

Benefits of Public Investment in Brownfield Cleanup and Redevelopment

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Executive Summary

This report summarizes the findings of a number of studies, as well as raw Wisconsin data, on the impact of public investment in brownfield redevelopment. While programs and data quality vary between states, the overwhelming conclusion is clear:

Investment of public funds in the remediation and redevelopment of brownfields generates a range of public and private benefits, including increased property values, increased tax revenues, jobs retained, new jobs created, environmental benefits, and social benefits.

Key findings include:

- Public investment leverages private investment, typically in a range from \$7 to \$19 private funds per public dollar invested.
- Property values increase as a result of public investment:
 - On site, a dollar of public investment yields \$5 to \$20 in property value increase.
 - In the surrounding neighborhood, property values typically increase in the range of 5-15 percent, just from the appreciation of the property due to the redevelopment of the brownfield.
- A new job is created for every \$10,000-\$13,000 spent on brownfield remediation..

In addition, brownfield redevelopment removes or greatly reduces exposure to harmful contaminants in the soil and groundwater. Because of the leveraging of private investment suggested in the literature reviewed, this health and environmental benefit is achieved at a lower cost than if the public sector took responsibility for the entire cost of cleanup, and the benefit is achieved more quickly than if the public sector took no role in supporting cleanup and redevelopment.

Yet, despite the substantial benefits to the public that have been documented from public investments in brownfield redevelopment, the amount of state funding for brownfield investigation and cleanup has been declining over time.

Benefits of Public Investment in Brownfield Cleanup and Redevelopment

During the 1970s and 1980s, a process of deindustrialization hit cities in Wisconsin—and across the "Rust Belt" of the upper Midwest—like a cluster of tornadoes ripping through the heart of communities. First, industries moved to less cramped quarters in the suburbs, and later to southern states and offshore. Then, in the wake of disasters like Love Canal, where buried barrels of industrial waste poisoned a neighborhood, state and federal laws were enacted to prevent the improper handling and disposal of hazardous industrial materials and to create a system to require those responsible for the mess to clean up, most famously through the Superfund law.

These protections were essential to protect public health, but created unintended social and economic consequences. Court interpretations throughout the 1980s found owners of property and banks that lent to those owners to be financially liable for cleanup, even if they had not been responsible for causing the release of hazardous materials in the first place. When brownfield owners failed to pay property taxes, municipalities and counties were reluctant to proceed with tax foreclosure because of the uncertainties around their liability for cleanup of the property once the local government was in the chain of title." As a result, large swaths of land in the heart of many Wisconsin cities lay vacant and deteriorating, posing real environmental and health threats of unknown magnitude.

With passage of the 1994 Land Recycling Law, Wisconsin became a national leader in developing a set of policies to manage the financial risks to innocent property owners, banks, and municipalities that acquired brownfields. This set of liability clarifications made possible thousands of brownfield cleanups, largely with private funds.

Subsequently, the legislature recognized that clarifying liability issues removed some of the worst legal hurdles discouraging redevelopment, but financial hurdles remained. Unless the financial gap between the higher cost of brownfield development compared to greenfield development could be narrowed, vast areas in older industrial cities—like Oshkosh, La Crosse, Green Bay, Kenosha, West Allis, Glendale, Beloit, Wausau, and Milwaukee—would be passed over by private developers seeking at least a comparable return on their investment. Even though, legally, the responsible parties remained liable for the costs of cleanup, in many, many cases, the responsible parties were no longer in existence, could not be located, or were essentially destitute—bankrupt or nearly so. Without public intervention, these sites would never be cleaned up.

As a result, the legislature created a number of grant and loan programs as part of the 1997-98 biennial budget bill, signed by Governor Tommy Thompson. The financial tools were designed to make brownfield redevelopment a more attractive option. At that same time, the legislature created the Brownfields Study Group to "evaluate Wisconsin's current brownfields initiatives and recommend changes, as well as propose additional incentives for the cleanup and reuse of brownfields."

The underlying policy approach was that the public sector would provide enough funding to create a market for brownfield sites and the private sector would fill in a portion of the funding gap. As a result, the public would not take on the full burden of cleaning up brownfields; rather, the public sector would work in partnership with the private sector.

Focus of This Research Review

This white paper is intended to summarize what is known about the benefits of public investments in brownfield cleanup and redevelopment. The principal focus is on the economic and fiscal benefits, but where information is available, the environmental and social benefits are also summarized. The paper first takes a look at data compiled by the Wisconsin Economic Development Corporation and the City of Milwaukee about the fiscal and economic impacts of public investment in brownfields. Next, several case studies that tell the story of specific brownfield redevelopment projects in Wisconsin are summarized. The review then looks to studies prepared for places outside of Wisconsin, looking first at national-scale studies, then state-wide studies in Delaware, Indiana, Minnesota, Washington,, Iowa, Massachusetts, and New York State. Five additional studies have been done of state program impacts in a particular locality or about the impacts of cities' own investments in brownfield redevelopment.

