Economic Development Quarterly
Volume 23 Number 2
May 2009 95-110

10.1177/0891242408328379
http://edq.sagepub.com
hosted at
http://online.sagepub.com

Assessing the Effect of Publicly Assisted Brownfield Redevelopment on Surrounding Property Values

Christopher A. De Sousa
Changshan Wu
University of Wisconsin–Milwaukee
Lynne M. Westphal
U.S. Department of Agriculture Forest Service, Northern Research Station

This study measures and compares the impact of publicly assisted brownfield redevelopment on nearby residential property values in Milwaukee and Minneapolis. It also examines the influence of land use, neighborhood characteristics, and other redevelopment factors on this impact. The research approach incorporates a hedonic method to quantify nearby property value effects at more than 100 brownfield projects, and stakeholder interviews are used to assess perceived impacts to real estate conditions. The results reveal that the spillover effect in terms of raising surrounding property values is significant in both quantity and geographic scope, as redevelopment led to a net increase of 11.4% in nearby housing prices in Milwaukee and 2.7% in Minneapolis. It also reveals that project size, value, and the amount of public funding have minor impacts on this effect; factors such as proximity to major roads, distance from rail, and higher incomes have greater positive impacts.

Keywords: *brownfield; development; hedonic modeling; land use; policy*

The redevelopment of brownfields has gained political support in the United States as an essential ingredient of urban revitalization. Nonetheless, assessing the economic, social, and environmental effects of such redevelopment is important as government budgets tighten and greater attention is paid to gauging the impacts of government intervention. One way to measure the public benefit of brownfield redevelopment is to calculate the value of redeveloped projects and the associated increase in property taxes (De Sousa, 2005; U.S. Conference of Mayors, 2006). Another measure of interest is the impact of brownfield redevelopment on neighboring property values (Simons, 2005; Simons & Saginor, 2006). This measure is considered important because it helps gauge the spillover or ripple effect on the surrounding community that is often associated with brownfield reclamation and redevelopment.

The purpose of this article is to measure and compare the impacts of publicly assisted brownfield redevelopment projects for green space and industrial, commercial, and residential use on nearby residential property values and real estate conditions in Milwaukee, Wisconsin, and Minneapolis, Minnesota. Specifically, the article seeks answers to four primary research questions:

- What is the effect of a brownfield property and its redevelopment on nearby residential property values?
- What is the geographic scope of this effect?
- Do different types of brownfield redevelopments affect nearby residential property values differently?

Authors' Note: The research for this study was funded by the U.S. Department of Agriculture Forest Service, Northern Research Station (Agreement 05-JV-11231300-018), to which we express our sincere gratitude. We would also like to thank the Milwaukee Department of City Development, the Minneapolis Community Planning and Economic Development Department, the Minneapolis Park and Recreation Board, the Greater Milwaukee Association of Realtors, and the Multiple Listing Service of Minneapolis for providing the data necessary for this study. Finally, and yet important, we would like to thank Cherie LeBlanc; our research assistants, Greg Rybarczyk and Lorne Platt; the anonymous reviewers; and the editors of *Economic Development Quarterly.*

- What is the effect on property values of different redevelopment factors, demographic variables, and location characteristics?

The research approach in this study incorporates both quantitative and qualitative methods. A hedonic method is used to quantify nearby property value effects, whereas interviews with public, private, and nonprofit sector stakeholders involved in brownfield issues are used to gather information on the perceived impacts to real estate conditions. Two cities are compared: Milwaukee, Wisconsin, and Minneapolis, Minnesota. The research adds to a specialized body of literature in this field. It also seeks to help policy makers and other stakeholders understand the nature and scope of the benefits of different types of brownfield reuse projects including those that have received public support.

Background

The Small Business Liability Relief and Brownfields Revitalization Act of 2001 defines *brownfields* as "real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant" (p. 6). The U.S. Government Accountability Office (2000) has estimated that there may be between 130,000 and 450,000 brownfields throughout the United States. A recent survey conducted by the U.S. Conference of Mayors (2006) found that 23,810 brownfield sites averaging in size from 5 to 15 acres currently exist in 172 of the cities surveyed. According to estimates provided by 158 of those cities, brownfield properties comprise more than 96,000 acres of land.

Federal policy making directed at managing contaminated property emerged in response to events such as Love Canal and the Valley of the Drums in the late 1970s. In 1980, the U.S. federal government passed the Comprehensive Environmental Response, Compensation, and Liabilities Act. Commonly referred to as *Superfund*, this act made funds available for managing contaminated sites and gave governments the power to require cleanup and damage costs from virtually anyone they considered responsible for producing or owning contaminated land. This approach, however, ended up working against many cleanup efforts by discouraging investment in property suspected of being contaminated. The Environmental Protection Agency (EPA) then introduced the Brownfields Action Agenda in 1995 to clarify the federal government's role in managing brownfields, to make funds available for pilot projects to test redevelopment approaches, and to provide direct assistance for redeveloping sites. At about the same time, many state governments began implementing voluntary cleanup programs to loosen rigid redevelopment policies and to offer more support for redevelopment and protection from liability. Nationwide, these approaches culminated in the 2002 passage of the federal Small Business Liability Relief and Brownfields Revitalization Act of 2001. Often referred to as the *Brownfields Law,* it codified and expanded the U.S. EPA's brownfields program, clarified and exempted some parties from Superfund liability, and limited Superfund enforcement authority at sites cleaned up under state programs. Although the U.S. EPA continues to manage the cleanup of the country's most contaminated hazardous waste sites via Superfund, most brownfields are now managed through state and local government efforts, with continued administrative and funding support from the federal government.

Literature Synthesis

Literature on the redevelopment of brownfields in North America and Europe has burgeoned during the past decade. Much of the research has focused on national policy making (e.g., Meyer, Williams, & Yount, 1995; Page, 1997; U.S. EPA, 2006), best practices for guiding economic development (e.g., Bartsch, 1996; Fitzgerald & Leigh, 2002; Simons, 1998), and barriers to redevelopment plus strategies for overcoming them (e.g., Howland, 2003; Meyer & Lyons, 2000; Pepper, 1997). Researchers have also devoted more attention to the relationship among brownfields, smart growth, and sustainability (e.g., Bjelland, 2004; De Sousa, 2008; Dorsey, 2003; Greenberg, Lowrie, Mayer, & Miller, 2001) and to measuring the outcomes of redevelopment activity (e.g., Eisen, 1999; Greenberg et al., 2001; McCarthy, 2006; Simons & El Jaouhari, 2001). A broad range of potential land use options for brownfield sites, such as green space (e.g., De Sousa, 2004; International City/County Management Association, 2002; International Economic Development Council, 2001; Kirkwood, 2001a) and housing (Greenberg, 2002; Kirkwood, 2001b), has also been studied by both professional associations and scholars. A key barrier to brownfield redevelopment that is consistently identified in the literature is the lack of funding support, and a main barrier to attracting funding is the lack of information about the benefits that brownfield projects generate.

It is surprising that little attention has been paid to measuring and comparing the benefits that brownfield redevelopments provide to government and society beyond project-generated jobs and taxes (Council for Urban

Economic Development, 2000; De Sousa, 2005; Simons & El Jaouhari, 2001). Studies by Persky and Wiewel (1996), De Sousa (2002), and Hara Associates (2003) have considered the broader socioeconomic and environmental costs and benefits of urban brownfield redevelopment, finding that it offers significantly more public benefits than does greenfield development. One of the key public benefits considered in these studies is the increase in property values (and associated tax increases) surrounding brownfield projects. Indeed, different assumptions about the nature and geographic extent of this effect are key factors in the contrasting public benefit value calculations by De Sousa and Hara Associates. Both studies point to the need for better information on this issue.

