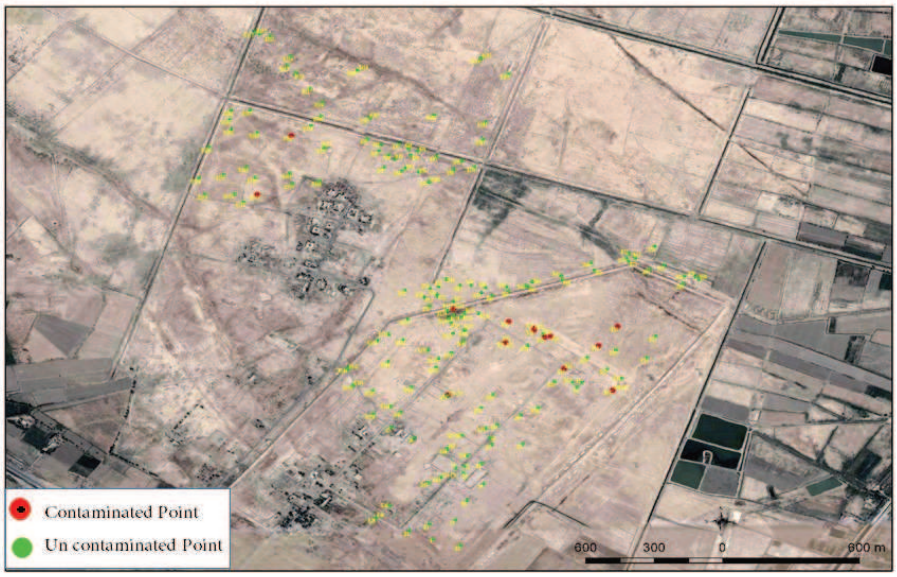

Fig. 2: show contaminated and uncontaminated points during tests (Ministry of Environment and Health of Iraq)

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The project is divided into 6 main communities and one center; each area is divided into three districts each with 8000 units and each district includes four neighborhoods and each one contains 2000 units, as shown in fig (3).

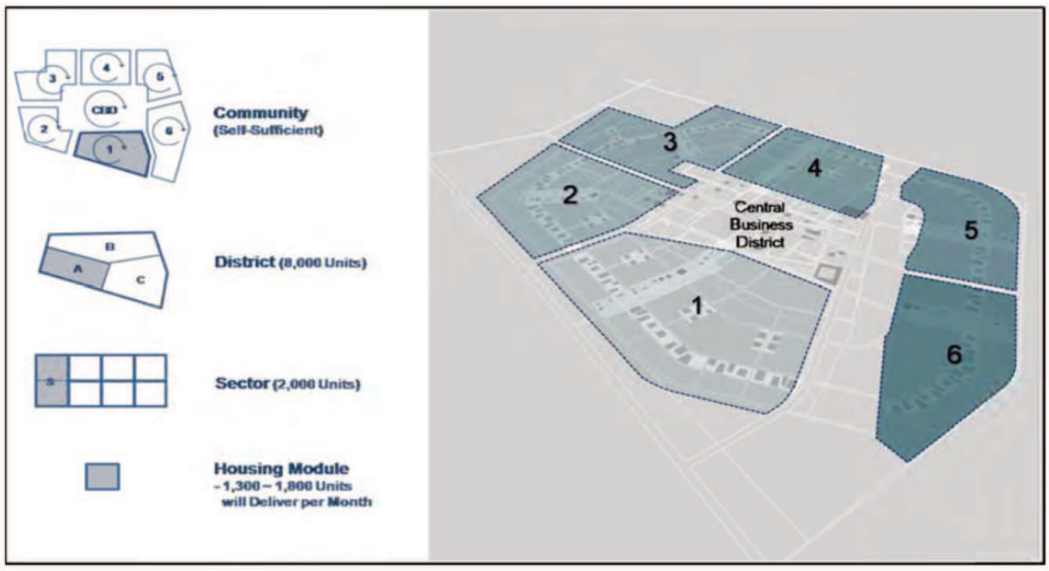

Fig. 3: Organizational structure of the project (National Housing Program, 2018)

Today, the construction of the city of Bismayah provided hundreds of job opportunities for Iraqi workers of various skills - engineering, craftsmen, workers, drivers, etc. Currently, the number of Iraqi workers working on the project is more than 6 times that of Koreans, which contributes to creating jobs and economic development in addition to the Korean company's commitment to training Iraqi workers in its professional training center until completion of the project in 2019. (fig 4)