A separate section is devoted to studies that examine the economic benefits of brownfield investment using a hedonic pricing approach, which focuses on the increased property values that occur on properties in the vicinity of brownfields when they are redeveloped. This section is followed by a brief discussion of the costs of doing nothing. That is, what are the hidden costs that state residents would face if public investment in brownfields does not grow.

The paper concludes with a summary of the research that has been done related to the environmental and social benefits of brownfield cleanup and redevelopment.

Economic and Fiscal Impacts

The vast majority of studies on the impacts of brownfield redevelopment concern the economic and fiscal benefits. Many of these studies are intended to understand whether and to what degree brownfield redevelopment programs "pay for themselves" by generating private sector economic activity and, consequently, increase the tax base (property values, incomes, and sales) so that the public coffers are refilled through the new activities occurring on brownfield sites. The economic benefits (jobs, wages, increases in property values) generate fiscal benefits (increased tax revenues without increasing tax rates). Other fiscal benefits may also be derived from the environmental and social benefits, to be discussed at the end of this paper, but those fiscal benefits have not been rigorously examined.

The overwhelming conclusion to be drawn from the studies reviewed is that public investment (the cost side of the cost-benefit equation) is more than repayed through economic activity that generates economic and fiscal benefits. In almost every case, the studies look at the grants, expenditures in-kind or tax credits provided by the public sector as the only cost.

While other costs might be analyzed—in particular, costs related to staffing to administer the grant programs and to operate voluntary cleanup programs that grant liability protections to property owners—the consensus of these studies appears to be that the scale of staff costs are relatively small in comparison to the costs of the direct subsidies provided to address contamination and barriers to redevelopment of brownfields. For that reason, this review adopts the same approach, focusing only on the direct investments in brownfields and not on the costs of operating these programs.

This section begins with a summary of the data provided by the Wisconsin Economic Development Corporation (WEDC) concerning the Brownfield Grant program and the Site Assessment grant program. Data provided by the City of Milwaukee is also summarized. Next, several case studies of brownfield redevelopment are summarized where full financial data are provided. Included with the Wisconsin

case studies is one hedonic pricing study that focused on two brownfield sites in the City of Kenosha. Then national and state studies from other jurisdictions are summarized. The section ends with a look at the findings of hedonic pricing models that focus on brownfields.

Overview of Wisconsin Brownfield Funding Programs

The Wisconsin Department of Natural Resources (DNR) lists eleven funding programs that may be used to support brownfield redevelopment. Only four of the programs are both (1) administered by the state, rather than by the U.S. Environmental Protection Agency (EPA), and (2) specifically for brownfields projects (DNR "Brownfield Grant and Loan Programs" 2013). Of those four, two are "pass-through" federal funds administered by the Wisconsin DNR. The state programs discussed below include only the two programs that are exclusively for brownfield assessment, cleanup, and redevelopment and that use state dollars: Wisconsin Brownfield Grants and Wisconsin Site Assessment Grants. A comprehensive guide to Wisconsin financial resources for brownfield cleanup and redevelopment was most recently updated and published in 2013 (Wisconsin DNR 2013, Financial Resource Guide).

Wisconsin Brownfield Grants. The Wisconsin Brownfield Grant Program (administered by the Department of Commerce from 1998-2011 and by the Wisconsin Economic Development Corporation from 2012 to the present) has awarded over \$90 million in competitive brownfield grants from FY 1998-2014. Applicants are required to estimate the number of jobs that will be created on site when the redevelopment is completed, the total eligible project costs, and the expected property value after redevelopment. Neither Commerce nor WEDC conduct post-redevelopment audits to determine whether the jobs anticipated in the grant proposal actually materialized.

According to the information provided by grant applicants, the economic impacts of the brownfield grant program include:

- The cost per job created has averaged just over \$11,000 since 1998.
- Each \$1 in grant funding is associated with a \$17 increment in property value.
- \$90 million in grant funds leveraged an additional \$691.5 million in eligible project costs.
- On average, eligible environmental costs were 17 percent of total eligible project costs (acquisition, demo, rehab, environmental, and infrastructure).

Site Assessment Grants. The Site Assessment Grant (SAG) program was administered by the DNR until FY 2012-13. Because the purpose of the SAG grant is to create the information base that potential purchasers need before committing to purchase a brownfield, data regarding economic and fiscal impact is not readily available. The DNR summarizes the impact of the Site Assessment grant during the period before FY 2012-13:

[DNR] awarded \$18 million to more than 200 communities to begin investigation and cleanup on more than 1,600 acres; these activities included 825 site assessments and investigations, the removal of more than 700 storage tanks and containers, and the demolition of more than 630 structures and buildings.