A number of studies have started to look at whether existing brownfield sites have a significant effect on neighboring property values and how this effect changes when brownfields are remediated or redeveloped (Simons, 2005). Although the findings vary, most studies suggest that undeveloped brownfields have a significant negative impact on neighboring property values and that this value is recoverable on remediation or redevelopment. Key findings from studies on commercial and industrial property include the following:

- Open solid waste landfills depressed surrounding commercial property values by as much as 45%, but that value was recovered when the landfills were properly closed (Guntermann, 1995).
- The values of commercial and industrial properties surrounding brownfields (within a 1.5-mile radius) are 10% lower on average after controlling for other location factors (Ihlanfeldt & Taylor, 2002).
- Proximity to an *industrial* brownfield property in Baltimore had no impact on the value of surrounding *industrial* property. However, proximity to *commercial* brownfields listed in or delisted from a brownfields registry did have a negative effect on the value of nearby *commercial* properties; in particular, property prices increase by 6.98% as one moves from 500 m to 1 km away from a *listed* commercial brownfield and increase by 4.36% as one moves from 500 m to 1 km away from a *delisted* commercial brownfield (Longo & Alberini, 2006).

The impact of brownfields is typically assumed to be larger on residential property values than on commercial land values. However, there is significant debate in the literature about how much of this impact is based on stigma rather than real risk, the lost value of use, or the aesthetic impact of derelict structures (Hara Associates, 2003; Meyer & Reaves, 1998). This debate in turn affects the question of whether remediation can restore value because pure stigma effects may perpetuate lower values. Nonetheless, brownfields have been shown to lower the value of surrounding residential property, whereas redevelopment allows it to rebound as follows:

- Disclosure of the possible presence of contaminants and cleanup requirements by real estate agents in Corpus Christi, Texas, caused homes within 1.609 km of a lead smelter to lose an average of 30.5% of their value (Jenkins-Smith, Silva, Berrens, & Bohara, 2002).
- Cursory research (methodology not explicitly outlined) on green space found seven brownfields-to-green space projects caused adjacent property values to increase four times more than citywide property values (International Economic Development Council, 2001).
- A study of the Lincoln neighborhood in Kenosha, Wisconsin, found that remediation of a brownfield would raise property values for a representative house nearby by 1.7% to 6.2%, whereas remediation and conversion to green space together would raise values by 3.4% to 10.0% (Kaufman & Cloutier, 2006).
- A meta-analysis of U.S.-based studies found that the average residential property within 2 miles from a source of environmental contamination loses 9.5% of its value. Property value losses were also $0.23 higher for every additional dollar in home value, and losses were reduced or removed after remediation of the contaminated property. By contrast, property located near positive attributes (e.g., beach, park) had a 25% premium, but the distance was not significant (Simons & Saginor, 2006).

There are several economic issues that still have not received much attention in the brownfield literature but that may have a significant impact on brownfield policy and practice. First, the impact of brownfield redevelopment on nearby residential property value and the geographic scope of that impact require more comprehensive study. Second, the literature does not shed enough light on whether the property value effect of brownfield redevelopment is different in more or less affluent areas. This is an important issue because policy makers want to know whether brownfield investments have a positive and significant impact on poorer communities. There is also a need for information about whether the amount of brownfield investment (public and private) or the nature of a project in terms of land use and property size affects

nearby property values differently. The final issue relates to whether brownfield stakeholders' perceptions are realistic regarding the benefits of redevelopment on surrounding real estate and the related catalytic effect.

The research reported here employs a hedonic price method to examine these issues. The hedonic method measures the welfare effects of changes in environmental assets and services by estimating the influence of a variety of externalities, policies, social problems, and land uses on the value of some marketed goods (i.e., typically residential property). Some of the issues examined using this method include air pollution (e.g., Chattopadhyay, 1999), noise (e.g., Espey & Lopez, 2000), views (e.g., Benson, Hanson, Schwartz, & Smersh, 1998), zoning (e.g., Thorson, 1997), crime and vandalism (Li & Brown, 1980), and underground storage tanks (Simons, Bowen, & Sementelli, 1997). Studies have also used hedonic methods to examine the welfare effects of various public and private investments, such as house construction (Ding, Simons, & Baku, 2000; Simons, Quercia, & Maric, 1998), urban green space (Morancho, 2003), and public transportation (Chau & Ng, 1998).

Scope and Method

The present study employs a mixed-methodological approach to examine the impacts of brownfield redevelopment on nearby residential property values in Milwaukee, Wisconsin, and Minneapolis, Minnesota. The study focuses on these two cities because both have a declining industrial base and a legacy of brownfields and are located in communities with mature brownfield programs that have supported a vast array of redevelopment projects.

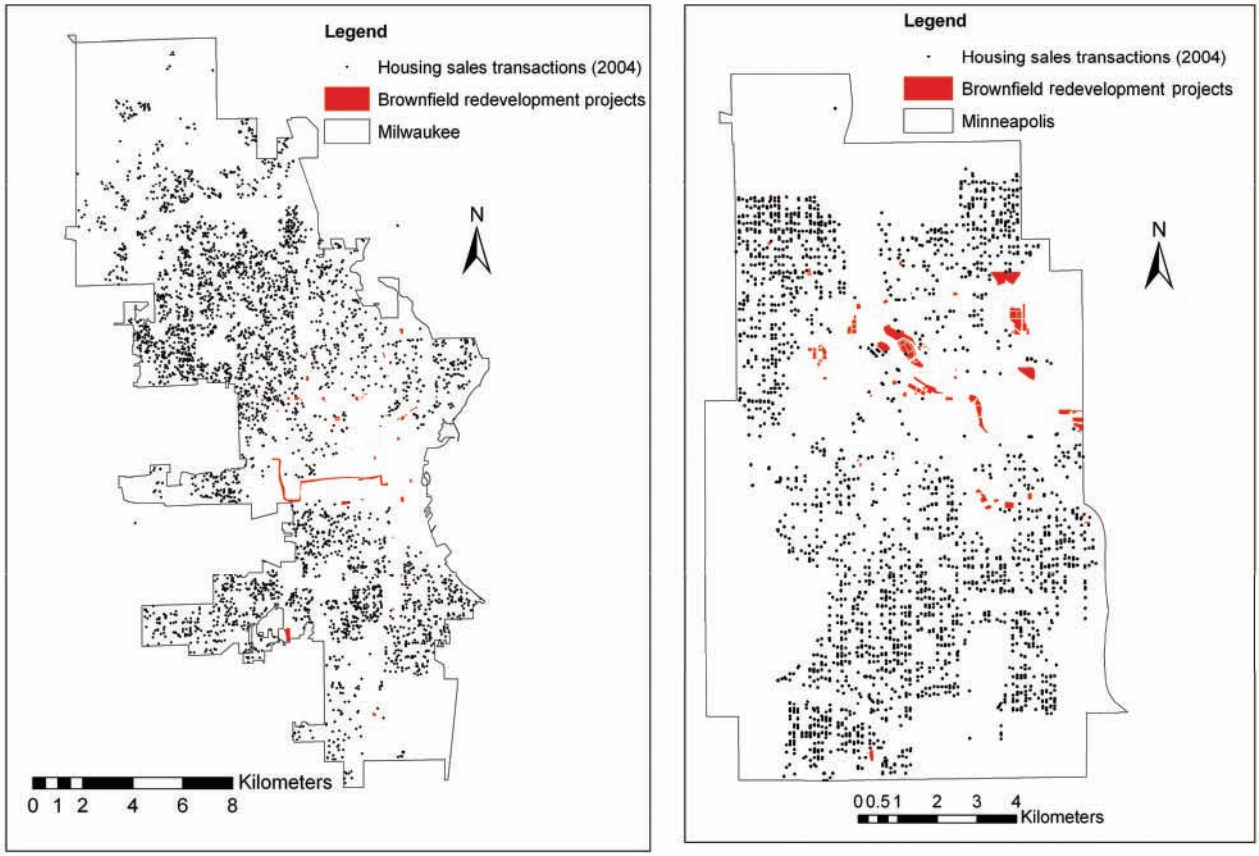
Minnesota was the first state in the country to introduce a voluntary cleanup program in 1988. Today it operates its central Voluntary Investigation and Cleanup Program (VICI) along with several subprograms targeting agricultural land contaminated by chemicals, petroleum-contaminated lands, former meth labs, and Resource Conservation and Recovery Act Program properties. Its VICI program offers liability assurance ranging from No Further Action Letters to Certificates of Completion and various financial incentives to support site investigation and cleanup.

