

# The Prevalence of Brownfields Redevelopment: Initiatives, Valuations and Experiences<sup>1</sup>

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## Abstract

Brownfield redevelopment is relatively a new area of interest for federal and local government in the U.S. In the past years, there are continuing interests by urban planners, policy makers and scholars in the effects of neighborhood amenities on brownfield. This paper intends to introduce brownfield redevelopment efforts and assess the approaches to implement such efforts by reviewing current federal legislation in the U.S. for brownfield, especially in the case of the Seattle Region. This paper provides an understanding of the brownfield phenomenon, statutory dilemmas, barriers and strategies of brownfield redevelopment. This paper also addresses the need of more policy adoption and implementation for successful brownfield redevelopment.

*Keywords: Brownfields, Brownfields Redevelopment, Sustainable Development*

## 1. INTRODUCTION

Recent years, there are increasing policy interests in urban environmental quality management. Transformation of urban areas in developed countries with prosper economic development have increased environmental contaminants and caused greater health risk to the urban residents. The main concern of environmental contaminants is from a vast number of previously developed urban core commercial and industrial sites that are underused or neglected. These sites, known as "Brownfield", can also have a negative impact on economic vitality, social benefits, and municipal tax base.

Brownfield redevelopment is relatively a new area of interest for federal and local governments in the U.S. Due to prospective economic and environmental benefits, U.S. Environmental Protection Agency (EPA) has made brownfield redevelopment a high priority and placed greater emphasis on technological advancements and legal and institutional developments for an effective promotion of reusing the brownfield.

While brownfield have been reused for a wide range of purposes, there is no clear understanding of what constitutes the best type of development, nor is there sufficient guidance in the academic literature to isolate the proper role of local governments in facilitating this process. To date, informal, anecdotal information and case studies drawing on the expertise of individual developers and officials have been used to guide municipal policies (see Rafson and Rafson [18]). Research up to now has been primarily focused on overcoming the barriers associated with the development, or the limited range of the benefits that can be derived from these sites. Moreover, current

direction of the studies in urban brownfield redevelopment is somewhat scattered in its consideration of local communities.

The objective of this paper is to identify and examine the statutory dilemmas and the barriers impacting brownfield redevelopment, and present some of the available initiatives and strategies for successful implementation of brownfield redevelopment policy. Since there exists a number of brownfield related literatures and public documents, this paper concentrates on technical consideration and valuation of brownfield, and goals and interest of community development.

This paper contributes to the fledging literature on brownfield redevelopment by focusing on the advanced planning laws and policies at the Seattle Regions. Many of the efforts undertake by state and local governments could serve as the prototypes for programs being adopted by other communities in the U.S. In addition, these initiatives provide a set of ideas and experiences, which could be used to solve similar problems in communities and regions elsewhere in the world.

## 2. THE BROWNFIELD PHENOMENON

### 2.1 What is Brownfield?

The U.S. EPA, the governing body for brownfield redevelopment, defines brownfield as "abandoned, idled, or under-used industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination ([4]). Specifically excluded from this definition are facilities that are undergoing government ordered cleanups or are Superfund sites, as well as sites contaminated with polychlorinated biphen-

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yls. This legislative change is a significant one, as the official U.S. definition now implicitly includes land contaminated by resource extraction and agricultural activities that may be outside of urban areas.

It should also be noted that the definition of the term “brownfield” is far from universal. Although the term is in common use in Canada ([15]), its application in Britain is not without a fair amount of confusion. Alker et al. [1] indicate that the use of this word is often confused with the earlier concept of a “brownland,” which had been used in the UK to define property that had been developed in the past. After a survey of the use of the term in several different Anglophone countries, they decide upon a more neutral definition: A brownfield site is any land or premises that has previously been used or developed and is not currently fully in use, although it may be partially occupied or utilized. Therefore a brownfield site is not available for immediate use without intervention. This, in fact, corresponds well with the definition in other countries such as the Netherlands (see Nijkamp et al. [16]), where redevelopment has occurred to a much greater extent than in North America. However, given that one of the primary concerns in the U.S. regarding brownfield is the disposition of the contamination on a site, the earlier definition is more relevant to the issues discussed here.

