

Portland Harbor: Industrial Land Supply Analysis

**Prepared for the City of Portland:
Bureau of Planning and Sustainability**

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Preface

This report addresses four questions about land in the Portland Harbor area. It supports the City of Portland's efforts to update its Economic Opportunities Analysis, plan for the land use in the Harbor area, and address issues related to the development and conservation of West Hayden Island.

ECONorthwest was the lead consultant to the City on this evaluation, assisted by subconsultants Maul Foster & Alongi, and Bonnie Gee Yosick LLC. This consultant team had substantial and appreciated assistance from many sources, but especially: City of Portland Bureau of Planning and Sustainability, Port of Portland, Port of Vancouver, Working Waterfront Coalition, and BST Associates.

Despite the assistance, ECONorthwest and its subcontractors alone are responsible for the report's contents. The report has been reviewed by City staff and an advisory committee, but the views expressed are those of the consultants and may not be shared by others who contributed to or reviewed this report.

Throughout the report ECONorthwest has identified sources of information and assumptions used in the analysis. Within the limitations imposed by uncertainty and the project budget, staff at ECONorthwest and the Bureau of Planning and Sustainability at the City of Portland have made every effort to check the reasonableness of the data, methods, and assumptions and to test the sensitivity of the results to changes in key assumptions. Any forecast of the future is uncertain. The fact that ECONorthwest and its team members evaluate the assumptions in this report as reasonable does not guarantee that those assumptions will prevail.

Summary

This evaluation starts from the assumption, embedded in the economic development policies of all local governments in the region, that the retention, expansion, and relocation to the region of industrial sectors is something that the region desires. It addresses the capacity of industrial land in the Portland Harbor area to accommodate future development, both for new public marine terminals and private marine-dependent businesses. It addresses *four questions posed by the City*:

1. Are the methods the City used to estimate the location and amount of vacant, partially vacant, and potentially buildable industrial land in the Portland Harbor area likely to yield reasonable estimates?
2. Given the estimated land supply in the Portland Harbor area, how suitable for a public marine terminal are the few sites identified by the City as having the best potential to accommodate such a terminal?
3. If those sites do not develop as marine terminals (for whatever reasons) to what extent can the Port of Vancouver play a role in accommodating forecasted cargo demand in the Portland region?
4. Finally, if existing vacant land in the harbor area and in Vancouver is estimated to be insufficient to accommodate forecasted or desired transshipment or industrial activity, what is the potential for more efficient use of industrial land in the Portland Harbor study area? That question implies answering the question: What does more efficient use of industrial land mean, and how would it be measured?

SUPPLY OF VACANT OR UNDERUTILIZED INDUSTRIAL LAND

The methods used for the City's evaluation of the supply of vacant land in the Harbor Area are sound, state of the practice, and produce results that have been confirmed by independent methods. When looking for where in the Harbor Area is vacant land that could potentially be assembled into a 100-acre (or, at a minimum, a 50-acre) site with waterfront access? the City correctly identified the two sites with greatest potential: Atofina and Time Oil.

POTENTIAL FOR MARINE TERMINAL SITES

Public marine terminals have specific land use requirements that are difficult to find. Ideally, sites must be large and flat, inside of an industrial zone, have significant shoreline on a navigable river, be served by both rail and truck, and free of contamination, wetlands, or other environmental constraints. Excluding West Hayden Island, there are no sites in the Portland Harbor that meet these ideal requirements, though there are a few sites that come close. This should not imply that West Hayden Island meets all the ideal site requirements (in fact West Hayden Island lacks sufficient truck access, and is constrained by wetlands), but is simply stating that the West Hayden Island site is outside the boundary of our study area. The questions are: how close do they come, and is there a way to cost-effectively develop these sites as productive public marine terminals?

The City of Portland identified the two sites in the Portland Harbor that are most likely to be suitable for development of a new public marine terminal: the Atofina site, and the Time Oil site. Of these two sites, development is technically possible on either, but there are major hurdles that would add significant costs. Both sites have some level of contamination, both sites would require negotiation and property acquisition from numerous property owners, and both sites are smaller than desirable, which precludes the possibility of an onsite rail loop. Ultimately, issues related to the Superfund cleanup of the Willamette River make all sites in the Portland Harbor very challenging (if not altogether unfeasible) for development in the near future.