The city of Minneapolis operates a brownfield program through its Community Planning and Economic Development Department. This program seeks to increase jobs and taxes, provide housing, improve the environment, and recycle land. Since 1994, Minneapolis has successfully initiated the cleanup of more than 100 sites resulting in the private investment of almost $1 billion (City of Minneapolis Community and Economic Development Department, 2006). The city works with interested parties to review potential projects and uses its own criteria to determine funding priority for applications to the city's funding partners (i.e., various state and regional agencies). Sites are rated based on development potential, consistency with city and neighborhood plans, job and/or affordable housing creation, and whether or not other funding resources are available. During the past decade, the city has noticed a shift from city-led redevelopment of a few large sites to city-facilitated redevelopment of an increased number of smaller sites (City of Minneapolis Community and Economic Development Department, 2006). The city has also noticed a change from the redevelopment of brownfields into light industrial projects in the early program years to a current focus on mixed-use or residential development.

The state of Wisconsin's brownfield efforts got under way in 1994 with the passage of the Land Recycling Law. The Department of Natural Resources (DNR), the Department of Commerce, and the Department of Revenue administer the state's brownfield program. The DNR is primarily responsible for overseeing the state's Voluntary Party Liability Exemption program. Under this program, any individual, business, or government agency that conducts an environmental investigation and cleanup is exempt from future environmental liability if regulations are followed. Wisconsin offers a wide range of financial programs including numerous grant (e.g., Brownfields Grant, Brownfields Green Space and Public Facilities Grant), loan (e.g., Land Recycling Loan Program, Industrial Revenue Bonds), and tax incentive programs (e.g., Development Zone Tax Credits, Business Improvement Districts, Environmental Remediation Tax Increment Financing).

A partnership of four city agencies oversees Milwaukee's brownfield program: the Department of City Development, the Health Department, the City Redevelopment Authority, and the Milwaukee Economic Development Corporation. Taking direction from the city's "Land Reuse Strategy," this partnership focuses its brownfield efforts on attracting private investment and creating jobs while restoring the environment. To deal with the challenges of brownfield redevelopment, the city has budgeted for numerous staff positions, established various tax incremental districts (directing cleanup), and set up an environmental testing fund for tax-delinquent properties. City staff have also participated in a task force to encourage flexible closure, clarify liability, streamline regulatory hurdles, recover costs, and facilitate groundwater negotiated agreements. In

Figure 1
Brownfield Redevelopment Projects and Housing Sales Transactions (2004) in the City of Milwaukee and the City of Minneapolis



addition, the city has adopted a centralized one-stop approach to reviewing and issuing development permits in an effort to make the process simpler, timelier, and more efficient.

Data Collection

Three data sets were collected to evaluate the influence of publicly supported brownfield sites and their redevelopment on nearby residential property values. The first data set includes the location and characteristics of brownfield projects in Milwaukee and Minneapolis plus the amount of public and private investment for each (see Figure 1). The Department of City Development, Wisconsin DNR, and the Milwaukee Property Files database provided information for Milwaukee. The Minneapolis Community Planning and Economic Development Department and the Minneapolis Park and Recreation Board provided information for Minneapolis. Data for Milwaukee brownfield projects include public funding provided for site assessment, remediation, and/or site preparation activities. Brownfield data for Minneapolis projects include information about public funding for construction activity (particularly for public buildings) in addition to site assessment, remediation, and/or preparation activities.

Brownfield redevelopment projects conducted between 1997 and 2003 were examined for their impact on surrounding property values. Brownfield programs in both cities were operating in earnest beginning in 1997, and digital data sets were also available for this period. Limiting projects to 2003 or earlier ensured that projects were completed and that their impact on surrounding property values could be measured using 2004 real estate data.

The second data set includes housing sales transactions surrounding brownfield projects in 1996 and 2004 (see Figure 1). This data set was obtained from the respective Multiple Listing Service offices in Milwaukee and Minneapolis. Price and structural data (e.g., house

style, type of basement, building age, number of bedrooms) were gathered for all properties. The third data set contains demographic information (e.g., median household income, poverty, percentage of minority population). This data set was obtained from the 2000 U.S. census and was used to assess the influence of brownfield projects on communities with different socioeconomic conditions. ArcGIS 9.1 commercial GIS software was used to geocode and link the brownfield project data, the home price and home structure data, and the demographic data for analysis.

Stakeholder Interviews

One objective of this research was to gather information on stakeholders' perceptions of how different types of brownfield redevelopment projects affect residential real estate conditions. To this end, 23 face-to-face and telephone interviews were carried out between September 2005 and August 2006 with public (11 interviews: 6 local or regional, 4 state, 1 federal government), nonprofit (8 interviews: 5 development-policy assistance, 3 project development), and private sector stakeholders (4 interviews: 3 developers, 1 real estate agent). Although a sample size of 23 may be considered relatively small, those interviewed represented an array of stakeholders involved in brownfield redevelopment. Indeed, more than half of the interviewees had been involved with more than 50 brownfield projects in some capacity. The University of Wisconsin–Milwaukee's Institutional Review Board for the Protection of Human Subjects approved the survey protocol.

The interviews included a series of open- and closed-ended questions related to the effect of brownfield redevelopment on the real estate market, the effect of different project land uses and characteristics on surrounding residential property values, measures for increasing the impact of brownfield projects on surrounding property, and implications of this increase (see the appendix). Using a closed-ended table, interviewees were also asked to rank different land uses in terms of their impact on the value of surrounding residential property using a 5-point scale (1 = *very negative impact*, 2 = *moderately negative impact*, 3 = *no impact*, 4 = *moderately positive impact*, and 5 = *very positive impact*; *no opinion* was also an option).

Hedonic Modeling

Hedonic models were constructed to evaluate the intensity and geographic scope of brownfield projects' influences on nearby residential real estate conditions. In addition, the effects of different types of brownfield redevelopment on residential real estate conditions were also examined. Using information about brownfield projects and nearby housing transactions (see Figure 1), we drew a sequence of buffer zones in 500 ft (150 m) increments around each housing sale transaction. Information was then obtained about brownfield projects within each buffer zone (e.g., number of projects, redevelopment area, public funding, total investment). Regression models were used to evaluate the geographic scope and intensity of the brownfield projects' influence on nearby housing prices. The impacts of different forms of brownfield redevelopment (green space, industrial, commercial, and residential) were also measured and compared to one another. A pre- and postdevelopment analysis was conducted wherein the negative impact of brownfields on nearby residential property values was assessed using 1996 housing transaction data and the positive impact of redevelopment was assessed using 2004 housing transaction data. For each analysis, a hedonic housing price model was constructed and calibrated using generalized least squares regression analysis with fixed effects. In essence,

1. Predevelopment analysis

$$\ln(P_{1996}) = \sum_{i=1}^{n_1} a_i x_i + \sum_{j=1}^{n_2} b_j y_j + \sum_{k=1}^{n_3} c_k z_{(post,k)} + \sum_{l=1}^{n_4} d_l e_l$$

2. Postdevelopment analysis

$$\ln(P_{2004}) = \sum_{i=1}^{n_1} a_i x_i + \sum_{j=1}^{n_2} b_j y_j + \sum_{k=1}^{n_3} c_k z_{(post,k)} + + \sum_{l=1}^{n_4} d_l e_l$$

P_{1996} and P_{2004} above are the sale price of houses with transactions in 1996 and 2004, respectively. x_i represents a housing structural property (e.g., living area, lot size, bedroom number, bathroom number, fireplace number, garage space, house age). y_i represents location and demographic factors (e.g., distance to railway and major roads, median household income, percentage of poverty, and African American population percentage). $z_{(pre,k)}$ and $z_{(post,k)}$ present the information on nearby undeveloped and developed brownfield sites including the number of brownfield sites for each type of redevelopment, public funds, areas of redevelopment, and so on within each buffer zone (e.g., 500 ft, 1,000 ft). Finally, e_i represents fixed effects (e.g., transaction season). For this research, only the seasonal effect (winter, spring, summer, and fall) was used as a fixed effect. Neighborhood jurisdiction effects were not used as a fixed effect because they were represented instead by the demographic and

location variables mentioned above. For housing price, a consumer price index (CPI) for houses in Milwaukee and Minneapolis was used to convert the 2004 price to the 1996 price.