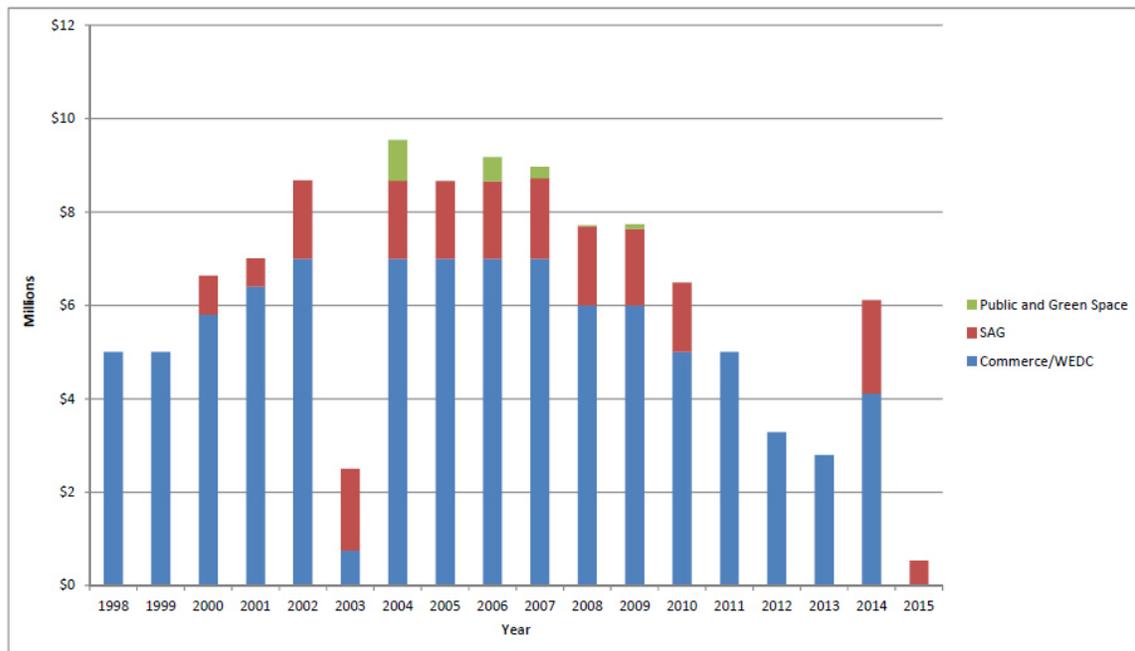
WEDC provided data about the SAG grant program from FY 2012-13 through the present.

- \$2.5 million awarded, eligible costs include environmental investigation, demolition, including associated asbestos abatement, removal of underground storage tanks, and removal of abandoned containers.
- Environmental costs were 44 percent of all eligible costs.

Funding Trends and the Funding Gap

Trend data is difficult to interpret because of the unknown influence of the recession on both need and state and municipal budgets. Nonetheless, to a degree, the facts speak for themselves. State brownfield funding has declined dramatically since 2004 (see graph). State funding of brownfield grants declined over \$3.4 million (35.9 percent) between 2004 and 2014. During this period, however, brownfields funding dipped sharply before 2014, when some funding was restored. Significantly, in FY 2013-13, WEDC originally budgeted \$3.5 million for the Brownfield Grant Program, but increased that to \$5.2 million when it became clear that demand was high.

State Brownfield Funding Trend, 1998-2014



Another indicator of the trends are the unmet need in grant programs. Early in the brownfield grant program, the grant funds requested from municipalities and developers outstripped available funds by two to three times. Since 2011, the number and amount of unfunded grants declined from 13 unfunded proposals totaling over \$15 million in 2010 to only 2-4 unfunded proposals in 2011-2013 and a total value of unfunded proposals averaging \$1 million annually during this period. Without additional information, the causes of this shift are difficult to determine. Possible explanations include a weak development environment or improved counseling of prospective applicants regarding program

requirements and the likelihood of funding. Information from communities about their inventory of brownfields suggests, however, that lack of brownfields requiring support is not the likely reason. Indeed, the lack of funding for Site Assessment Grants from 2011-2013 may have reduced the number of sites that were ready for developer interest and preparation of detailed plans needed for the WEDC Brownfield grant.

Case Studies in Wisconsin

The City of Milwaukee compiled jobs and private investment information for all 97 brownfield sites that have used City brownfield resources (TIDs, grants and loans, etc.) from 1990 through 2013. The total amount of public investment (state, City of Milwaukee or federal) is not reported.

- At least 4,835 total jobs were created or retained
- Over \$810 million in private investment was leveraged.

