Brownfield/Greenfield
Development Cost Comparison Study
EXECUTIVE SUMMARY

December 2004

Prepared for:

Port of Portland
Portland Development Commission
City of Portland
METRO

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1. EXECUTIVE SUMMARY

PROJECT OVERVIEW

The availability and location of industrial land as a resource for the creation of new employment is a major economic and policy issue throughout the State of Oregon and the Portland metropolitan area. A number of efforts have occurred or are currently underway to understand and address this issue.

As part of this ongoing regional discussion on industrial land, a consortium of public agencies (the Port of Portland, Portland Development Commission, METRO and the Portland Bureau of Planning) sponsored this Brownfield/Greenfield Development Cost Comparison Study. The goal of the project is to provide the project sponsors with a better understanding of costs and issues associated with industrial development of greenfield sites and the redevelopment of brownfield sites. In addition, a methodology was developed that calculates and compares brownfield and greenfield development costs. The challenge was to develop a model that could be replicated in future studies. Therefore, the uses could change and the sites could change, but the methodology would remain constant.

Using a case-study approach, the project compared the public and private development costs associated with specific industrial projects between brownfield sites and greenfield sites. Four types of industrial development projects were identified: general manufacturing, high tech, warehouse and distribution, and industrial park. A specific profile and site plan for each use was completed. Four greenfield sites and three brownfield sites were also identified. The site plan for one of the uses was then tested on one greenfield and one brownfield site. An analysis of costs was then prepared for each project on the two sites.

METHODOLOGY

Uses
Four industrial uses that were appropriate for the Portland metropolitan area were identified.

- *High Tech Manufacturing* includes high technology industries that are primarily related to manufacturing and processing. In this study, a 350,000 SF high-tech facility is tested that includes two 125,000 SF fabrication plants, one 40,000 SF central utility building, one 60,000 SF office building and 725 parking spaces.

- *Industrial Park* is a series of larger individual buildings whose uses could include light industrial manufacturing, distribution or industrial services. For this project, 630,000 SF of industrial park space, divided into multiple buildings, was tested on both sites.

- *Warehouse / Distribution* includes industries primarily engaged in the warehousing, storage and distribution of goods. For this project, 400,000 SF of distribution space in a single building with 200 parking spaces and 300 trailer spaces was tested on both sites.

- *General Manufacturing* includes industries utilizing manufacturing processes. For this project, three single-user general manufacturing facilities were tested on each site. These facilities totaled 450,000 SF in three buildings – a 100,000 SF user, a 150,000 SF user, and a 200,000 SF user – and 1,100 parking stalls to serve all three facilities.

Site Selection

Since the goal of the study was to compare costs for industrial projects, it was necessary to identify sites appropriate for the user profiles based on size, zoning and location. Additional issues considered in choosing the sites included distribution around the region, extent of brownfield contamination, adjacency to the Urban Growth Boundary, surrounding industrial uses, level of existing infrastructure, and specific needs of the identified uses.

Brownfield

For this study, appropriate sites needed to be over 25 acres and zoned industrial. While the overall inventory of brownfield sites in the region is significant, with over 1,100 acres of vacant land listed in the City of Portland's Brownfield Site Inventory; the availability of large, viable brownfield sites in industrial areas in the region is limited. In addition, certain sites were identified and eventually discarded for reasons of concern about the market impacts of inclusion in the study and for potential liability issues[1]. While the goal was to identify four brownfield sites to include in the study, at the end only three sites were used. To compensate and still meet the original goals of the study, two different uses were put on one of the brownfield sites.

Greenfield

Four sites were selected in the Portland metropolitan region. Three of the sites are in areas where land was recently brought into the Urban Growth Boundary (UGB). One site is located within the existing UGB. The sites range between 70 and 350 total acres. Therefore, only portions of each of the greenfield sites were used for each conceptual site plan.