Last, additional calculations were performed to assess the willingness to pay (WTP) for residential property near brownfields before and after redevelopment in relation to various demographic and location characteristics (e.g., income, poverty, race, proximity to water). The implicit price for a brownfield close to a residential property (in 1996) was calculated as the first derivative of housing price over a demographic or location characteristic (s): $\frac{dp}{ds} = \beta_1 \times P$, where β_1 is the coefficient of a brownfield site and P is the price of a residential property. The implicit price for a redeveloped brownfield site (in 2004) close to a residential property was calculated as $\frac{dp}{ds} = \beta_2 \times P$, where β_2 is the coefficient of a brownfield site.

Results and Discussion

Stakeholder Interviews

Examining brownfield stakeholders' opinions about the impact of redevelopment on surrounding real estate conditions is useful for several reasons. First, it helps set the project in a real-world context by identifying how stakeholders and the groups they represent perceive these effects. Second, it helps in interpreting any effects that have been uncovered. Last, it makes it possible to compare perceived effects with those revealed through the quantitative analysis. When asked about an undeveloped brownfield's impact on the value of surrounding residential property, most respondents (61%) said that it was negative largely because of blight, fears of contamination, and the sense that the site was a sign of poor quality of life in the community. Furthermore, many (35%) pointed out that the negative impact of a brownfield is directly related to the extent of blight and property contamination (4%, or one interviewee, provided no opinion). Most (74%) believed that brownfield redevelopment has a positive impact on the value of surrounding residential property, and several (17%) noted that the effect depends on end use (two interviewees provided no opinion). Although a few of these respondents (9%) mentioned that the impact is felt solely by adjacent property, others believed that the effect can be felt two to three blocks (48%) and four to five blocks (9%) away (typical block size in both Milwaukee and Minneapolis is approximately 330 ft by 660 ft, or 100 m by 200 m). Incidentally, many respondents (78%) felt that brownfield redevelopment has a positive impact on nonresidential property values as well (9% stated that it depended on use, and 13% provided no opinion).

Recall that interview respondents were asked to rate potential land uses and their impacts on nearby residential property values. When sorted by their average scores (see Table 1), it is clear that residential and park projects of various kinds are perceived to have the greatest impact. Lower density residential projects are believed to have a slightly higher impact, with large, new, planned subdivisions having a more positive impact than small infill projects. Parks were also highly rated, both in general and with respect to neighborhood parks specifically. Retail and office projects were generally considered to have only a moderately positive impact. Heavy industry was the only land use that was considered to have a negative effect on surrounding residential property, whereas light industrial reuse was perceived as moderately positive.

In discussion related to other characteristics such as project size, character, and location, the majority (70%) of respondents said they felt that the bigger the project, the bigger the impact, whereas six (26%) stated that it depended on the degree of blight or the new land use, and one provided no opinion. Most (74%) felt that just demolishing, remediating, and leaving a brownfield vacant would also have a positive impact on surrounding property values, even though more than half (57%) pointed out that redevelopment had the greatest impact. There was less consensus on whether the property value effects differ if the brownfield project involves rehabilitation of existing buildings versus new construction. One third of the interviewees (30%) stated that rehabilitated properties had a greater impact, one third (30%) stated that new construction did, and another one third (35%) stated that both can have an equal impact depending on the nature of the rehabilitation and its "fit" with the community (4% had no opinion). There was also less consensus on whether the property value effect differs in locations with different economic status. Many (48%) stated that the impact is higher in lower income communities, although a few (17%) stated that it was higher in middle- to upper-income communities with a stronger market. The remainder noted that it was either proportional (9%) or dependent on community needs (9%) or that they were simply unsure (17%).

When asked how brownfields could be redeveloped to achieve the greatest increase in surrounding property values, interviewees mentioned neighborhood involvement (17%), compatibility with surrounding uses (13%), project attractiveness (9%), employment generation (4%), and

Table 1
Rating of Redevelopment Project Types in Terms of Impact on Surrounding Residential Property Values

Project Types	Average Score[a]	*n*
Large planned subdivision residential	4.9	14
Park, open space (in general)	4.8	16
Residential redevelopment (in general)	4.6	16
Single-family residential	4.6	18
Neighborhood park	4.6	18
Townhouse, row house residential	4.5	18
Low-density condo, apartment residential	4.3	18
Small infill residential	4.3	19
Seminatural habitat	4.3	18
Small shop, main street retail	4.3	19
Linear trail	4.2	17
Retail (in general)	4.2	17
High-density condo, apartment residential	4.0	18
Office (in general)	3.9	16
Light industry	3.8	17
Low-density office	3.8	18
Big box outlets	3.5	17
Industrial (in general)	3.3	15
Heavy industry	2.4	18

a. Interviewees were asked to rank different land uses in terms of their impact on the value of surrounding residential property using a 5-point scale (1 = *very negative impact*, 2 = *moderately negative impact*, 3 = *no impact*, 4 = *moderately positive impact*, 5 = *very positive impact*) or to provide no opinion.

conformance with the local comprehensive plan (4%). They generally felt that the effect of a project could be enhanced if it was designed to fit in with the community and meet community goals related to jobs, recreation, housing, or other issues. When asked if there were any problems associated with brownfield redevelopment's increasing the value of surrounding properties, 44% of the interviewees brought up issues related to gentrification and rising property costs or rents. A few respondents (9%) pointed out that some residents do not like to see any change in their communities, and one interviewee expressed the concern that existing industry might be displaced by residential redevelopment near industrial areas.

Hedonic Modeling Results

Brownfield projects were analyzed using hedonic modeling if adequate Multiple Listing Service transaction information was available for surrounding property and if they received public funding. In Milwaukee, 61 brownfields were identified (including 24 residential, 25 commercial, 11 industrial, and 1 park), of which 45 (13 residential, 22 commercial, 9 industrial, and 1 park) were constructed between 1997 and 2003 and had the necessary information to run the analysis. In Minneapolis, 117 brownfields were identified (45 residential, 36 commercial, 32 industrial, and 4 parks), of which 58 (17 residential, 16 commercial, 21 industrial, and 4 parks) had the required information. In Milwaukee, the mean redevelopment cost and public investment value for the brownfield redevelopment projects in the sample were approximately $6,000,000 and $130,000, respectively, and the average site size was about 5.1 acres. In Minneapolis, the average redevelopment cost and public investment value were approximately $18,000,000 and $8,600,000, respectively, and the average site size was 6.2 acres (Table 2 provides more details).

Part of the discrepancy in public investment value between Milwaukee and Minneapolis is because of differences in the data that are kept by the two cities, as mentioned previously: Public assistance data for Milwaukee brownfield projects include public funding for site assessment, remediation, and/or preparation but not construction activity. This way of tracking public investment focuses on costs associated with brownfield mitigation specifically and eliminates the subsidies for infrastructure and land use that may also apply when developing clean land. Milwaukee has also provided public support for many small projects requiring minor site assessment and cleanup activities, and Minneapolis has supported more than a dozen large megaprojects valued at more than $20 million each.