ROLE OF VANCOUVER IN PROVIDING HARBOR-AREA INDUSTRIAL LAND

Recent forecasts suggest that under mid-range assumptions about cargo demand, the Port of Portland's existing marine terminals will reach the limits of their capacity (for at least some cargo types) in the next several decades. Once these facilities meet their capacity, the Port will need to develop new facilities, or else turn away demand. The Port of Vancouver shares many of the same attributes that make the Port of Portland an attractive place for marine shipping. Thus, the Port of Vancouver is a logical place to site new marine terminals, if sites are unavailable in the 4,000-acre Portland Harbor.

Projecting future land needs to accommodate demand for public marine terminals is difficult, and even the best forecasts suggest a wide-range of potential outcomes. Given mid-range (and presumably most likely) scenario for future demand, the Port of Vancouver may, in theory, have

enough developable land to accommodate regional growth in cargo volumes through 2040. The assumptions in variation of the mid-range forecasts show the Portland-Vancouver Region needing an additional 200 to 600 acres for new terminals by 2040: there is vacant industrial land with water-access that is in that range. In practice, however, competing demands for Port of Vancouver lands, policies and competition among affected jurisdictions, and the potential for higher growth in cargo volumes all make it possible, if not likely, that the land controlled by the Port of Vancouver would not be able to accommodate all of the regional demand for marine cargo. The “high” forecast of cargo demand, for example, is three times the mid-range demand.

From a regional perspective, it makes little difference whether terminal development occurs in Portland or Vancouver. Both cities function as part of the same regional economy, and share the same infrastructure and labor pool. At a local level, however, if demand for public marine terminals is shifted from Portland to Vancouver, the City of Portland would lose some industrial jobs and the income they generate to Vancouver.

POTENTIAL FOR INCREASED EFFICIENCIES IN THE USE OF LAND

Typical measures of efficiency of land use include employment, real market value, and built space. Harbor industrial development tends to have low floor-area ratios (FAR) and a relatively low number of jobs per acre. Thus, typical measures of efficiency would all tend to improve if industrial land were converted to other commercial uses. But industrial lands in general, and harbor lands in the case of this study, are clearly an important piece of the regional economy. Therefore, we suggest two alternative measures of efficiency that are more appropriate for harbor industrial land: value added and tonnage of cargo.

Data from recent years show some measures of economic output have been increasing faster than vacant land is being converted to developed land, and other measures have not. The region should continue to track these measures and adopt policies with the intention of increasing measures of economic output faster than vacant land is converted to developed land. This seems like an objective that could appeal to people with different interests: economic development, environmental amenity, or smart growth.

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Chapter 1 INTRODUCTION

Section 1.1 describes events leading to this study and what the City hopes to learn from it. The City wants to evaluate the potential for the Portland Harbor to support economic activity. It has four questions about the capacity of land in the Portland Harbor to support future economic activity: (1) about the supply of vacant and underutilized land in the harbor area for marine terminals or water-dependent industrial uses; (2) about the land needs and potential land available for new port terminals; (3) about the role of Vancouver as a regional port; and (4) about potential changes in the use of industrial land (one aspect of which is referred to as “land efficiency”). **Section 1.2** describes how the rest of the report is organized.

1.1 BACKGROUND AND PURPOSE

The City of Portland (City) is the center of a large regional economy: there are about one million jobs in the seven-county metropolitan area, and almost 400,000 jobs within the city limits.

Many factors have contributed to the growth of the Portland economy, but one important factor is its ability to transport goods. Portland benefits from accessibility by highways (at the intersection of Interstates 5 and 84), rail (two Class 1 railroads - Union Pacific and BSNF, and short-line railroads), air (Portland International Airport), and sea (the Columbia and Willamette rivers).

The Portland Harbor is an industrial area located along the Willamette River that relies on the confluence of transportation infrastructure in the City (Exhibit 1.1). It contains about 4,000 acres of land located south of the Columbia River, west of I-5, and on both the east and west shores of the Willamette River. River-related industrial activities operate as a partnership between public marine terminals (owned and operated by the Port of Portland) and private businesses, including many marine-dependent industries. Key industrial sectors in the Portland Harbor include construction, manufacturing, warehousing, and transportation.