The following table provides site overviews, and the uses proposed on each:

Use	Site Type	Site Size (acres)	Building Area (SF)	Parking Stalls
High – Tech Manufacturing	Brownfield	35.75	350,000	725
	Greenfield	53.20	350,000	725
Industrial Park	Brownfield	45.50	630,000	1,130
	Greenfield	44.50	630,000	1,130
Warehouse / Distribution	Brownfield	37.95	400,000	200
	Greenfield	23.85	400,000	200
General Manufacturing	Brownfield	35.75	450,000	1,100
	Greenfield	37.95	450,000	1,100

As the study progressed, issues relating to liability and publicity were raised and concerns were expressed regarding the identification of actual brownfield sites in the report. It was determined that the brownfield sites should be generic in the final report. To make all the

[1] Some sites that were initially considered for inclusion in the study are currently being actively marketed for sale. The site owners indicated that they were not comfortable including their properties in this study due to potential stigma and negative sale price impacts to their properties, regardless of the author's intentions to conceal the identities of individual sites.

sites equal, it was then decided that the greenfield sites would also be made generic. Therefore, while actual sites were utilized, for the purposes of this study, all geographic identifying features have been removed.

Costs

The primary focus of this study was on quantifiable costs, including hard and soft costs both on-site as well as off-site. The cost information was classified into four major categories:

On-Site Construction Costs

On-site construction costs include all building costs and on-site infrastructure and parking costs, plus additional on-site costs, including site grading, lift stations, tank removal and pilings associated with several of the brownfield and greenfield sites.

System Development Charges (SDC's) and Credits

Large, one-time user fees paid with the development of the site were included in this category. This includes System Development Charges (SDC's) for sanitary sewer, water, storm drainage, street improvements and parks. SDC credits were based on the extent of existing development on the site.

Off-Site Construction Costs

These are the costs associated with the public utilities, including sanitary sewer, water and storm drain mains, necessary to accommodate the build-out of each concept . The delivery of private utility (electric, natural gas, telecommunications) costs were not identified separately, and were assumed as part of the estimated street costs. Major utility upgrades, such as substations, transformers, water reservoirs, and treatment facility expansions were not included (the presumption is that SDC fees are intended to finance these public facility expansions).

Environmental Remediation Costs (Brownfield Sites Only)

The potential environmental remediation requirements for each site were based on publicly available information and the project team's experience with similar properties. The estimated costs represent the minimum estimated effort required to obtain a No Further Action (NFA) letter from the Oregon Department of Environmental Quality (DEQ) for the properties. Environmental remediation costs were divided into two categories: Hard Costs and Other Costs. Hard Costs included remediation costs associated with soil and groundwater; compliance with state and local stormwater regulations; ongoing operation and maintenance of remediation efforts and remedies; and costs associated with the coordination and processing of the remediation plan, application and follow-up with DEQ and management of the remediation.

Other Costs included soft costs for insurance, environmental studies, planning and legal expenses, figured at 20% of the hard costs. Of these soft costs, 20% is insurance. The second component of Other Costs is carrying cost interest, which is the interest cost accrued during remediation, for an assumed 24-month timeline at a 30% cost of equity and 8.50% for debt. The third component of Other Costs is a risk premium, assumed to be 0.5% of total development costs based on the perceived additional risk associated with the brownfield contamination.

Financial Analysis

The financial characteristics of individual development concepts were evaluated, with a focus on determining the residual property value associated with these concepts. The residual value represented the maximum value that the development concept yields for the property (land and improvements), and equates to the maximum price that a developer would be willing to pay for the property based on the study's assumptions. If the residual value is below the market value of the property, or what the owner perceives to be market value, then the development is not considered to be viable. In some cases in this analysis, the residual land value was negative, implying that the development program yields a property value of less than zero under the assumptions used (i.e., upside-down).

Public costs and benefits

A comparison of public costs and benefits was conducted for the specific brownfield and greenfield development concepts. To the maximum extent possible within the scope, public costs and revenue streams resulting from development were estimated. The comparisons were informed by a literature review of national trends and experiences.

CASE STUDIES

The case studies provided the means to compare the four uses on both brownfield and greenfield sites. The following provides a summary of the findings of these studies.

Site Development Overviews

High Tech Manufacturing

With the proposed development, the brownfield site had an estimated negative residual land value of ($7.80) per square foot. This reflects a site that would be considered "upside-down" under the case study assumptions, with a value well below zero. In contrast, the greenfield site had a positive residual land value of $6.42 per square foot.