Table 2
Descriptive Statistics of Brownfield Redevelopment Projects (1997–2003)

	Range	Min	Max	*M*	*Mdn*	*SD*
Milwaukee						
Redevelopment costs ($)	33,950,100	49,900	34,000,000	6,273,013	2,300,000	8,630,697
Public investment ($)	932,137	1,903	934,040	126,702	47,962	188,919
Site area (acres)	112.8	0.1	112.9	5.1	1.3	16.7
Minneapolis						
Redevelopment costs ($)	198,229,409	135,708	198,365,117	17,939,306	2,284,722	32,892,125
Public investment ($)	135,777,925	35,090	135,813,017	8,614,854	1,964,722	22,618,055
Site area (acres)	44.4	0.2	44.6	6.2	2.4	10.3

The first research objective was to assess the effect of brownfield properties and their redevelopment on surrounding residential property values. As mentioned, pre-redevelopment (1996) and post-redevelopment (2004) hedonic models were constructed for each city (results are detailed in Tables 3 and 4). Standard housing structure variables (house age, number of bathrooms, garage capacity, number of fireplaces [Minneapolis], living area, and lot area), demographic characteristics (African American percentage, income, commuting time, and percentage of population below poverty level), and location characteristics (distance to major roads, railroads, and body of water [Milwaukee]) were included in the model's construction. The results of this analysis show that the relationships between housing price and these standard variables are consistent with the hedonic modeling literature. For instance, the number of bathrooms, size of living area, and lot size are correlated positively and significantly with housing prices, whereas housing age is negatively correlated with housing prices. Household income is positively related to housing prices, whereas African American population percentage, commuting time, and population percentage below the poverty level are negatively related to housing prices. Brownfield-related variables, such as the number and size of brownfield projects, different redevelopment forms, amount of public funding, and total investments, were also included in the models. For the sake of organization, results on the geographic scope of the brownfields effect are presented below before the results on the monetary scope.

The analysis of the whole sample reveals that undeveloped brownfields in Milwaukee had a significant influence on the value of properties located up to 4,000 ft (1,219 m) away, whereas in post-redevelopment, these brownfields did not significantly affect nearby property values (see Tables 3 and 5). The opposite was true in Minneapolis, where brownfields pre-redevelopment had no impact on nearby property values, whereas in post-redevelopment the brownfields had a significant influence on the value of properties up to 2,000 ft (609 m) away. Although Minneapolis brownfield properties did not have statistically significant influence on the value of properties 2,000 ft to 2,500 ft away, the impact was still positive (compared to those farther than 2,500 ft). Minneapolis brownfields' geographic scope of influence is therefore considered to be 2,500 ft (see Tables 4 and 5). More specifically, the geographic scope of influence for redeveloped Minneapolis brownfield sites was +4.2% for properties within 1,500 ft and +1.8% for properties 1,500 to 2,500 ft (457 to 762 m) away. Given that the typical block size in both cities is approximately 330 by 660 ft (100 by 200 m), it is clear that the impact zone of a brownfield project extends about five blocks, well beyond the adjacent one to three blocks suggested by most of the interviewees. As suggested in the literature, the impact of brownfield redevelopment is greatest on properties closest to the brownfield and diminishes with distance.

As for monetary influence, redevelopment of the brownfields in this study led to an 11.4% net increase in nearby housing prices in Milwaukee and a 2.7% net increase in Minneapolis (see Tables 3, 4, and 5). In Milwaukee, this net increase erased only the undeveloped brownfield's negative effect on surrounding real estate. That is, pre-redevelopment brownfield sites lowered surrounding property values (within 4,000 ft) by 11.4%, and redevelopment had no effect on surrounding property values other than erasing the 11.4% deficit. When data for the whole sample are analyzed for Minneapolis, brownfield sites before redevelopment had no influence on residential property values within 2,500 ft (762 m), and redeveloped brownfields increase values by 2.7% (within 2,500 ft). It is interesting that the Milwaukee results are more in line with the perceptions of both interviewees and the literature in terms of the negative impact of a brownfield on surrounding real estate and the role of redevelopment in erasing that impact. In Minneapolis, however, the presence of brownfields did not seem to bring down the

Table 3
Full Hedonic Models for Analyzing the Influence of Brownfield Projects on Nearby Residential Property Values in the City of Milwaukee

	Pre-Redevelopment (1996)				Post-Redevelopment (2004)			
	β	*SE*	*t*-Stat.	Sig.	β	*SE*	*t*-Stat.	Sig.
Intercept	4.256	.409	10.409	.000***	6.288	.317	19.821	.000***
Age	–.007	.001	–10.023	.000***	–.006	.001	–12.219	.000***
Number of bathrooms	.097	.029	3.273	.001***	.094	.018	5.294	.000****
Garage capacity	.065	.013	4.970	.000***	.000	.000	0.658	.511
Living area (natural log)	.760	.050	15.181	.000***	.740	.040	18.282	.000***
Lot area (natural log)	.205	.030	6.755	.000***	.092	.023	3.947	.000***
African American (%)	–.001	.000	–1.950	.051*	–.006	.000	–18.476	.000***
Annual income (thousand dollars)	.002	.001	1.424	.155	.002	.000	1.635	.102
Commuting time (min)	–.003	.003	–0.872	.383	–.007	.002	–2.870	.004***
Distance to major road (ft)	–3.40E-005	.000	–4.859	.000***	–1.34E-005	.000	–2.380	.017**
Distance to rail (ft)	1.48E-005	.000	4.224	.000***	1.15E-005	.000	3.705	.000***
Distance to water (ft)	–3.51E-005	.000	–9.302	.000***	–1.82E-005	.000	–5.645	.000***
Below poverty (%)	.001	.001	1.027	.305	–.008	.001	–6.504	.000***
Winter	.058	.033	1.752	.080*	–.168	.027	–6.290	.000***
Spring	.046	.030	1.540	.124	–.087	.024	–3.636	.000***
Summer	.056	.030	1.847	.065*	–.022	.024	–0.885	.376
No. of brownfields within 500 ft	.000	.145	0.003	.998	–.081	.071	–1.144	.253
From 500 to 1,000 ft	–.043	.092	–0.464	.642	–.189	.050	–3.783	.000***
From 1,000 to 1,500 ft	–.091	.041	–2.218	.027**	–.003	.035	–0.093	.926
From 1,500 to 2,000 ft	–.040	.049	–0.823	.411	.024	.022	1.077	.282
From 2,000 to 2,500 ft	–.051	.040	–1.296	.195	.068	.023	2.969	.003***
From 2,500 to 3,000 ft	–.114	.034	–3.323	.001***	–.018	.024	–0.723	.470
From 3,000 to 3,500 ft	–.178	.035	–5.159	.000***	–.009	.021	–0.411	.681
From 3,500 to 4,000 ft	–.173	.030	–5.765	.000***	–.035	.019	–1.820	.069*
From 4,000 to 4,500 ft	.005	.029	0.158	.875	.007	.019	0.352	.725
From 4,500 to 5,000 ft	–.031	.027	–1.165	.244	–.003	.017	–0.172	.863
No. of brownfields within 4,000 ft	–.121	.011	–11.092	.000***	–.003	.007	–0.439	.661
Residential sites within 4,000 ft	.027	.039	0.704	.481	.090	.021	4.221	.000***
Commercial sites within 4,000 ft	–.173	.019	–9.245	.000***	.001	.010	0.086	.932
Industrial sites within 4,000 ft	–.122	.028	–4.368	.000***	–.070	.017	–4.197	.000***
Park sites within 4,000 ft	–.045	.071	–0.631	.528	.124	.061	2.038	.042**

Note: For the pre-redevelopment model, dependent variable is natural logarithm of 1996 dollars, N = 1,245, R^2 = .53, Adj. R^2 = .52; for the post-redevelopment model, dependent variable is natural logarithm of 1996 dollars, N = 1,907, R^2 = .64, Adj. R^2 = .63.
*90% significance level. **95% significance level. ***.99% significance level.

values of surrounding residential property, but their redevelopment did raise those values slightly. This could be because stronger residential property markets in Minneapolis are less affected by brownfields or because there is a tendency to redevelop brownfields located in communities with stronger property markets. In fact, the mean house value in Minneapolis rose 87.1% from $93,000 to $174,000 between 1996 and 2004 ($231,000 before CPI adjustment; annual rate = 8.1%), whereas in Milwaukee the value increased only 44.6%, from $74,000 to $107,000 ($122,000 before CPI adjustment; annual rate = 4.7%).