For other communities, case studies are the primary source of information about the impact of brownfield investments. Both the state and local development agencies have developed brownfield case studies throughout the last 20 years. Typically, these are labeled "success stories," so that the sample of cases detailed in these studies is likely biased towards the most successful cases. Nonetheless, case studies serve to illustrate the upper range of benefits that have been realized in communities across Wisconsin. Many case studies are missing key information needed to report the relative scale of costs compared to benefits. The cases below are illustrative. The Kenosha case, unlike the others, reports the results of a hedonic pricing study conducted on two Kenosha sites. These selected cases are presented in alphabetical order.

Kenosha. Kaufman and Cloutier (2006) conducted a hedonic pricing study, focused on two small brownfield sites in an inner city neighborhood in Kenosha to estimate how property values in the neighborhood would respond to the brownfields being redeveloped into greenspace. By examining property values in relation to open spaces, they concluded that "remediation and redevelopment of the brownfields into greenspace would increase property values for 890 residences between \$2.40 and \$7.01 million." This translates to an average price increase of \$2,700 to \$7,800. Remediation alone, without redevelopment, increased home values from 1.7 to 6.2 percent, but redeveloping the area as open space further increased the benefit, with a 3.4 to 10 percent rise in home values (De Sousa, Wu, and Westphal 2009).

La Crosse. Just four of the city's brownfield redevelopment projects have increased property values by over \$60 million and created 1250 permanent jobs in the city (Kirch 2014).

- At the 6-acre "CenturyTel" site, the property tax base increased from \$600,000 to over \$35 million, approximately 500 service jobs were retained and 350 new service jobs were created with an annual payroll of approximately \$20 million.
- At the 1.7-acre River Crossing Square, the property tax base of a former parking lot that contained contaminated foundry sand increased the tax base \$3.5 million and created approximately 100 service jobs.
- At the 0.7-acre Riverside Center Building 1, the tax base increased from \$1.2 million in 2003 to \$13.7 million after redevelopment. New development on the site was responsible for bringing 638 full-time and 131 part-time jobs with an hourly pay rate from \$10 to \$33.69. The entire Riverside Center complex will have a combined value, post-redevelopment, of \$50 million.

- At the 1.4-acre Midwest Garment site, that housed a dry-cleaning plant, the 2009 assessed value was \$1.1 million. Prior to redevelopment, the dry-cleaning and tailoring service had cut 20 regular jobs and 100-125 seasonal jobs. In 2010, the city acquired the site, along with an adjacent site, and attracted development of the Kwik Trip bakery freezer facility. The post-redevelopment assessment is \$11 million, generating more than 100 jobs.

Madison. A site formerly used for a variety of commercial and industrial activities (auto repair, printing, and manufacturing) is being redeveloped into mixed use development. Public funding was limited to \$365,000 from the Wisconsin brownfield grant program. This public investment leveraged \$65,000,000 in private investment. As a result of the redevelopment, other long-vacant parcels in the vicinity have been leased and are being renovated in anticipation of the increased activity in the area catalyzed by the brownfield development (C. Valcheff, case study submitted to the Wisconsin Brownfields Study Group, 2014).

Milwaukee. A hedonic model of housing prices near brownfields (De Sousa, Wu, and Westphal 2009) looked at 61 brownfields that underwent cleanup and redevelopment from 1997 to 2003. The average redevelopment cost was \$6 million, and the average public investment was \$130,000. "Redevelopment of the brownfields in this study led to an 11.4% net increase in nearby housing prices in Milwaukee" (De Sousa, Wu, and Westphal 2009, 103). As a result, the depressed prices of housing prior to redevelopment of the brownfield was erased, but did not result in prices moving higher than in areas that had not experienced any brownfield activity. Notably, the effect on property value varied significantly by post-development land use category; "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" (p. 106). Project size and project cost had no effect on the magnitude of the effect on prices of nearby housing, indicating that "both small-scale and large-scale projects are worthy of public support" (p. 107-108).

Milwaukee, 30th Street Corridor. In Milwaukee's 30th Street Industrial Corridor, the DNR's Remediation and Redevelopment Program secured \$800,000 in funding from the federal government to address environmental contamination and to kickstart redevelopment on over 200 parcels (City of Milwaukee 2012).

- Overall, the state of Wisconsin invested \$550,000 in site assessment grants and brownfield redevelopment grants, leveraging an additional \$3 million in funding.

Milwaukee, West Side. On the west side of Milwaukee, near Miller Park, Real Estate Recycling LLC "purchased a polluted, bankrupt former foundry. At the time of purchase, the property value was \$1.5 million and had no jobs and severe pollution in the soils and groundwater. Real Estate Recycling received a \$500,000 brownfield redevelopment grant from the Wisconsin Department of Commerce. The state funds leveraged \$3 million in tax increment financing from the City of Milwaukee and private investment of over \$10 million. Now the 200,000 square feet of light industrial space has a tax value of over \$13 million and employs 400 people in high paying jobs near the center of the city. The company pays over \$400,000 a year in property taxes (Hall 2014).