Industrial Park

With the proposed development, the brownfield site had a positive residual land value of $0.80 per square foot and the greenfield site had a positive residual land value of $1.33 per square foot.

Warehouse / Distribution

With the proposed development, the brownfield site had a negative residual land value of ($0.85) per square foot, while the greenfield site has a positive residual land value of $6.88 per square foot.

General Manufacturing

With the proposed development, the brownfield site had a negative residual land value of ($6.47) per square foot. The greenfield site has a positive residual land value of $6.96 per square foot.

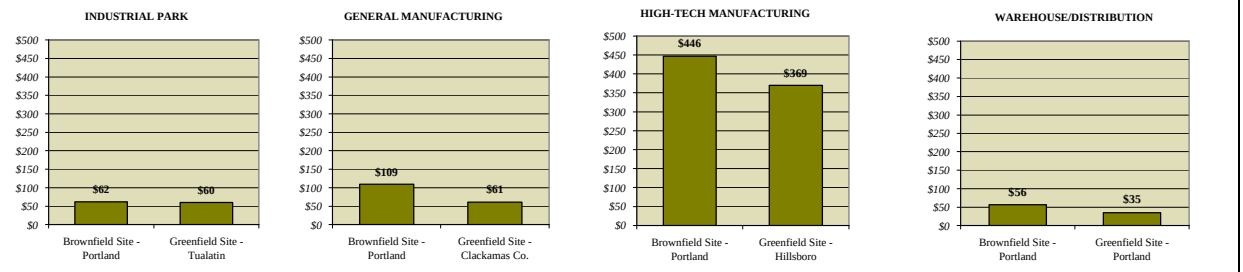
Financial Findings

The case studies evaluated revealed the general findings that greenfield sites have an overall lower development cost than brownfield sites, and brownfield sites require lower marginal infrastructure investment than greenfield sites. The following table provides a summary of the financial comparison between the case studies.