## 2.2 Characteristics and Impacts of Brownfield

Typical brownfield sites in urban areas include properties with a diverse range of former uses. They have been the location for a range of activities including power transmission, dry cleaning, petroleum distillation and distribution, smelting, metals recycling and warehousing ([24]). Due to releases from normal operations, previously acceptable disposal procedures and accidental spills, many of these locations have concentrations of contaminants in the soil and groundwater, which exceed public and environmental health criteria. Contaminant levels on brownfield sites may be moderate, but not excessive; as noted above, the US EPA does not consider sites listed under the Superfund National Priorities List to be brownfield sites.

Wright and Davlin [27] proposed a typology for brownfield, based on their attractiveness for redevelopment. “Tier 1” sites are located on sites with good locational attributes that have relatively little contamination onsite. “Tier 2” sites are less desirable for development, due to their poorer location or higher levels of contamination. Due to their extreme levels of contamination and poor location, “Tier 3” sites are difficult to develop. While private interests are typically willing to become involved in redeveloping “Tier 1” sites, some level of government intervention may be necessary to spur action on “Tier 2 and 3 sites.”

Brownfield sites typically have a range of different impacts on the local neighborhood. Aside from the significant environmental and health risks posed by the presence of contaminants on these sites (see Litt and Burke [12]), particularly contaminants which may be mobile in the groundwater (see Kaufman et al. [11]), there are significant

economic and sociological effects associated with brownfield. They are a significant source of lost tax revenue for cities. Similarly, they are often a lost source of jobs for the local community.

The sociological effects are considerable as well. Abandoned properties are often associated with blight, crime, physical decay and disorder, which can have a considerable impact upon neighboring property values and on the quality of life in the neighborhoods in which these sites are located. Research done by Taylor et al. [23] on 25 city blocks in Baltimore and a neighborhood in Philadelphia suggests that street blocks with more nonresidential land uses tend to have more physical deterioration. The authors suggested that this is due to sociological changes as well as an economic decline in these neighborhoods. A survey of Illinois households by Ross and Mirowsky [20], determined that abandoned buildings were highly suggestive of physical decay to residents, and that these abandoned buildings could be related to a breakdown of social controls in the area. A survey of tax assessors in municipalities in New Jersey conducted by Greenberg et al. [9] indicated that 10% of municipalities in the state had brownfield with notable neighborhood impacts, and that 3% had sites which resulted in significant, wide-scale neighborhood and land use impacts at distances greater than a quarter mile away, corresponding to severe blight.

## 3. REGULATORY BROWNFIELD REDEVELOPMENT STRATEGIES

In the U.S., all levels of government have roles with regard to urban brownfields redevelopment. Both federal and state governments have regulatory power over the environment and can influence the characteristics of the cleanup on the site. Municipal and regional governments, on the other hand, typically have a monopoly on certain local land use planning and zoning decisions, which may be important for redevelopment projects. Federal, state, county and local governments may be sources of funding for development projects, as well.

### 3.1 Applicable Federal Statutes in the U.S.

#### *The Resource Conservation and Recovery Act (RCRA)*

The Resource Conservation and Recovery Act (42 USC §6901 et seq., 1976.) was the first significant piece of federal legislation to manage hazardous waste. It extended responsibility for damages caused by hazardous waste to the generators of waste, and allowed for citizen suits against any person deemed to be in violation of the law. It also provided the EPA with the jurisdiction to establish criteria for sanitary landfills. The Hazardous and Solid Waste Amendments (P.L. 98-616, 9 November, 1984) to the Act established land disposal restrictions on liquid wastes, as well as minimum technology requirements for landfills, requirements for permits, and stronger penalties for noncompliance.

#### *The Comprehensive Environmental Response, Liability and Compensation Act (CERCLA)*

This legislation (42 USC § 9601 et seq., 1980), known as CERCLA or Superfund, is the cornerstone of federal policy with respect to contaminated property in the U.S. A rotating funding system for orphaned site cleanups was developed under this Act, which used taxes on chemical feedstock as an initial funding source. It was theoretically to have been replenished as a result of litigation with money received from responsible parties as a result of litigation. This did not occur in practice. Instead it developed a system of retroactive, “strict”, and “joint and several” liability for contaminated sites, which defined “Potentially Responsible Parties” as any past or present owners of a site, operators of facilities, or generators or transporters of waste. In 1986, CERCLA was reauthorized and amended with the Superfund Amendment and Reauthorization Act (P.L. 99-499, 17 October, 1986). This Act appropriated additional funds for site remediation, and for the cleanup of leaking underground storage tanks.