Neenah. The Glatfelter Corp. had operated for 100 years in central Neenah. "When the Glatfelter paper mill closed in 2006, 220 jobs were lost and the assessed value of the property

and buildings was only \$3.7 million" (Neenah Glatfelter 2013; WEDC 2014). Neenah received a total of \$1.2 million for brownfield cleanup, including:

- \$700,000 in Blight Elimination and Brownfield Redevelopment funds through WEDC,
- \$429,500 in federal "Ready for Reuse" grants, and
- a \$97,000 Wisconsin site assessment grant.

This support for investigation and cleanup paved the way for private redevelopment. Today, the site boasts:

- almost 400 jobs, with additional jobs to be added in the future,
- average salary for jobs is over \$80,000,
- two new buildings on site are assessed at more than \$23 million, for a leverage rate of \$19 of private investment for each \$1 in public investment (\$1.2 million) on the site.
- the redevelopment has added to Neenah's property tax base, generating over \$700,000 in tax revenue annually.

Stevens Point. Redevelopment of the downtown Centerpoint Mall was a city-led development, with much of the site remaining in public ownership for both public use and leasing to private entities. Funding for the redevelopment included \$750,000 in state-allocated CDBG funds, \$213,000 in state brownfield grant funding, and investment of \$7.6 million by the city. In addition, tenants of the redeveloped building have invested over \$6 million in their facilities at the site. One tenant, Great Lakes Loan Services, will have over 100 employees at the site. According to city staff, "This project has positively impacted downtown Stevens Point, by bringing hundreds of students and employees to the area to learn, work, shop, eat and wander. The full impact has yet to be witnessed as the College has not yet began a full semester, however there is no doubt that it has positively affected downtown especially after the recession" (K. Kearns, case study submitted to the Wisconsin Brownfields Study Group, 2014).

Stoughton. A largely vacant industrial parcel was redeveloped into a 33-unit affordable housing development. Public funding included a \$200,000 brownfield grant from the state and an additional \$568,000 in local funding. The private investment leveraged by these public investments totals over \$7 million. Property taxes increased \$23,000 annually from this parcel.

Wausau. The Riverfront Revitalization project is a 31.0-acre area in downtown Wausau stretching nearly one mile along the Wisconsin River. It consists of 23 contiguous parcels, all former or current brownfields (Brownfield Renewal Award 2013). Although the project is not yet completed, it has been very successful in leveraging both public and private investment.

- The three major commercial buildings on the site have used a total of \$40.5 million in private funding, and at least \$3 million in private foundation funds have contributed to the development of the riverfront trails, greenspace, and public plaza.
- The completed commercial components of this project have led to the creation of 840 permanent new jobs, an estimated 75 percent of which are professional jobs with average annual wages of greater than \$60,000 with a total payroll value of over \$50 million.
- Since redevelopment, it has generated a total of \$7 million in tax revenue for the city, compared to annual property tax revenues in 2012 of \$21.5 million (Wisconsin Department of Revenue 2014).

- Further work is being performed in the northern sections, “utilizing two U.S. EPA brownfield cleanup grants, a U.S. EPA brownfield area-wide planning grant, as well as private donations and City funds.”

West Allis. While data from WEDC does not track the economic return on SAG grants, West Allis has tracked this. The city estimates that it has catalyzed over \$125 million in actual and projected redevelopment by its use of Wisconsin Brownfield Site Assessment (SAG) grants. Since 1999 West Allis received 20 SAG awards totaling nearly \$1 million (City of West Allis, no date).

These state investments produced:

- 737 jobs created or retained
- Grants produced a 125:1 return on investment.

National Studies

Two studies of national scope conclude that public brownfields investment leverages private development and increases jobs and tax base.

A study of the EPA Brownfield Grant concludes: "Since the inception of the EPA’s Brownfields Program in 1995, cumulative brownfield program investments have leveraged more than \$21 billion from a variety of public and private sources for cleanup and redevelopment activities. This equates to an average of \$17.79 leveraged per EPA brownfield dollar expended. These investments have resulted in approximately 93,000 jobs nationwide. These projects demonstrate the positive impact a small investment of federal brownfields funding can have on community revitalization through leveraging jobs, producing clean energy, and providing recreation opportunities for surrounding neighborhoods (U.S. EPA 2013).