Examining the impact of different land uses on surrounding property values provides more detail on the nature and scope of the influence of brownfield redevelopment (see Tables 3, 4, and 5). This is particularly important for green space projects given that their economic "value" is often gauged on the basis of their influence on surrounding property. In Milwaukee, all land uses had a positive net effect on surrounding property values. Commercial and park projects had the highest net benefit (15.8% and 11.7%, respectively). Residential projects had slightly lower net benefits (8.6%), and industrial projects had the lowest net benefit (4.7%). All land

Table 4
Full Hedonic Models for Analyzing the Influences of Brownfields Projects on Nearby Residential Property Values in the City of Minneapolis

	Pre-Redevelopment (1996)				Post-Redevelopment (2004)			
	β	*SE*	*t*-Stat.	Sig.	β	*SE*	*t*-Stat.	Sig.
Intercept	9.329	.160	58.359	.000***	10.789	.062	173.422	.000***
Age	–.003	.000	–6.245	.000***	–6.05E-005	.000	–0.325	.745
No. of bathrooms	.120	.013	9.264	.000***	.185	.007	26.256	.000***
Garage capacity	.110	.013	8.526	.000***	.059	.006	9.224	.000***
No. of fireplaces	.176	.015	11.529	.000***	.127	.008	15.747	.000***
Living area (natural log)	.227	.020	11.116	.000***	.096	.008	12.446	.000***
Lot area (natural log)	.010	.008	1.240	.215	.004	.002	1.790	.073*
African American (%)	–.011	.001	–13.278	.000***	–.005	.000	–14.913	.000***
Annual income (thousand dollars)	.006	.000	11.212	.000***	.004	.000	12.044	.000***
Commuting time (min)	–.005	.002	–2.736	.006***	–.004	.001	–3.780	.000***
Distance to major road (ft)	–1.60E-005	.000	–4.518	.000***	–7.65E-006	.000	–4.248	.000***
Distance to rail (ft)	1.17E-005	.000	3.171	.002***	8.03E-006	.000	3.928	.000***
Below poverty (%)	–.001	.001	–0.632	.528	.001	.001	1.261	.207
Winter	–.029	.027	–1.089	.276	–.086	.014	–6.235	.000***
Spring	.047	.024	1.993	.046**	–.010	.012	–0.780	.436
Summer	.061	.024	2.606	.009***	.005	.012	0.382	.702
No. of brownfields within 500 ft	–.028	.055	–0.505	.614	.038	.025	1.509	.132
From 500 to 1,000 ft	–.033	.038	–0.866	.387	.027	.017	1.630	.103
From 1,000 to 1,500 ft	–.021	.031	–0.667	.505	.050	.012	4.272	.000***
From 1,500 to 2,000 ft	.021	.023	0.934	.350	.034	.011	3.118	.002***
From 2,000 to 2,500 ft	.003	.020	0.151	.880	.011	.008	1.256	.209
From 2,500 to 3,000 ft	.004	.020	0.208	.836	–.014	.008	–1.888	.059*
From 3,000 to 3,500 ft	.001	.017	0.040	.968	.004	.007	0.621	.535
No. of brownfields within 2,500 ft	–.001	.011	–0.048	.962	.027	.004	7.525	.000***
Residential sites within 2,500 ft	–.019	.027	–0.691	.490	.030	.013	2.418	.016**
Commercial sites within 2,500 ft	–.048	.027	–1.770	.077*	.009	.008	1.145	.252
Industrial sites within 2,500 ft	.012	.013	0.905	.366	.033	.007	5.075	.000***
Park sites within 2,500 ft	.067	.071	0.945	.345	.045	.020	2.255	.024**

Note: For the pre-redevelopment model, dependent variable is natural logarithm of 1996 dollars, N = 2,614, R^2 = .54, Adj. R^2 = .53; for the post-redevelopment model, dependent variable is natural logarithm of 1996 dollars, N = 3,017, R^2 = .66, Adj. R^2 = .66.
*90% significance level. **95% significance level. ***99% significance level.

Table 5
Property Value Effect of Brownfields Pre- and Post-Redevelopment by Project Type

	Pre-Redevelopment Effect (%)	Post-Redevelopment Effect (%)	Net Effect (%)
Milwaukee (4,000 ft/1,219 m)	–11.4	0.0	11.4
Residential	0.0	8.6	8.6
Commercial	–15.8	0.0	15.8
Industrial	–11.5	–6.8	4.7
Parks	0.0	11.7	11.7
Minneapolis (2,500 ft/762 m)	0.0	2.7	2.7
Residential	0.0	3.1	3.1
Commercial	–4.6	0.0	4.6
Industrial	0.0	3.2	3.2
Parks	0.0	4.4	4.4

Note: The results are based on the 95% significance level, except for the pre-redevelopment effect of commercial brownfield sites in Minneapolis, which is based on the 90% significance level.

Table 6
Geographic Scope of Brownfield Projects by End-Use Type

	Milwaukee		Minneapolis	
	Pre-Redevelopment (ft/m)	Post-Redeveloped (ft/m)	Pre-Redeveloped (ft/m)	Post-Redeveloped (ft/m)
Residential	4,000/1,219	3,500/1,067	*ns*	3,000/914
Commercial	4,000/1,219	4,000/1,219	2,500/762	2,000/610
Industrial	4,000/1,219	4,500/1,372	*ns*	2,000/610
Park	*ns*	*ns*	*ns*	2,500/762
Overall	4,000/1,219	*ns*	2,500/762	2,500/762

Note: *ns* = no significant impacts.

uses in Minneapolis also had a positive net effect on surrounding property values, with commercial and park projects having the highest net benefit (4.6% and 4.4%, respectively) and industrial and residential projects having slightly less of an effect (about 3.2% and 3.1%, respectively). These results generally correspond with the opinions of those interviewed, except for residential reuse in Minneapolis, which is relatively lower than expected. In summary, these results indicate for both Milwaukee and Minneapolis that commercial and park projects bring about the highest net benefits, although the benefits are higher in Milwaukee than in Minneapolis.

Breaking the results down further for the different types of land uses, one can discern whether the net benefit (predevelopment + postdevelopment) is produced by erasing the negative influence of a brownfield site or from the positive influence of a development project, or both. It is interesting that in Milwaukee, the impact of undeveloped brownfields that were going to be converted into residential or park use was not significant. The impact of brownfields that were going to be converted into commercial and industrial use, on the other hand, was highly significant and negative (–15.8% and –11.5%, respectively). Minneapolis showed a somewhat similar pattern. Brownfields that were going to be converted into residential, park, and industrial uses did not have a significant impact on surrounding property values prior to redevelopment. Brownfields before their redevelopment for commercial use had a negative (–4.6%) and significant impact (at the 90% significance level) on surrounding property. As for redevelopment, park and residential projects in Milwaukee accounted for an 11.7% and 8.6% increase in nearby housing values, respectively. Commercial projects had no significant impact, and industrial ones had a negative (–6.8%) and significant effect. In Minneapolis, positive effects resulted from park (4.4%), industrial (3.2%), and residential (3.1%) developments, whereas commercial projects did not have a significant impact on surrounding property.

The net geographic scope of these property effects is outlined in Table 5 and broken down by undeveloped (prior to development) and developed property for each land use in Table 6. One interesting feature of the data is that the negative impact of the brownfield before its development is typically not as severe for sites that are going to be converted into parks and residential use, particularly within 500 ft (150 m) of these sites. This might suggest that brownfields that will be converted into parks and housing tend to be located in places with stronger residential property markets where it is more desirable to both residents and developers to build parks and houses rather than industrial or commercial projects. In addition, brownfields converted into parks are sometimes greener to start with (containing natural habitat that has taken root when sites were fallow), so they may have less of a blighting effect on surrounding property.

One of the objectives of the study was to assess whether different brownfield redevelopment factors (i.e., public investment, redevelopment value, site size) affected property values surrounding brownfield projects differently. The amount of public brownfield funding did not have a significant influence in Milwaukee. The opposite was true in Minneapolis, where an additional $1 million of public investment in a brownfield redevelopment increased nearby housing values by the small but statistically significant amount of 0.10%. The value of a redevelopment project and its lot size did not significantly influence its impact on nearby property values in Milwaukee. This is likely because redevelopment projects in Milwaukee erase the negative effect that undeveloped brownfields have on surrounding real estate. In Minneapolis, the value of a redevelopment project had a very small, but significant, influence on surrounding property values: An additional $1 million of project value increased nearby housing values by 0.07%. The lot size of a brownfield project in Minneapolis also had a small positive influence on surrounding property values, with one additional acre increasing nearby housing values by about 0.16%.