Fig. 4: Bismayah project during and after construction (National Housing Program, 2018)

The planning and design of space in the context of the regeneration of brownfields plays a key role in the sustainable development of cities. Brownfield provides a more sustainable option for land development by taking full advantage of existing infrastructure, cleaning up contaminated areas without infringing into green areas. Development of brownfield areas takes center stage in sustainable planning strategies to stop urban sprawl, preserve green spaces, reduce greenhouse gas emissions and reinvest in urban areas, as well as opportunities to promote a sustainable economy (Walkowiak & Frazier, 2000, p. 1). All this requires a big effort and a partnership between stakeholders, local government, universities, and the state. Due to the partnership between public representatives of the Iraqi Government and private sector representatives of the Hanwa Company the Bismayah project was completed and helps to solve the housing problem in Baghdad.

8 CONCLUSION

Brownfield development is a complex process. The presence of contaminated areas has affected the growth and development of cities negatively, as new cities were being built on greenfield site. This is a potential threat to urban sustainability, as it prevents the activation of contaminated areas in urban areas which would contribute to integrated environmental, economic and social development. In Iraq, there are many types of

brownfields, including contaminated or uncontaminated areas and buildings. Awareness needs to be raised as to the impotence of policies to reactive them. Despite the neglect of brownfield development in Iraq, efforts to mobilize investment into the exploitation of brownfields have led to housing projects like the Bismayah residential city. These types of projects help revitalize the local economy, reduce social problems and curtail adverse environmental effects.

There are many strategies to use brownfield sites to reactively. They depend on many factors relating to the type of site, previous use, position, economic facilities, and future use, as well as factors relating to the state policies and legislation. The Basmayah project resorted to a partnership between public representatives of the Iraqi government and private sector representatives of the Hanwa Company to secure its realization.

9 REFERENCES

Center for Environmental Policy and management, U. o. (2006). Connecting Smart Growth and Brownfield Redevelopment. Center for Environmental Policy and Management.

Doak, M. (2004). Contaminated land and risk assessment: the basic necessary steps prior to Remediation and Development. Groundwater Challenges of the National Development Plan (p. 1_9). IAH.

EPA. (n.d.). Types of Contaminated Sites | Enforcement | US EPA. Retrieved from https://www.epa.gov/enforcement/types-contaminated-sites)

Grimski, D., & Ferber, U. (2001). Urban brownfields in Europe. Land Contamination & Reclamation, Volume 9(1), 43-148.

Huber, & Nicole. (2008). Olympic Sculpture Park - Seattle, WA. places Journal., 20(3), 6-11.

Maribor, F. o. (2012). Brownfield Revitalisation Methodology.

Ministry of Environment and Health of Iraq. (n.d.). Technical Report on the Environmental Assessment Results of the Bismayah Residential Site. Ministry of Environment and Health of Iraq.

National Housing Program. (2018). Bismayah New City. Retrieved from Bismayah New City (National Housing Program): http://bismayah.org/pages/03sitephoto/sitephoto.asp?sel_id=75&page=1

Perovic, S., & Folić, N. K. (2012). Brownfield regeneration – imperative for sustainable urban development. GRAĐEVINAR 64, 64(5), 373-383.

Shaaban, M. H. (2016). Sustainable Urban Regeneration Of Brownfields. Giza, Egypt: Faculty Of Engineering, Cairo University.

shamusoconner. (2011, May 6). Retrieved from THIS IS THE STORY OF…: https://thisisthestoryof.wordpress.com/2011/05/06/the-gasometers-of-vienna-amazingarchitecture/

shamusoconner. (2011, May 6). Retrieved from THIS IS THE STORY OF…: https://thisisthestoryof.wordpress.com/2011/05/06/the-gasometers-of-vienna-amazingarchitecture/

Smith, G. (2010). Brownfield Planning: A tool for economically and socially effective sustainable urban development. Nairobi, Kenya: ISOCARP Congress.

South Lakeland District Council. (2016). Contaminated Land Strategy: Part IIA Environmental Protection Act 1990.

Tang, Y.-T., & Nathanail , C. (2012). Sticks and Stones: The Impact of the Definitions of Brownfield in Policies on Socio-Economic Sustainability. sustainability, 840-862.

Walkowiak, E., & Frazier, D. (2000). Brownfields redevelopment as a catalyst for creating sustainable cities. WIT Press, 39, 10.

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