Paull (2008) conducted a literature review of the economic and environmental impacts of brownfield redevelopment. Key findings include:

- At the current pace, only 1.4 percent of the brownfields inventory is cleaned up each year.
- Compiling results from eight studies, Paull concluded that public investments in brownfields leverage total investments at a ratio of approximately \$1 of public investment to \$8 total investment.
- Based on six studies that examined job creation, the study concluded that "it takes between \$10,000 and \$13,000 in public investment to leverage one job."
- Property values within a 3/4-mile radius of a brownfield cleanup increase in value from 5 to 15 percent.
- In some cases, especially where land use shifted from industrial to parks or mixed use, property values within 3/4-mile of the site increased 100 percent.
- On a project-specific basis, "public investment in brownfields are generally recouped from local taxes generated by the project within about five years."

State Studies

A number of states have conducted analyses of the impacts of their brownfield programs, focusing in most cases on the economic and fiscal impacts associated with public financial support for brownfield cleanup and redevelopment. In some states, the program provides grants. In other states, the financial tool is a tax credit. The eligibility requirements vary among the states. Nonetheless, the findings

consistently report positive economic and fiscal impacts of brownfield investments. The findings are presented in alphabetical order by state.

Delaware. Two studies have been completed relating to Delaware's brownfield redevelopment program. The first study (Brown, Laznik, and Ratledge 2010) focused exclusively on the economic impact of brownfield redevelopment. They found that:

- "For every nominal dollar spent by the brownfield program (both state and federal funds), property values have increased approximately \$17.50," a result almost identical to the property value impact found in data from WEDC on the Brownfield Grant program in Wisconsin.
- Assessed value of brownfield properties increased over \$470 million since 1998.
- In New Castle County, the largest county in Delaware by population, property values for former brownfields increased 10 times more than for other properties.
- In New Castle County, property tax revenue was \$2.7 million higher due to brownfield redevelopment.
- "Higher paying jobs in finance and insurance increased near brownfields. Lower paying jobs in retail and wholesale trade declined near [former] brownfields."
- "Total wage and salary disbursements in 2008 were \$135 million larger than they would be had development matched county growth."
- Disposable personal income per capita was nearly \$200 larger than it would have otherwise been."

Another study (Merriman-Nai 2013) focused on social impacts of brownfield redevelopment (discussed below), but reported results for economic impact as well. For the study area in northeast Wilmington, Nai found positive trends in the neighborhood economy "(indicated by changes in income levels, housing values and tenure, employment, educational attainment, and the attraction of private development and new businesses)."

Indiana. The Indiana Finance Authority (IFA) conducts an annual survey of brownfield funding recipients to track Return on Investment. In 2013, 721 surveys were returned for sites that received some form of funding since 1997 (Indiana Brownfields Programs 2014). The following results are reported by IFA:

- ROI for IFA-funded projects is \$9 of investment for every \$1 of brownfield financial assistance provided.
- ROI for all projects, including projects that received technical assistance, liability determination letters, and oversight of federally-funded grant activities by the Program is \$41 of investment for every \$1 of State assistance.
- Total jobs created: 14,170
- Total jobs retained: 5,351
- Total businesses created: 294
- Total businesses retained: 245
- The project funding mix was 50 percent public (state, local and federal) and 50 percent private. The state share (IFA funds) was only 2 percent of total project costs.

Minnesota. A study of the benefits of brownfield redevelopment looked at approximately 276 cleanups funded under the Minnesota program from 1995-2010. It found that \$118 million in grant funding generated:

- \$3 billion in private investment;
- Over 20,000 new jobs;
- Retention of over 12,000 jobs; and
- Increased tax base of \$73 million.

Washington. An analysis determined that:

"Every \$1 in Washington State cleanup grants creates: \$6 in local and state tax revenue, \$7 in payroll value, and \$32 in business revenue" (Maul, Foster, Alongi, no date).

Iowa. An economic analysis of the impact of the brownfield tax credit (Jin 2013) found that:

- \$2 million in tax credit awards leveraged \$28 million in eligible cleanup expenses (based on both brownfield and "grayfield"; only 3 brownfields projects are in the database).
- "For the three brownfield properties, the average assessed property value increased 31.3 percent from less than \$0.5 million before to \$0.6 million after project completion."

Massachusetts. Studies of the Brownfields Tax Credit (BTC) program in Massachusetts find \$7 of benefit for each \$1 in tax credits granted for brownfield redevelopment (Kirschenbaum 2013). MassDevelopment "administers the Brownfields Site Assessment Program by providing up to \$100,000 for environmental assessments and up to \$500,000 (and, in limited cases, up to \$2 million) for environmental cleanup" (MassDevelopment 2013, 1). In 2013, the agency estimated that its funding helped to create 4,400 new and construction jobs. A study by Redevelopment Economics (2012) of the Massachusetts brownfield tax credit program examined 44 completed projects. Among the findings:

- On average, sites had been vacant for an average of 14 years before redevelopment.
- Remediation costs were less than 6 percent of total capital investment in the project.
- "The leverage ratio (\$45.60/other funds to \$1/BTC) is very favorable ."
- "The BTC projects in this study led to almost 14,000 direct temporary/construction jobs and 25,500 construction-related direct and indirect jobs."
- While only half of the BTC projects in the study involved job-generating projects, the study found:
 - 7,000 direct and 13,300 total (direct and indirect) jobs;
 - \$100 million in annual direct state and local tax revenues and \$156 million total (direct and indirect) revenues, annually.
 - Total output of \$1 billion direct spending and \$1.9 billion total (direct and indirect) spending.