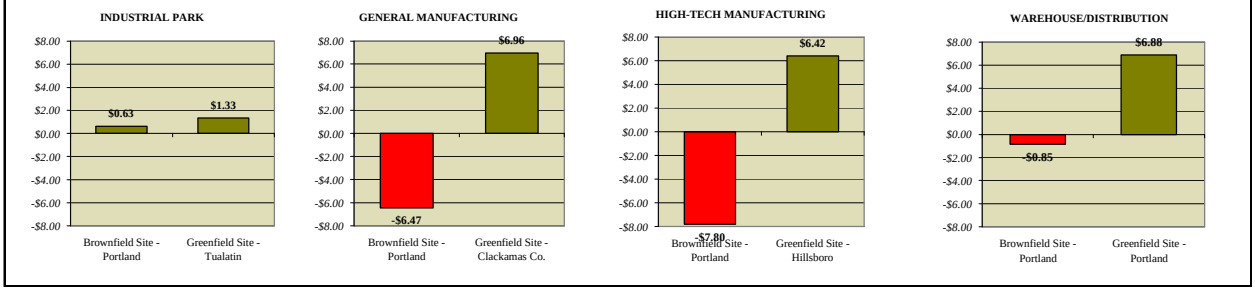
SUMMARY OF SCENARIOS EVALUATED

Site/ *Concept*	Net Site Size/Acres	Building S.F.	Environmental Remediation 1/	Construction Cost Hard	Construction Cost Soft	SDCs Calculated	SDCs Credits	SDCs Net	Infrastructure Costs	Total Cost/Less Land Total	Total Cost/Less Land PSF
Industrial Park											
Brownfield Site - Portland	45.50	630,000	$8,748,887	$23,086,500	$4,617,300	$1,846,243	($25,368)	$1,820,875	$558,000	$38,831,562	$61.64
Greenfield Site - Tualatin	44.50	630,000	$0	$25,050,000	$5,010,000	$1,713,209	$0	$1,713,209	$5,739,167	$37,512,376	$59.54
General Manufacturing											
Brownfield Site - Portland	35.75	450,000	$22,980,475	$20,857,500	$4,171,500	$1,212,343	($249,062)	$963,281	$24,000	$48,996,756	$108.88
Greenfield Site - Clackamas Co.	37.95	450,000	$0	$21,000,000	$4,200,000	$868,675	$0	$868,675	$1,347,000	$27,415,675	$60.92
High-Tech Manufacturing											
Brownfield Site - Portland	35.75	350,000	$28,027,465	$105,900,000	$21,180,000	$1,383,121	($249,062)	$1,134,059	$24,000	$156,265,524	$446.47
Greenfield Site - Hillsboro	53.20	350,000	$0	$105,000,000	$21,000,000	$1,782,663	$0	$1,782,663	$1,452,500	$129,235,163	$369.24
Warehouse/Distribution											
Brownfield Site - Portland	37.90	400,000	$7,821,799	$11,154,000	$2,230,800	$715,907	($75,858)	$640,049	$735,000	$22,581,648	$56.45
Greenfield Site - Portland	23.85	400,000	$0	$10,840,000	$2,168,000	$730,069	$0	$730,069	$290,500	$14,028,569	$35.07

TOTAL DEVELOPMENT COST/LESS LAND



CALCULATED RESIDUAL LAND VALUES



1/ Includes direct hard and soft costs associated with remediation, as well as additional carrying costs, developer risk premium and lender risk premium.

Key financial findings include:

- Under each of the scenarios, the greenfield site delivered the lowest development cost per square foot, as well as the highest residual land value. The differential was least in the Industrial Park scenarios; with the $8.7 million cost of environmental remediation on the Portland brownfield site offset by a $3.0 million cut and fill requirement on the greenfield site and a $5.2 million differential in infrastructure costs.

- Infrastructure costs, as defined in this analysis, were substantially higher on three of the greenfield sites, with the exception being the Warehouse/ Distribution program sites.

- The brownfield site used in the General and High-Tech Manufacturing scenarios has extremely high clean-up costs, related to soil and groundwater contamination. These add $11.1 million in hard costs, which also dictates

higher insurance costs, which are $1.9 million. As a result, the overall environmental remediation cost under these scenarios is estimated at $22.0 for the General Manufacturing program and $28.0 million for the High-Tech program. Higher remediation costs were assumed under the High-Tech scenario, with the higher overall costs of development increasing the impact of the risk premium.

PUBLIC COST BENEFIT ANALYSIS

Public benefits and costs were evaluated and compared for the brownfield and greenfield sites, based on a review of existing published studies and estimated public costs and revenue streams for the case study jurisdictions. For each of the sites, public benefits and costs were identified as Quantifiable – Direct or Qualitative and Other Quantifiable. Quantifiable – Direct public benefits that were similar across jurisdictions included SDC income, property tax revenue, Tri-Met payroll revenue and jobs. Annual tax revenues are greater for all of the case study examples that occur on sites located in the City of Portland and/or Multnomah County. This is due to the greater array of revenue streams within these jurisdictions compared to sites outside of Portland/Multnomah County.

Qualitative and Other Quantifiable benefits that were shared between brownfield and greenfield jurisdictions include state business tax revenue, state and local income tax revenue, utility tax revenues and achievement of economic development goals. Additional public benefits realized by the redevelopment of the brownfield sites include efficiencies realized through the utilization of existing infrastructure and the enhancement of surrounding property values.

In regard to Quantifiable – Direct public costs, standard public service infrastructure needs like fire, police, schools, public transportation and roads can generally be expected to incur costs due to increased development and population from brownfield redevelopment or greenfield development. However, the brownfield and greenfield case study development concepts in this analysis are, relatively speaking, of insufficient size to warrant significant marginal cost increases.

Marginal System Development Charges (SDC's) would be one Quantifiable- Direct public cost. While SDC's are intended to recover public costs associated with a development, they are typically set at a level below full marginal cost. The proportion of costs that are not recovered represent a public cost associated with the project.

Qualitative and Other Quantifiable costs shared between brownfield and greenfield jurisdictions include state, regional and local administrative costs. Legal costs can also be assumed for both types of sites. Public legal costs for brownfield sites, related to the risk of remediation activities, can be significant among other legal costs. Alternatively, greenfield sites can be expected to also incur significant legal and administrative costs related to UGB inclusion, site planning and other related issues unique to the Oregon land use system.