Table 7
Effect of Demographic and Location Characteristics on the Willingness to Pay for Homes Near Brownfields Redeveloped

Demographic and Location Characteristic	Willingness of Consumers to Pay (Net) for Homes Near Brownfield Redevelopment Projects	
	Milwaukee ($)	Minneapolis ($)
As personal incomes increase (based on 1,000 increments)	+17.9	+19.1
As commuting time increases (min)	0	–23.9
As the percentage of poverty increases	0	0
As the percentage of African American population increases	–9.0	–28.7
As the distance to major roads increases (based on increments of 1,000 ft/305 m)	–269	–51.6
As the distance to railways increases (based on increments of 1,000 ft/305 m)	+152	+25.1
As distance to water increases (based on increments of 1,000 ft/305 m)	–269	0

Additional calculations were performed to assess WTP for residential property near pre- and postdevelopment brownfields based on various demographic (i.e., household income, African American population percentage, poverty level) and location characteristics (i.e., commuting time and proximity to water, rails, and roads). As mentioned previously, the implicit price for a brownfield to a residential property (in 1996) was calculated as the first derivative of housing price over a demographic or location characteristic (s): $\frac{dp}{ds} = \beta_1 \times P$, where β_1 is the coefficient of a brownfield site (–0.121 and 0 for Milwaukee and Minneapolis) and P is the price of a residential property. The implicit price for a redeveloped brownfield site (in 2004) close to a residential property was calculated as $\frac{dp}{ds} = \beta_2 \times P$, where β_2 is the coefficient of a brownfield site (0 and 0.027 for Milwaukee and Minneapolis). Table 7 lists the net WTP for an average single-family house in Milwaukee and Minneapolis. It reveals that the WTP for residential property in both Milwaukee and Minneapolis near redeveloped brownfields is higher in areas closer to major roads, farther away from railways, with higher incomes, and with lower African American populations. In Milwaukee, the WTP for residential property near redeveloped brownfields is also higher closer to waterways, whereas in Minneapolis it is higher in areas with shorter commuting times. This suggests that brownfield remediation and redevelopment will have a greater impact on the value of surrounding property in both cities if carried out in locations closer to major roads, farther away from rail corridors, with higher incomes, and with lower percentages of African Americans.

This finding does present a quandary. On one hand, promoting brownfield redevelopment in areas with these characteristics will leverage the most public benefit in terms of property tax generation. Moreover, less public investment is typically required to leverage private investment in these stronger market areas, and those residing there may feel less of a pinch from increasing property values. This raises environmental justice issues, however, related to the need to increase public support for brownfield redevelopment in poorer and segregated communities where many brownfields are located. The policy-relevant decision is whether the need to achieve environmental justice can be an appropriate motivation for the use of public funding even if the economic benefits may be slightly lower than for brownfield projects in more affluent communities.

Concluding Remarks

This research reveals that brownfield projects not only generate desirable economic outcomes themselves but also have spillover effects on surrounding home values that are significant in both quantity and geographic scope. Although park and residential projects seem to provide the most significant benefit to adjacent property, there are also significant and positive net benefits associated with removing the negative impacts of brownfields that are converted to industrial and commercial use. As a result, public investment in brownfield redevelopment, regardless of type, does help erase the negative effect imposed by deindustrialization and helps cities restore and raise their property tax base on and around brownfield sites.

From a policy perspective, it is also encouraging to note that both project size and project cost had no impact in Milwaukee and a very minor impact in Minneapolis. This indicates that both small- and large-scale projects are

worthy of public support. The amount of public investment in brownfield reuse also has virtually no impact. This allows for continued flexibility in terms of supporting projects with both high and low cleanup and redevelopment costs. The results also support the change in approach taken by many cities, including those examined here, away from city-led redevelopment of a few large sites to city-facilitated redevelopment of an increased number of smaller projects. This approach tends to favor the redevelopment of brownfields with stronger market potential that require a smaller amount of public funding per private dollar invested. Incidentally, brownfield projects located in areas with stronger market viability (i.e., in higher income areas that are closer to roads, water, and employment) also seem to have greater positive impacts on surrounding property values.

Although these results are informative from a policy-making perspective, they do point to a potential dilemma in terms of supporting brownfield redevelopment and urban revitalization. One scenario is to use public funding to support more market-driven brownfield projects in locations that will generate the greatest property tax benefit per unit of public investment, both on and off site, and then use the taxes generated from these projects to improve services throughout the city. An alternative scenario is to target a greater share of public funds to projects in lower income communities to ensure equitability in brownfield funding and to mitigate past environmental injustices.

Appendix
Survey Questions

Describe your involvement in brownfields redevelopment.

Approximately how many brownfield projects have you been involved in? # ____ projects

In your opinion, what is the impact of an undeveloped brownfield site on the value of surrounding residential property?

What is the impact of brownfields redevelopment on the value of residential property nearby and what is the geographic scope of that impact? Discuss.

What is the impact of brownfields redevelopment on the value of nonresidential property nearby?

In your opinion, does the size of a brownfields project, in terms of both land and building area, affect the impact it has on residential property values nearby? Discuss.

In your opinion, does just demolishing, remediating and leaving a brownfield vacant have an impact on surrounding property values, or is redevelopment necessary? Discuss.

Please rank the following types of redevelopment projects in terms of the impact they have (in your opinion) on the value of surrounding residential property. (Check boxes, see Table 1 above for additional redevelopment types)

	Very Negative Impact	Moderately Negative Impact	No Impact	Moderately Positive Impact	Very Positive Impact	No Opinion
Redevelopment Types	1	2	3	4	5	
Residential redevelopment in general	☐	☐	☐	☐	☐	☐
Single-family dwelling	☐	☐	☐	☐	☐	☐
Townhouse/row house	☐	☐	☐	☐	☐	☐
Low-density condo/apartment	☐	☐	☐	☐	☐	☐
High-density condo/apartment	☐	☐	☐	☐	☐	☐
Small infill project	☐	☐	☐	☐	☐	☐
Large planned subdivision	☐	☐	☐	☐	☐	☐
Park/open space in general	☐	☐	☐	☐	☐	☐
Neighborhood park	☐	☐	☐	☐	☐	☐
Seminatural habitat (prairie, woodlot)	☐	☐	☐	☐	☐	☐
Linear trail	☐	☐	☐	☐	☐	☐
Retail in general	☐	☐	☐	☐	☐	☐
Small shop/neighborhood main street	☐	☐	☐	☐	☐	☐
Big box outlets	☐	☐	☐	☐	☐	☐
Industrial in general	☐	☐	☐	☐	☐	☐
Light industry	☐	☐	☐	☐	☐	☐
Heavy industry	☐	☐	☐	☐	☐	☐
Office-in general	☐	☐	☐	☐	☐	☐
Low-density office	☐	☐	☐	☐	☐	☐

Interviewees were asked to rank different land uses in terms of their impact on the value of surrounding residential property using a 5-point scale (1 = very negative impact, 2 = moderately negative impact, 3 = no impact, 4 = moderately positive impact, 5 = very positive impact) or to provide no opinion.

(continued)

Appendix (continued)

Does the impact on residential property value differ if the brownfield project is rehab versus new construction?

Does the impact of a brownfield project on residential property value differ in neighborhoods of different economic status? Discuss.

How can we redevelop brownfields to achieve the greatest increase in surrounding property values?

Are there any problems associated with brownfields redevelopment's increasing the value of surrounding property?

Discuss any projects that you are familiar with that demonstrate the "ripple/catalytic/spillover effect" often associated with brownfields redevelopment.

References

Bartsch, C. (1996, Winter). Paying for our industrial past. *Economic Development Commentary, 19,* 14-24.

Benson, E. D., Hanson, J., Schwartz, A., & Smersh, G. (1998). Pricing residential amenities: The value of a view. *Journal of Real Estate Finance and Economics, 16*(1), 55-73.