*The Small Business Liability Relief and Brownfield Revitalization Act.*

The Small Business Liability Relief and Brownfield Revitalization Act (H.R. 2869, 107th Cong., 1st sess.) provided the first major reform of the CERCLA legislation to stimulate urban brownfield redevelopment. This bill amended several aspects of CERCLA to provide relief to smaller businesses and to support state efforts with respect to brownfield revitalization. The provisions in this bill included *de minimis* liability exemptions for transporters of small amounts of hazardous substances, for entities arranging the disposal of municipal solid waste, for contiguous property owners, and for prospective purchasers and innocent landowners. It also provided for expedited settlements based on the ability to pay, allocated federal funding for brownfield, and provided protection for participants of state cleanup programs.

### 3.2 Washington State Statutes and Regulations

The management of brownfield in the State of Washington is controlled mainly through the Model Toxics Control Act (RCW 70.105D), which grants primary authority for these matters to the Washington Department of Ecology. Other relevant statutes having to do with issues of contaminated land include Underground Storage Tanks (RCW 90.76), the Water Pollution Control Act (RCW 90.48), Puget Sound Water Quality Protection (RCW 90.71), and the State Environmental Policy Act (RCW 43.21C). It should also be noted that under the Growth Management Act (RCW 36.70A), development is to be directed towards Urban Growth Areas, and the level of densification necessary to achieve this level of integration suggests that urban brownfield redevelopment would be one potential means of achieving these goals.

The Model Toxics Control Act (MTCA) was based on the federal Superfund program, and set up a local and state level Toxics Control Account which included an associated Hazardous Substances Tax. This tax is levied on the sale of pesticides, petroleum products and certain types of chemi-

icals. The State fund also receives money through penalties, fines and fees related to hazardous waste cleanup activities. These funds are allocated to the clean up sites listed on the state Hazardous Sites List, the provision of technical assistance to individuals conducting remediation activities, and the investigation of potentially contaminated sites. The MTCA provides for a similar level of liability as CERCLA, allows voluntary cleanups, and Prospective Purchaser Agreements. It also protects owners of property from liability for contaminant plumes for which they are not responsible, and grants attorney’s fees to the plaintiffs in the case of Private Rights of Action.

Regulations from the MTCA are given under WAC 173-340, and provide for the administration of the Act. One important section within the regulations details the cleanup levels mandated for sites in the state. Under WAC 173-240-700, cleanup standards are divided into three categories: A, B and C. Method A standards involve routine cleanups of relatively few contaminants, and standards are calculated from standard tables which express existing state and federal contaminant standards. Method B standards (“Universal method”) use either default or site-specific data and formulae to calculate cleanup standards based on environmental risks to human health. Method C standards (“Conditional”) are similar to Method B standards, except that they are typically used when compliance with Method B standards is potentially impossible. In this case, institutional controls are placed on the site to prevent exposure to contaminants. This system allows for the use of both risk control measures and institutional controls such as deed restrictions in remediation and redevelopment plans, and it is thus important to note in the context of urban brownfield redevelopment approaches.

### 3.3 Federal Initiatives

There are a number of important initiatives in place at the national level that are to promote the reuse of brownfield. These are administered primarily through the Brownfield Economic Development Initiative ([26]). With regards to issues of liability, the EPA and the Department of Justice have entered into “Prospective Purchaser Agreements” with prospective buyers of properties in the past, and have often issued “Comfort Letters” to provide assurances that the EPA would not take enforcement action against redevelopers. EPA Brownfield Assessment Demonstration Grants can allocate up to \$200,000 to state or municipal governments for projects that utilize innovative approaches for investment or remediation. The EPA has also granted states and municipalities funds through the Revolving Loan Fund Pilots program that can be used to capitalize or fund revolving loans having to do with redevelopment projects. Targeted Brownfield Assessments may also be performed by the EPA on contamination sites that will have significant benefits to the community if redeveloped. Finally, under federal tax incentives, certain taxpayers may also be eligible to deduct the cost of environmental remediation for the year that the cost is paid or incurred. These incentives are typically limited to existing

pilot areas and areas with significant levels of poverty.