CONCLUSIONS AND IMPLICATIONS

Site Development Costs

Under each of the scenarios, the greenfield site delivered the lowest development cost per square foot, as well as the highest residual land value. And while infrastructure costs, as defined in this analysis, are generally higher on the greenfield sites, they do not exceed the brownfield remediation costs, therefore resulting in an overall cost advantage for the greenfield sites. The infrastructure costs are internalized into the development pro forma, reflecting an assumption that the development would be required to bear these costs as a condition of approval. While these costs could be defined as public costs, in this study they are the responsibility of the developer as opposed to being borne by the public.

Major off-site infrastructure and utility system upgrades, such as electrical substations and transformers, water reservoirs, waste water treatment facility expansions, state highway expansions, etc., are not required as a result of the development programs placed on the greenfield sites. While these types of major system upgrades may, and often would, be required as part of large acreage expansions of the Urban Growth Boundary, this is not the case for these sites.

The following table summarizes the estimated remediation costs of the brownfield sites, and the cost differential to produce an equivalent product relative to the greenfield option. As shown, the cost of remediation in these instances outpaces the savings in infrastructure costs.

	Brownfield Remediation Costs		Greenfield Infrastructure Costs		Overall Cost Differential	
Use	**Total**	**PSF-Bldg.**	**Total**	**PSF-Bldg.**	**Total**	**PSF-Bldg.**
Industrial Park	$8,471.756	$13.45	($5,181,167)	($8.22)	$982,055	$1.56
General Manufacturing	$22,980,475	$51.07	($1,323,000)	($2.94)	$21,581,081	$47,96
High-Tech Manufacturing	$28,027,465	$80.08	($1,428,500)	($4.08)	$27,030,361	$77.23
Warehouse/Distribution	$7,821,799	$19.55	$444,500	$1.11	$8,553,079	$21.38

The general findings of this study do not support the hypothesis that the costs associated with the remediation and redevelopment of brownfield sites can be on par with the costs to develop new greenfield sites; however, it would be unreasonable to draw any final conclusions based on the limited number of comparisons completed as part of this contract. A variety of issues can affect site development costs and these vary between sites. The methodology developed as part of this study does provide a foundation from which to look at a variety of sites and development scenarios to aid in addressing this policy question.

Brownfield Remediation Costs

Brownfield remediation costs, in all of the case studies, were greater than the infrastructure costs associated with development of the greenfield sites. It is important to understand however, what makes up the site development costs and how the assumptions can influence costs. The total brownfield development costs are composed of hard and soft construction costs, hard and soft remediation costs, carrying costs during cleanup, and the risk premium. These latter three remediation costs (soft, carrying and risk premium) have a significant impact on the overall redevelopment costs.

Methodologically, the analysis in this study approaches the development scenarios from the perspective of a private sector developer doing a speculative development. This assumption limits the direct applicability of the findings to this type of development. Alternative development approaches under a different scenario could include remediation by an end user, or remediation by a public sector entity. Under both approaches, remediation costs would be considerably less, particularly under a public sector remediation scenario.

No Two Sites Are the Same – The Difficulty of Generalizations

Generalizations are difficult to make because each site, whether brownfield or greenfield, has its own unique characteristics. No two sites are the same, whether they are brownfield or greenfield. Each has unique issues and characteristics that affect costs and development issues; e.g. the types of constituents that make up the contamination, adjacency to a body of water, the potential for migration of the contamination, the location of the site in relation to existing infrastructure, location in relation to specialized infrastructure, the size of the site, etc.

The study showed that there is a continuum of site preparation costs for both brownfield and greenfield sites. Taking remediation and infrastructure factors into account it would be possible to categorize the sites in this study by their intensity of color – a continuum of brownness or greenness. For the brownfield sites, a light brownfield site would be one that has minimal contamination issues and low cost clean-up requirements. A dark brownfield site would have major contamination issues, and high cleanup costs. A moderate brownfield site would be in the middle.