Bjelland, M. (2004). Reclaiming brownfields sites: From toxic legacies to sustainable communities. In D. G. Jannelle, B. Warf, & K. Hansen (Eds.), *WorldMinds: Geographical perspectives on 100 problems* (pp. 197-202). London: Kluwer.

Chattopadhyay, S. (1999). Estimating the demand for air quality: New evidence based on the Chicago housing market. *Land Economics, 75*(1), 22-38.

Chau, K., & Ng, F. (1998). The effects of improvement in public transportation capacity on residential price gradient in Hong Kong. *Journal of Property Valuation and Investment, 16*(4), 397-410.

City of Minneapolis Community and Economic Development Department. (2006). *Minneapolis Community Planning and Economic Development Department Brownfields Program*. Retrieved November 9, 2006, from http://www.ci.minneapolis.mn.us/cped/brownfields.asp

Comprehensive Environmental Response, Compensation, and Liabilities Act of 1980, 42 U.S.C. 9601-9675 (1980).

Council for Urban Economic Development. (2000). *Brownfields redevelopment: Performance evaluation.* Washington, DC: Author.

De Sousa, C. (2002). Measuring the public costs and benefits of brownfields versus greenfield development in the greater Toronto area. *Environment and Planning B, 29*(2), 251-280.

De Sousa, C. (2004). The greening of brownfields in American cities. *Journal of Environmental Planning and Management, 47*(4), 579-600.

De Sousa, C. (2005). Policy performance and brownfield redevelopment in Milwaukee, Wisconsin. *Professional Geographer, 57,* 312-327.

De Sousa, C. (2008). *Brownfields redevelopment and the quest for sustainability.* London: Elsevier.

Ding, C., Simons, R., & Baku, E. (2000). The effect of residential investment on nearby property values: Evidence from Cleveland, Ohio. *Journal of Real Estate Research, 19,* 23-52.

Dorsey, J. W. (2003). Brownfields and greenfields: The intersection of sustainable development and environmental stewardship. *Environmental Practice, 5,* 69-76.

Eisen, J. B. (1999). Brownfields policies for sustainable cities. *Duke Environmental Law and Policy Forum, 9,* 187-229.

Espey, M., & Lopez, H. (2000). The impact of airport noise and proximity of residential property values. *Growth and Change, 31,* 408-419.

Fitzgerald, J., & Leigh, N. G. (2002). *Economic revitalization: Cases and strategies for city and suburb.* London: Sage.

Greenberg, M. (2002). Should housing be built on former brownfields sites? *American Journal of Public Health, 92*(5), 703-705.

Greenberg, M., Lowrie, K., Mayer, H., & Miller, K. T. (2001). Brownfield redevelopment as a smart growth option for the United States. *Environmentalist, 21*(2), 129-143.

Guntermann, K. (1995). Sanitary landfills, stigma and industrial land values. *Journal of Real Estate Research, 10,* 531-542.

Hara Associates. (2003, May). *Market failures and the optimal use of brownfield redevelopment policy instruments.* Paper presented at the 37th annual meeting of the Canadian Economics Association, Ottawa, Ontario, Canada.

Howland, M. (2003). Private initiative and public responsibility for the redevelopment of industrial brownfields: Three Baltimore case studies. *Economic Development Quarterly, 17,* 367-381.

Ihlanfeldt, K., & Taylor, L. (2002, January). *Assessing the impacts of environmental contamination on commercial and industrial properties.* Retrieved May 9, 2006, from http://weber.ucsd.edu/~carsonvs/papers/297.pdf

International City/County Management Association. (2002). *Growing greener: Revitalizing brownfields into green space.* Washington, DC: Author.

International Economic Development Council. (2001). *Converting brownfields to green space.* Washington, DC: Author.

Jenkins-Smith, H., Silva, C., Berrens, R., & Bohara, A. (2002). Information disclosure requirements and the effect of soil contamination on property values. *Journal of Environmental Planning and Management, 45,* 323-339.

Kaufman, D., & Cloutier, N. (2006). The impact of small brownfields and greenspaces on residential property values. *Journal of Real Estate Finance and Economics, 33,* 19-30.

Kirkwood, N. (2001a). *Manufactured sites.* London: E & F Spon.

Kirkwood, N. (2001b). *Why is there so little residential redevelopment of brownfields? Framing issues for discussion.* Cambridge, MA: Harvard University, Joint Center for Housing Studies.

Li, M., & Brown, H. (1980). Micro-neighborhood externalities and hedonic housing prices. *Land Economics, 54,* 124-141.

Longo, A., & Alberini, A. (2006). What are the effects of contamination risks on commercial and industrial properties? Evidence from Baltimore, Maryland. *Journal of Environmental Planning and Management, 49*(5), 713-737.

McCarthy, L. (2006). In the dark about brownfields. *Papers of the Applied Geography Conferences, 29,* 292-301.

Meyer, P., & Lyons, T. (2000). Lessons from private sector brownfield redevelopers: Planning public support for urban regeneration. *Journal of the American Planning Association, 66*(1), 46-57.

Meyer, P., & Reaves, C. W. (1998). *Accounting for stigma on contaminated lands*. Louisville: Center for Environmental Policy and Management, Kentucky Institute for the Environment and Sustainable Development.

Meyer, P., Williams, R., & Yount, K. (1995). *Contaminated land: Reclamation, redevelopment and reuse in the United States and European Union.* Aldershot, UK: Edward Elgar.

Morancho, A. B. (2003). A hedonic evaluation of urban green areas. *Landscape and Urban Planning, 66,* 35-41.

Page, W. (1997). *Contaminated sites and environmental clean-up: International approaches to prevention, remediation, and reuse.* San Diego, CA: Academic Press.

Pepper, E. (1997). *Lessons from the field—Unlocking the economic potential with an environmental key.* Washington, DC: Northeast-Midwest Institute.

Persky, J., & Wiewel, W. (1996). *Central city and suburban development: Who pays and who benefits?* Chicago: University of Illinois at Chicago, Great Cities Institute.

Simons, R. (1998). *Turning brownfields into greenbacks.* Washington, DC: Urban Land Institute.

Simons, R. (2005). *When bad things happen to good property.* Washington, DC: Environmental Law Institute.

Simons, R., Bowen, W., & Sementelli, A. (1997). The effect of leaking underground storage tanks on residential sales prices. *Journal of Real Estate Research, 14*(2), 29-42.

Simons, R., & El Jaouhari, A. (2001, Fall). Local government intervention in the brownfields arena. *Economic Development Commentary, 25,* 12-18.

Simons, R., Quercia, R., & Maric, I. (1998). The value impact of new residential construction and neighborhood disinvestment on residential sales prices. *Journal of Real Estate Research, 15,* 147-162.

Simons, R., & Saginor, J. (2006). A meta-analysis of the effect of environmental contamination and positive amenities on residential real estate values. *Journal of Real Estate Research, 28*(1), 71-104.

Small Business Liability Relief and Brownfields Revitalization Act of 2001, Pub. L. No. 107-118, H.R. 2869 (2002).

Thorson, J. (1997). The effect of zoning on housing construction. *Journal of Housing Economics, 6,* 81-91.

U.S. Conference of Mayors. (2006). *Recycling America's land: A national report on brownfields redevelopment* (Vol. 4). Washington, DC: Author.

U.S. Environmental Protection Agency. (2006). *State brownfields and voluntary response programs—Updated in August 2006.* Washington, DC: SRA International.

U.S. Government Accountability Office. (2000). Brownfields: Information on the programs of EPA and selected states. Washington, DC: Author, GAO-01-52 December 15, 2000.

Christopher A. De Sousa is an associate professor of geography at the University of Wisconsin–Milwaukee. He is also a member of the urban studies faculty and founding codirector of the Brownfields Research Consortium.

Changshan Wu is an associate professor of geography at the University of Wisconsin–Milwaukee. His current research involves geographic information systems and remote sensing applications in housing studies, urban land use change assessment, and transportation analysis.

Lynne M. Westphal is a research social scientist with the U.S. Department of Agriculture Forest Service Northern Research Station, leads the People and Their Environments research group, and conducts research on people and urban natural resources.