Over the past decade several studies of the Portland Harbor have been completed. The 2010 *West Hayden Island Economic Foundation Study* (prepared by Entrix for the City of Portland) summarized the conclusions of these studies:

“Portland Harbor serves as an economic engine for the metro regional economy... Past studies indicate that cargo and manufacturing activities dependent on waterborne transportation contribute significantly to the metro region’s economy. These studies indicate that marine-related economic activity generates from 20,000 to 100,000 jobs and from \$1.4 to 3.4 billion annually in regional income.”

Exhibit 1-1. Portland Harbor study area



Source: City of Portland, Bureau of Planning, 2011.

Another recent study, *Portland's Working Rivers: The Heritage and Future of Portland's Industrial Heartland* (2008 report prepared by Carl Abbott for the Working Waterfront Coalition) describes the impact of the harbor on the City. Some of its conclusions:

- The Portland Harbor is the nexus of a multi-modal system. The Willamette and Columbia rivers serve marine terminals, ocean shipping lines, barge lines, and bulk handling facilities. These waterborne facilities connect to railroads, interstates, commercial and general airports, and pipelines.
- Approximately 90% of harbor sites have access to rail routes, improving efficiency of transporting large loads from sea to land.
- Cargo forecasts by the Port of Portland further highlight the importance of the harbor: the volume of trade through Portland is expected to double by 2035.

In 2004, four river-related districts (Northwest Industrial District, Swan Island / Central Eastside, Rivergate, and Columbia Corridor) had employment about equal to the metropolitan area's three other industrial districts: the Sunset Corridor and 217 Corridor (where the electronics and computer industry is concentrated), and the Milwaukie/Clackamas Corridor (with a mix of manufacturing and distribution).

The importance of the harbor to the regional economy would be sufficient reason for the City to evaluate the harbor's needs for continued operation and expansion. But additional issues motivate the current evaluation. First, the City is in the process of concluding an extensive study of the City and regional economy (its *Economic Opportunities Analysis*, or EOA) as required by state land-use law. Second, the City has been engaged in studies of West Hayden Island, where there is a question about which land should be made available for future port development and which should be preserved as natural areas.¹ Answering that question depends in part on whether alternative areas in or near the Portland Harbor study area have land that is appropriate and sufficient for the water- and port-related development that is expected or desired.

Thus, though several studies of development issues in the Portland Harbor area have occurred in the last five years, the City wanted an evaluation to (1) synthesize and evaluate the findings of previous studies as they relate to the harbor economy and industrial land uses, and (2) address three specific questions related to the development of industrial land in the Portland Harbor.

To that end, the City asked ECONorthwest (ECO) to re-examine the inventory of existing harbor lands, both in Portland and the broader region (including Vancouver). This report addresses the capacity of industrially-designated land in the harbor area to accommodate future development,

¹ A current proposal for West Hayden Island is to devote 300 acres of land for marine terminal development, while setting aside 500 acres for open space.

both for new public marine terminals and private marine-dependent businesses. It addresses four questions posed by the City, each new question building from the answer of the question preceding it:

1. Are the methods the City used to estimate the location and amount of vacant, partially vacant, and potentially buildable industrial land in the Portland Harbor area likely to yield reasonable estimates?
2. Given the estimated land supply in the Portland Harbor area, how suitable for a public marine terminal are the few sites identified by the City as having the best potential to accommodate such a terminal?
3. If those sites do not develop as marine terminals (for whatever reasons), to what extent can the Port of Vancouver play a role in accommodating forecasted cargo demand in the Portland region?
4. If existing vacant land in the harbor area and in Vancouver is estimated to be insufficient to accommodate forecasted or desired transshipment or industrial activity, what is the potential for more efficient use of industrial land in the Portland Harbor study area? That question implies answering the question: What does more efficient use of industrial land mean, and how would it be measured?

By answering these questions, this report helps the City move forward in its planning processes. It provides information to help with assumptions that the City's *Economic Opportunities Analysis* may be making about industrial land supply and the efficiency (density) at which that land is likely to develop. It helps the City assess the importance of West Hayden Island as a site for future development of new public marine terminals by evaluating the (limited) potential of suitable sites for such development elsewhere in the Portland Harbor.²

² This report does not, however, include any analysis regarding the applicability of its findings to state, regional or local planning policies: such information will presumably be provided as part of any additional analysis by the City.