The same type of continuum of color could be created for the greenfield sites in the study, only focusing on availability of infrastructure and site development costs. A light greenfield site would have readily available infrastructure and be "shovel ready" with few additional requirements. A dark greenfield site would have major infrastructure needs and require substantial site preparation work. A moderate greenfield site would be in the middle.

These continuums, as applied to the case studies, are shown in the following table:

Use	Brownfield site	Greenfield site	PSF Differential	Conclusion
High Tech Manufacturing	Dark	Light	$77.23	Same site as General Manufacturing site – more expensive use
Industrial Park	Moderate	Dark	$1.56	Difficult greenfield site
Warehouse/Distribution	Moderate	Light	$21.38	Greenfield site is better served than brown
General Manufacturing	Dark	Moderate	$47.96	Very difficult brownfield site

Public Sector Costs

The case study development concepts in this analysis were not of sufficient size to pose significant, measurable public costs for affected jurisdictions. By design of the study, these costs are borne by the private sector. Internalization of brownfield remediation and infrastructure costs by the developer, rather than incurred by the affected jurisdiction(s), clear the public sector of the largest potential public cost disadvantage of brownfield redevelopment compared to greenfield development. To the extent that a jurisdiction assumes remediation costs, which may be a favorable policy option to enhance financial

feasibility of clean up and crystallize actual site remediation and redevelopment, public cost streams would increase by the magnitude of remediation costs estimated for each brownfield concept.

Public Sector Benefits

Benefits to the public sector, particularly in terms of revenue enhancement, were substantially greater for brownfield redevelopment concepts compared to greenfield development for the case studies considered in this analysis. By location of the case study sites, the revenue differential is largely due to the greater array of revenue streams within Multnomah County and the City of Portland compared to suburban jurisdictions. The following table provides a comparison of annual revenue stream differences for each development concept.

	Brownfield Public Benefits	**Greenfield Public Benefits**	**Public Benefit Differential**
Use	**Annual**	**Annual**	**Annual**
Industrial Park	$1,400,000	$977,000	$423,000
General Manufacturing	$1,300,000	$465,000	$835,000
High-Tech Manufacturing	$3,430,000	$2,100,000	$1,330,000
Warehouse/Distribution	$482,000	$308,000	$174,000

In addition to the quantifiable public benefits cited above, a wide variety of benefits would also accrue to affected jurisdictions that are not quantifiable due to the limitations of the case study approach and sizes of sites considered in this analysis. The scope of these benefits is broader for brownfield remediation and redevelopment, also due in part to the location of case study sites in Multnomah County. In general, however, brownfield redevelopment poses the following public benefits not accrued by greenfield development:

- Local income tax revenues;
- Public land conservation and environmental policy goals;
- Social benefits of contaminated site remediation and economic revitalization; and
- Enhancement of surrounding property values.

It is a Challenge to Keep Brownfield Sites Industrial

There is an economic challenge to maintaining industrial zoned brownfields as industrial properties after they are cleaned up. The remediation costs of bringing an “upside down” brownfield site “right side up” often cannot be recovered when the site can be developed only for industrial land values. Industrial land values in the Portland metropolitan area tend to range from $3.50 to $6.50 per square foot, the lowest value of any major land use. For comparison, office and residential land ranges from $7.50 to $10.00 per square foot, while commercially zoned land is valued at significantly higher levels. As remediation costs must be deducted from land value, industrially zoned property has the most limited ability to absorb clean up costs while still maintaining a positive residual land value.

It’s “Easier” to Develop Greenfield Sites

Brownfield sites come with stigmas. For many developers, the unknowns and the difficulties of developing a brownfield site are too great. It is perceived that suburban greenfield sites are easier to develop and less constrained than urban brownfields. This

perception is also shared by site selectors, who are under contract for users to find them a location for a new industrial investment. Issues of liability, cost and risk are all part of this challenge. This dilemma can make it difficult for brownfield sites to get full exposure in the market and make it difficult for sites to be considered for redevelopment. The result of this is that most difficult brownfield sites require experienced developers who have extensive knowledge with redeveloping these sites. Traditional developers tend to shy away from these sites. It is therefore necessary for outside parties, such as public agencies with a desire to have brownfield sites redeveloped, to create relationships with experienced brownfield developers.