### 3.4 State Initiatives

Washington State has also developed certain programs to aid in brownfield redevelopment. Under 1997 amendments to the MTCA, the Voluntary Cleanup Program was created, whereby private landowners could voluntarily remediate their own site, and submit a report on the results for review by the Department of Ecology. The Department of Ecology and the State Attorney General are also able to enter into Prospective Purchaser Agreements with potential buyers of contaminated property, which can ensure that enforcement action will not be taken on a site at the same time as remedial action is being expedited on this site. These Agreements are typically issued for the redevelopment of commercial or industrial property which will result in substantial new resources for redevelopment, and when the redevelopment and subsequent use will not exacerbate existing contamination or otherwise increase the health risks on neighboring sites.

Some financial assistance may also be granted by the state. Grants from the Local Toxics Control Account may be made to local communities for remediation efforts. State tax incentives which give favorable tax treatment to certain aspects of remedial action in the state are also available.

### 3.5 Local Initiatives

At the local level, municipal governments are limited mainly by their lack of financial resources (see Nijkamp et al. [16]). While businesses and higher-level governments can leverage considerably more funding into the remediation of a site, the size of most municipal budgets makes remediation difficult to achieve on a wide scale. One major exception to this, of course, is tax increment financing. This funding approach fixes the property tax payable for a site at predevelopment levels, and uses the difference between pre- and post-development property tax levels to pay down bonds issued for funding the redevelopment.

Other instruments used to promote urban brownfield redevelopment at a local level include municipal capital investment for key areas, condemnation/eminent domain and subsequent site assembly, public-private partnerships, tax exemptions and abatements, and others.

## 4. ISSUES SURROUNDING BROWNFIELD

Aside from the typical considerations of economic development and environmental protection programs, the characteristics of brownfield redevelopment often provide additional obstacles to redevelopment.

### 4.1 Technical Considerations of Brownfield Redevelopment

An extensive discussion of the technical considerations of brownfield remediation is beyond the scope of this paper. It should be noted that there are extensive case studies available on redevelopment projects available from the Federal Remediation Technologies Roundtable, and infor-

mation on the costs of different remediation methods is available from the Seattle EPA ([25]). Several other guides to selecting appropriate characterization and remediation technologies are also available.

Expert decision models have also been developed by researchers to aid in brownfield redevelopment, primarily for private developers. Attoh-Okine and Gibbons [2] demonstrate the use of a Bayesian model in brownfield decision-making that could account for missing or contradictory information in the inputs. Tam and Byer [22] propose a methodology whereby the owners of a property would consider separate scenarios to determine both the optimal cleanup levels and the optimum site use. Finally, Kaufman et al. [11] have developed a GIS-based program to assess surface and subsurface risks and the costs associated with remediation on site in the Rouge River Watershed in Michigan. When tested, this model had a high correlation to final cleanup costs.

### 4.2 Brownfield Valuations

One of the most important considerations in the redevelopment of contaminated sites for the public interest is the cost involved in managing contamination. It is unreasonable to imagine that a contaminated site is completely worthless, given that the site may well be remediated and that there may be other possible uses for the site even in a "dirty" state. Similarly, it is not reasonable to assume that the value of the site is equivalent to its "clean" value. Because of the significant impacts on sales price of brownfield, there has been a considerable amount of experience with this issue among professional appraisers and research in other academic fields.

Although other work had been done on the valuation of risk on sites, Patchin [17] was the first to address the issue of quantifying the economic impact of brownfield contamination with respect to property valuation. According to Patchin, the economic damage associated with a contaminated property may be divided into three parts: cleanup costs, future liability and "stigma." In this circumstance, stigma is associated with the uncertainty involved with managing a formerly contaminated site.