1.2 ORGANIZATION OF THIS REPORT

This report has three additional chapters and three appendices:

Chapter 2, Framework and Methods: Summary of economic concepts underlying the analysis, and specific methods used to answer the four questions that are the focus of this report.

Chapter 3, Analysis: Current and likely future conditions for key factors affecting economic activity in the Portland Harbor.

Chapter 4, Summary of Findings: Briefly restates the important conclusions of our analysis.

Appendix A: Research Methods: Framework for understanding and methods for conducting our analysis (more detail than is provided in Chapter 2 of the main report).

Appendix B: Port Terminal Site Evaluation Criteria: Used by Maul Foster & Alongi, Inc. to evaluate the feasibility of potential sites in the Portland Harbor.

Appendix C: Analysis of Harbor Land Capacity and Demand, Portland and Vancouver: Provides greater detail (including a wealth of tables) on the data-driven methods used, in part, to determine the potential for the Port of Vancouver to accommodate forecast demand for the Portland Harbor, if there are insufficient sites in Portland to accommodate all of the expected demand.

Appendix D: Mapping Analysis: Presents the results of the City's visual survey of aerial maps of the Portland Harbor to classify the lands in one of several categories.

Chapter 2 **FRAMEWORK AND METHODS**

Section 2.1 discusses a *framework* for evaluation: concepts that underlie any evaluation of this type. It discusses (1) the role of industrial activity in the economy, (2) definitions of industrial use and industrial land, (3) factors relating to the supply of and demand for industrial land, and (4) the concept of land efficiency: what is it, why does it matter, and how is it measured. **Section 2.2** is more specific about the *methods* used for the evaluation (review of previous studies, secondary data, case studies, interviews) and how they are used to address this study's four questions. **Appendix A** provides a more detailed description of our framework and methods.

2.1 **FRAMEWORK**

2.1.1 **WHY CARE ABOUT INDUSTRIAL LAND?**

This study starts from the assumption, embedded in the economic development policies of all local governments in the region, that the retention, expansion, and relocation to the region of industrial sectors is something that the region desires. Industrial activity and employment is mainly classified as export oriented (“traded sector”) and is likely to have jobs at higher than average wages.

2.1.2 **DEFINING INDUSTRIAL LAND AND USERS**

- **Industrial land:** What is commonly referred to as “industrial” land is land designated by a local government (in its comprehensive plan, and implemented by its zoning ordinances) to allow (but not necessarily require) industrial uses. In the Portland Harbor, the City does strictly limit non-industrial uses, and allows only river-related and river-dependent industry.
- **Harbor land:** A smaller subset of industrial land pertinent in this study is “harbor” land. For this study, we use the City’s definition of the “Portland Harbor.” A map of the Portland Harbor is shown previously in Exhibit 1-1.
- **Industrial users:** A recent analysis of industrial land published by the American Planning Association³ used NAICS codes to define “industrial use” in urban areas, including a “strict” definition of construction, manufacturing, wholesale trade, and transportation and warehousing. This list, however, does not necessarily reflect the types of businesses that require industrial land. For example, many jobs in the construction industry are not physically located at a

³ Howland, Marie. 2011. “Planning for Industry in a Post-Industrial World: Assessing Industrial Lands in a Suburban Economy.” *Journal of the American Planning Association*. Winter, Vol 77, No 1. pp 39-53.

central, industrial location, but instead operate on sites throughout the region. Therefore, one should not focus exclusively on a list of NAICS codes to identify the range of businesses that could have demand for industrial land in Portland.

- **Public marine terminals:** Our analysis treats public marine terminals (i.e., the Port of Portland facilities) differently from other uses of harbor industrial land. These port terminals function as public infrastructure, facilitating economic activity for other industries in the region.

2.1.3 SUPPLY OF AND DEMAND FOR INDUSTRIAL LANDS

The total amount of land inside the Portland city limits is essentially fixed. Thus, for the City of Portland, the question of land supply focuses on how much land is vacant, partially vacant, or underutilized, and how much land is constrained (by environmental contamination, environmental overlays, and other issues).

In general, industrial land must accommodate most job growth in “industrial” sectors. It must also accommodate some job growth in “non-industrial” sectors. In other words, not all jobs in “industrial” sectors use industrially-designated land, and not all industrially-designated land is used by “industrial” sectors.