An Inventory of Sites is Required to Meet a Variety of Industry Needs

Physical site issues can play a role in a specific type of user choosing between or having the ability to locate on a brownfield or a greenfield site. However, the physical site that a company chooses is only one issue in a diverse mix of criteria that they use in deciding investment locations. Some users are very specific about the location of the property they are interested in using. Factors that can influence this include: access to transportation infrastructure (i.e., rail, water); proximity to other firms, either suppliers or customers (agglomeration or cluster effects); zoning, for example heavy industrial vs. light industrial, business park or high tech. These locational factors may outweigh or at least mitigate the brownfield vs. greenfield site issues.

Matching the locational needs of different types of industries and the market opportunities of different geographic locations will enhance brownfield redevelopment. It is critical to understand which types of companies can go where. Some industries and development types will be able to take on the brownfield challenges, others will not, and will focus their development decisions on greenfield sites. Each type of land, brownfield and greenfield, has a role to play in a regional economic development strategy.

Focus on the Brownfield Sites that have a Demand in the Market

The old saying of "location, location, location" in real estate is as valid in brownfields as it is in greenfields. As this study shows, different brownfield sites have different remediation cost profiles. However, brownfield sites located in areas of high market demand are better able to remain viable real estate investment opportunities if there is likely to be a high residual land value. The public sector should focus available assistance dollars to those sites that have the highest remediation costs and that are located in an industrial area that has market demand.

The Public Sector's Role in Brownfield Redevelopment

There is a role for public incentives that support the goal of keeping industrial brownfields for industrial uses because the private marketplace will be less likely to do this, due to the lower market value of industrial land.

Risk Reduction

First, the data provided in this study shows clearly that the cost of high risk capital to conduct site study and clean-up is a significant factor. The rate of return required by equity investors and the lack of debt capital are factors to which many states and municipalities have turned their attention. The creation of state revolving loan funds, tax-free bonds, private debt funds and participating grant money are all mechanisms that are being used to reduce the cost of capital.

One of the major issues associated with brownfield sites is the uncertainty created by unknown liability ("inflated risk assumptions"). Environmental insurance is a way to mitigate this risk. The cost and quality of environmental insurance is not only a direct cost factor but also an indirect cost. Comprehensive environmental insurance policies for these projects eliminate or lessen reduction in residual land value associated with stigma (the risk factor). Several states have created pooled, state-subsidized environmental insurance. These programs have reduced the direct cost of insurance policies and provided for broader coverage and longer terms than insurance that is available for individual projects.

Site Characterization Assistance

Another potential area for public involvement is in site characterization. The cost for preliminary, investigative studies to characterize contamination conditions at a site are not only a significant project expense, but frequently becomes a barrier to entry. Few private entities are willing to spend thousands, often hundreds of thousands of dollars to characterize a site that may or may not turn out to be suitable for redevelopment. Direct subsidy of characterization costs will create an expanded market of brownfield sites. The sites in this study have been sufficiently characterized for remediation estimating and insurance. However if that were not the case, it is unlikely that a third party developer could have supported those costs. State and municipal brownfield initiatives can provide forgivable loans for characterization. If the investigative results support development, the loan is repayable. If not, the loan becomes a forgivable grant.

Study Methodology Limitations

The purpose of this study was to determine the development costs for a specific development use, compared between a specific brownfield site and a specific greenfield site. The methodology used in the study is a case study approach, using a specific development project of a certain size and then preparing a pro forma analysis that is based on a private developer doing a speculative development. The study shows that the approach and the model function, and can be replicated with other uses and on different sites. It is also the case that the output of the model, in terms of costs and therefore residual land value, would change if different assumptions were used.

The actual development characteristics of each of the sites in this study are unique and site specific. Each has a cost structure for either remediation or new infrastructure services that are different from each other and from any other site in the Portland region. And the number of sites, only seven, provides a limited number of case studies from which to draw generalizations. So while the study found that it was more costly to remediate a brownfield site than to provide infrastructure to a greenfield site, the study's analysis should be considered as proposing a general theoretical construct for appropriately evaluating specific sites, as opposed to generating rules of thumb that can be consistently applied across all brownfields and greenfields in the region.