It should be noted that the effects of contamination are highly dependent upon the loss of income or utility, and the potential for liability with respect to a particular site. Dotzour [7] noted that sale prices for single family homes did not appear to change even after it was revealed that the homes were situated on a plume of groundwater contamination. This is probably because as they were on a public water supply, homeowners experienced no loss of utility and had no responsibility for cleanup. Additionally, a number of statistical models have been unsuccessful in identifying certain property price effects of contamination. Schoenbaum [21] evaluated the assumption that pollution affects land use and development for parcels in an Industrial area in Baltimore, MD and could not find systematic relationships between the presence of environmental contamination, and assessed land values, vacancy rates, turnover, or the construction of improvements onsite. This

may, of course, be due to the use of assessed values rather than true sales data, but this lack of a relationship also suggests that issues of “stigma” in certain property markets maybe exaggerated.

Other research has been done to establish more general neighborhood effects on housing prices. Ding et al. [6] assessed the effect of residential investment on property values in Cleveland, OH, using hedonic price regression with lagged variables. This analysis showed that there was a positive impact on the value of residential properties attributable to residential investment within 150 feet. This suggests that revitalization projects can have a significant impact at the “micro” level, with several smaller concentrated developments possibly having more of an effect on a neighborhood than one larger clustered development. Ioannides [10] used data from the 1985 and 1989 American Housing Survey to show that opinions about the value of one’s home is often significantly affected by opinions about the value of neighbor’s homes.

One important reason to consider this is because of the effect of property values on redevelopment decisions. Brueckner [3], for example, proposes a model of urban redevelopment decisions that incorporates a dynamic approach, with depreciating durable structures. According to this model, if the expected present value at any stage is less than that of the expected present value if the capital is demolished and the property redeveloped and put to a new use, the producer will tend to redevelop the property to maximize benefits. This model has been used to explain redevelopment on parcels of single-family residential property in Vancouver, BC (see Rosenthal and Helsey [19]), and industrial and commercial property in Chicago, IL (see Munneke [14]). Combining an approach to assess the costs of contamination with potential land prices for redeveloped property would be a useful tool in understanding the phenomenon of brownfield redevelopment and the effectiveness of municipal involvement.

The cost penalty associated with site contamination is reduced over time. As the technology for site assessment and remediation improves, costs of site remediation will inevitably diminish, and the uncertainty with respect to liability for undiscovered contamination will drop. Consequently, sites that may have been considered marginal in the past due to the presence of contamination may be viable private sector projects in the future, moving up to Wright and Davlin’s [27] “Tier 1 or Tier 2” designation. Similarly, the redevelopment of certain parcels in a “blighted” neighborhood could potentially result in increases in the potential value of other brownfield parcels in the same area. This could also promote further redevelopment. On the other hand, one might also argue that as existing “Tier 1” sites are being removed from the stock of brownfield within a city, stricter environmental controls and changes in land use could prevent a significant return of urban land to brownfield. This would mean that a downward shift in penalties could be offset. Further research may be necessary to firmly establish the ways in which these relationships interact in the urban land market,

and how municipal level support can influence these dynamics most effectively.

#### 4.3 Community Development Goals versus Private Interests

Although the involvement of private interests is usually necessary to leverage the funding required for remediation, there is an incomplete understanding of how urban brownfield redevelopment in the past has provided benefits to neighboring communities. According to a basic economic determinism approach, it is completely possible that municipal support could be used to encourage businesses to site activities. It is the most beneficial to urban business interests and the fiscal health of the municipality. However, it is less oriented towards broader goals of environmental and economic equity in disadvantaged neighborhoods and improvements in the quality of life in a community. Even local governments less fixated on growth may be convinced that a more economically beneficial approach is necessary to remediate these sites, as the environmental and health risks that they represent should be removed at all costs. Although Greenberg and Schneider [9] argue that brownfield redevelopment projects would be considered more cost effective and viable if these health and environmental externalities are incorporated into the analysis, it is possible that there are broader public costs and benefits that are involved with this type of project. It is difficult to determine the total benefits that municipal involvement with urban brownfield redevelopment can provide, but it is necessary that municipalities have some understanding of how they can manage their involvement beyond typical discussion of economic activity and amelioration of environmental risk in order to maximize public benefit.