New York. The New York Brownfield Alliance (2014) commissioned a study of the economic, fiscal, and environmental impacts of New York's brownfield tax credit program. The study looked at 96 sites that had received Brownfield Cleanup Program assistance. The research found:

- More than 15,000 jobs created and 1,200 more jobs planned.
- \$7 billion in economic reinvestment in brownfield sites
- Each dollar of brownfield program investment generates an addition \$8 in investment.
- Over a 20-year period, each dollar of brownfield program investment yields 2-3 times the return in tax revenue in net present value.

- The analysts compared the economic benefits of brownfield cleanup to road projects. They concluded that funding brownfield redevelopment produced more jobs at a lower public cost than road-building projects.

Hedonic Pricing Studies

All of the studies cited above concern the effects of changing an abandoned and derelict brownfield into a productive industrial plant, office or retail development, housing or public space. All of the fiscal benefits are tied directly to what happens on the brownfield site with redevelopment. Another approach considers the effect on neighboring properties when a brownfield is cleaned up and redeveloped into a new use.

A method called hedonic price modeling is used to measure the effect of differences in land use on surrounding properties. This increase in price may occur because the area is more desirable with new development compared to a brownfield. In addition, as the area becomes more desirable, property owners and buyers become more willing to invest in maintenance and improvement on their own properties. Several studies estimate the off-site benefits to property values.

- The Milwaukee results from DeSousa, Wu, and Westphal (2009) are reviewed above in the section on Case Studies in Wisconsin. Part of the same study was to do a similar analysis in Minneapolis. The results were not entirely consistent, which appears to be a result of Minneapolis projects being located in areas with higher housing demand than the area in Milwaukee (p. 104). In Minneapolis, presence of a brownfield had no impact on housing prices before redevelopment. As a result, even though the price increase after redevelopment increased only 2.7 percent, that increase was from a higher relative base price than in Milwaukee where the presence of brownfields was associated with depressed prices before redevelopment.
- A report on brownfield redevelopment in Charlotte, North Carolina, found that redevelopment increased property values of nearby properties (within a half-mile of the site), with home sale prices increasing \$1,000 - \$15,000 per home following redevelopment (Chilton, Schwartz, and Godwin, no date).
- In Cook County, Illinois, a study of cleanups under Illinois's equivalent to the voluntary party liability protection program found that cleanups raised property values within 1.5 miles of a brownfield voluntary cleanup site by two percent (Linn, 2012). Extrapolating from this finding, the value of a \$100,000 home near a brownfield would increase by \$2,000, increasing a homeowner's access to credit for home improvements and other needs.
- An evaluation conducted by Haninger, Ma, and Timmins (2012) for the EPA's evaluation of its brownfields programs found significant off-site property value increases.
 - Conducting a hedonic analysis on a data set including all brownfields that applied for a cleanup grant from EPA from 2003-2008 and home sale transactions, the authors concluded that:
 - "cleanup leads to housing price increases between 4.9% and 32.2%" (Haninger, Ma, and Timmins (2014) and
 - housing values within a kilometer of a brownfield cleanup increased at least 5.1 - 12.8 percent as a result of cleanup and redevelopment activities.
 - Using the same data, the authors estimated the aggregate economic benefit across all of the properties nearby to brownfield redevelopment. Taking the conservative estimate of the increase in home prices (5.1%) and applying that to the homes within 1 kilometer

of a brownfield cleanup, the authors estimate the aggregate increase in value at almost \$200 million (Haninger, Ma, and Timmins (2014). **"This represents an average benefit value of \$3,917, 192 per site"** [emphasis added]. They conclude that taking the most conservative estimate from their calculations yields an estimated benefit from EPA grant funding that is an order of magnitude higher than the cost, just from the off-side increase in housing values (p. 34).

Cost of Doing Nothing

Another way to consider the benefits of public investment in brownfield redevelopment is to consider the costs of doing nothing. In part, these costs are the converse of the benefits summarized above. Continued loss of tax base and associated revenues, minimal creation of new jobs, reduced vitality of the areas adjacent to brownfields. Cities with large numbers of brownfields would be increasingly dependent on state shared revenue and other state aids to provide basic public services because of a tax base depressed by brownfields remaining idle and undeveloped. In addition, the environmental contamination would likely remain uncontrolled for decades, leading to public health risks.

Looking at the effect of "doing nothing," Simons and Saginor (2006) looked at the loss in housing value associated with location near a brownfield. Their "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)" (cited in De Sousa, Wu, and Westphal 2009).

Environmental Benefits

Environmental benefits of brownfield redevelopment can be categorized into two types of benefits. First, the cleanup of contamination is a direct environmental benefit, resulting in improved health outcomes. Second, the redevelopment results in improved health and environmental outcomes due to the location and pattern of development associated with brownfield redevelopment.

Two public health studies of brownfield areas in Wisconsin studies have been completed, in Milwaukee and in Baraboo, and a third in Janesville is underway. The Milwaukee study focused on the 30th Street industrial corridor.

- Milwaukee (30th Street Corridor)
- Baraboo
- Underway: Janesville

Brownfield redevelopment reduces the amount of "greenfield" land converted to developed use. As a result, 4.5 acres of greenfield land would be required to accommodate the same building space that was made available by redeveloping an acre of brownfield (Jin 2013). Because of higher density zoning in areas around brownfield sites, the number of housing units per acre is higher than if the same housing was produced on a greenfield site (Desousa 2006).

Brownfield projects reduce air emissions. A 2001 study in Baltimore found Volatile Organic Compounds (VOCs) were 36 percent lower and NOX emissions were 40 percent lower at brownfield sites (post-

development) than at greenfield sites due to the lower vehicle miles of travel associated with [infill] sites compared to locating development at the fringes of the metro area (Jin 2013, 12).

Brownfield projects also protect water quality because of the higher density of development at infill sites. The EPA estimates that housing development at 8 houses per acre produces 74 percent less water pollution than development at 1 house per acre (Jin 2013, 11).

Social Impacts

The research on the social impacts of brownfield redevelopment are less cohesive and less uniformly positive in their findings than the studies on economic, fiscal, and environmental impacts. One social impact of particular concern is the rising cost of housing due to brownfield redevelopment, often referred to as gentrification. The increase in property values can have a negative effect on low-income tenants who are displaced to other locations as rental rates increase due to the rising property values in the vicinity, and the risk of being displaced is viewed as a negative impact by neighborhood residents and social science researchers (Essoka 2010; Pearsall 2009). Other literature suggests that negative perceptions about the impact of brownfield redevelopment can be avoided with appropriate public involvement throughout redevelopment planning and implementation.

A detailed study in Northeast Wilmington, Delaware, described as a high poverty and high crime area, looked at changes in social and demographic characteristics after brownfield redevelopment. The study encompassed three Census tracts and 18 state-certified brownfields, representing 11 percent of all state-certified brownfields in Delaware (Merriman-Nai 2013, 26, 28). Among the findings, Merriman-Nai (2013) reports generally positive changes in relation to neighborhood economy, civic pride and community engagement, improved property maintenance and decreased illegal dumping, improved community services, including faith-based organizations and a new health clinic, and improved health and safety. Some negative results included increased income disparities (increases in the number of residents at the top and bottom of the income distribution, and declines in the middle). "Increased home ownership, and a decline in absentee landlord-owned rental properties, was considered the key to community stabilization and revitalization" (p. 9).

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Appendix A

Many more case studies have been developed on brownfield redevelopment than are presented in this paper. The following excerpt from the DNR's Financial Resource Guide for Cleanup & Redevelopment (2013) provides links to additional case studies. Where needed, web links have been updated.

Success Stories - Web Resources

Think you may be interested in applying for grants or using some of the programs listed in this guide? Want to see practical examples of successful cleanup and redevelopment projects that utilized many of the resources contained in this publication? The following web links provide real-life brownfield success stories, relating how local governments and other interested parties took the crucial steps needed to clean up and redevelop contaminated properties.

- Remediation and Redevelopment Success Stories – This web page includes Wisconsin success stories involving the RR Program. Included in each story is a list of assistance received for each site (e.g. funding, liability, exemptions, etc.)
<http://dnr.wi.gov/topic/brownfields/success.html>
- EPA Brownfield Success Stories – This page highlights the accomplishments of EPA brownfields grantees across the country, including revolving loan funds, assessment grants and more.
<http://www.epa.gov/brownfields/success/>
- Recycling America's Land - This page contains brownfield redevelopment success stories from across the nation. The reports are based on information provided by cities about the status of brownfields from 1993 until the present.
<http://www.usmayors.org/brownfields/>
- City of Milwaukee Brownfields Success Stories – This page includes multiple success stories from the Milwaukee area.
<http://city.milwaukee.gov/DCD/BrownfieldsRedevelopment/Successstories.htm#.U5R2piguJ8E>

Source: Wisconsin DNR (2013), Financial Resource Guide for Cleanup & Redevelopment. PUB-RR-539.
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