One particular issue is the balance between public and private benefits. DeSousa [4, 5] conducted two separate analyses of prototypical industrial and residential projects on a theoretical brownfield and greenfield in the Greater Toronto Area, Ontario. The results of these two studies demonstrate that the public benefits were highest for industrial redevelopment on brownfield, but that private profit was highest for the development of residential brownfield developments. This approach demonstrates that the use of a site should be examined in a wider context. Public and private benefits may not be equivalent for a given project, and subsidies may need to be targeted in order to ensure that development on these sites provides benefits for the community.

McCarthy [13] studied the redevelopment framework at the federal, state and local levels in Toledo, OH to identify the role that the public sector has played in facilitating brownfield redevelopment for private interests, and in ensuring that public needs are met with these developments. A qualitative assessment of the information suggested that while government authorities had been reasonably successful in facilitating private redevelopment projects, broader community goals had not been met. According to the author, there was little evidence that government efforts in the municipality had successfully addressed non-viable

sites in distressed communities, or the non-economic needs of local residents, or failures in public participation.

Although these sources may not provide a complete picture of the problems in urban brownfield redevelopment, the very lack of research in this area suggests that there may well be a disconnect between the provision of programs meant to provide benefits to communities, and their actual results.

## 5. CONCLUSIONS AND FUTURE RESEARCH

As stated previously, the existing literatures regarding urban brownfield redevelopment is somewhat scattered, relied largely on expert but anecdotal evidence, and developed conclusions that may not be universally applicable. Given the significant differences between the sites grouped under the category of "brownfield", successful solutions for one region, one set of contaminants and one neighborhood context may well be insufficient to address a site if the characteristics change. Broader academic research in this area can therefore often be stymied simply by the heterogeneous nature of brownfield.

There are positive developments in this and related fields that reinforce the growing importance of these redevelopment projects. Recent legislative reforms to CERCLA in the U.S., coupled with increases in federal and state support of redevelopment projects, have streamlined what was once a difficult and inflexible process, vulnerable to unknown liability and difficult requirements. Advancements in contaminant detection and remediation techniques have allowed cleanup efforts to proceed more cheaply than in the past. The availability of environmental insurance, the decline in environmental "stigma," and the increase in lender experience with such projects have removed important financial barriers to redevelopment. Increased local awareness of the benefits of these projects has stimulated interest in municipal incentives to promote redevelopment of brownfield sites. And finally, the growing appeal of urban living and the recent reversal of trends of out-migration from cities have made it more feasible to design remediation projects, which are profitable to the private sector.

In the future research, the most concern areas of urban brownfield redevelopment need to be addressed and examined. Most notable concern involved with brownfield redevelopment thus far is the difficulty in describing what constitutes the "best" type of development for a site. Redeveloping sites for commercial or industrial uses may be the most efficient, however it may be too contaminated for other uses. The local community may not welcome these developments, even though they may provide more economic and job opportunities.

New upper- and middle-income housing can be more profitable for the developers and provide some benefits to local neighborhoods. However, it may result in gentrification within the community. Recreational and community uses for a site may not be economically viable without private funding. However, it can provide considerable benefits and equities to the community and may reverse

the trends of blight.

While these issues may appear to be less related to brownfield redevelopment than to other aspects of economic development policies, the disposition of brownfield are inextricably linked to each of these perspectives. The supply of urban land that redevelopment provides, first of all, can be instrumental in achieving many of the goals of each of these interests. Given that local governments have a virtual monopoly control on land use, it makes responsible municipal authorities notable actors in economic development policy. However, the use of brownfield can also involve more tangible financial involvement from the municipality, such as tax-increment financing, grants, infrastructure improvements or other measures. It would seem likely that the nature and level of this support would be highly dependent on the specific ethos behind other economic development approaches.

In the previous discussions with respect to the use of brownfield, for example, have centered mainly on the obstacles to private interests in the area and the elimination of potential environmental and health risks from contamination. The future discussions, on the other hand, should be focused on evaluating the economic development drivers for urban brownfield redevelopment, as well as the effectiveness of redevelopment projects in achieving wider community and sustainable development goals.

Although research to date has often attempted to keep these issues separate, the acceptance of contaminated site reuse and increasing implementation of these projects implies that there may be a greater amount of choice involved with these sites in the future. Therefore, examining a wider range of literature on the benefits and drawbacks of sustainable development policies is essential in understanding the best use of brownfield sites, and further academic research is necessary to integrate these two fields.

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