Analysis of land *supply* is about estimation, not forecasting. The use of “data layers” from Geographic Information Systems (GIS) is the standard technique for such estimation. Because it is estimation, the uncertainty is not about the future, but about the data and assumptions that are used to describe what is on the ground now. Our evaluation consists of a review of the data and assumptions.

Factors affecting supply and demand are not independent. Businesses and developers choose the land with the best value. Price makes a difference. In the Portland Harbor land may be more expensive (cost per acre) than at the region’s periphery. But land in the Portland Harbor is also close to the downtown, labor markets, port terminals, and interstate highways. If it is only a little more expensive, it may still be a preferred location for growth. If it becomes too expensive, then prospective industrial users may locate elsewhere, on land that provides a better value (for example, because lower land cost and congestion are judged to more than offset the higher costs of being more distant from a preferred location). Businesses that need water access would have an incentive to bid more for land providing that access, and other businesses would find better value in alternative locations.

2.1.4 “EFFICIENT” USE OF INDUSTRIAL LAND

Efficiency is a measurement of how much output is produced per unit of input. In this case, the City’s concern is about the amount of economic activity (output) generated per acre of land (input).

Traditional measures of efficiency

Typical measures of efficiency of land use include employment, real market value, and built space. These measures look at the amount of economic activity occurring on a property, but give relatively low marks to industrial development. Compared to an office tower, an acre of industrial development is likely to have much lower assessed value, employment, and gross square footage of built space. Thus, measures of the efficiency of employment land based on any of these measures in the numerator would all tend to improve if industrial land were converted to commercial uses.

But industrial lands (and harbor lands) are clearly important to the regional economy. If every jurisdiction allowed vacant industrial land to convert to commercial uses on the assumption that some other jurisdiction would provide the industrial land, the regional supply of industrial land would get smaller quickly. Land with port access is a particularly important and relatively rare component of all regional industrial land. Marine terminals provide access to other markets, facilitating commerce, and allowing traded-sector businesses to export their goods to other markets.

Alternative measures of the output component of efficiency

To evaluate the efficiency of the use of industrial land in the Portland Harbor, one needs a definition of efficiency that makes sense for industrial land. We suggest two alternative measures of efficiency that are most appropriate for harbor industrial land: value added, and tonnage of cargo.

- **Value added:** Value added is defined as the value of outputs (per unit or in the aggregate) minus the cost of inputs purchased from other firms used to create output.⁴ Proponents of the industrial and manufacturing sectors point to its potential for high “value added.” One measure of the efficiency of a fixed supply of industrial harbor land would be the amount of value added generated per acre for businesses located in the harbor.
- **Cargo:** There is a reasonable argument that much of the industrial land in the Portland Harbor area serves a regional need for

⁴ In that sense, value added is a measure of a firm’s contribution to GDP. Another way to think about this is that everything that a firm itself puts into the production of a product (primarily the labor of its employees and capital) “add value” to the raw materials and intermediate goods and services it purchases to make its final product.

transshipment. Therefore, a regional measure of transshipment activity might be appropriate for measuring the efficiency of such land. Some measure of cargo (e.g., tonnage, volume, value, berth utilization) is an obvious choice. Because data are more readily available for tonnage of cargo, that is an alternate measurement of land-use efficiency in the Portland Harbor that we examine in this report. If the City were interested in tracking these alternative efficiency measures in the future, then tracking multiple measures of cargo (i.e., tonnage and value) would provide a more complete picture of cargo trends.

2.2 METHODS

2.2.1 GENERAL DATA SOURCES AND TECHNIQUES

To conduct our analysis, we used the following data sources:

- **Existing studies.** Extensive analysis has been conducted regarding the Portland Harbor, industrial land, and port terminals. These efforts result in a library of reports and studies addressing different aspects of the regional economy. Appendix A includes a list of recent (or ongoing) studies that were reviewed in our analysis.
- **Secondary data sources.** ECO incorporated many secondary data sources into its analysis.⁵ As with “existing studies,” the objective is to leverage past research efforts to answer the questions posed in this study. Appendix A includes a list of the secondary data sources used in our analysis.
- **Interviews:** Many people in the Portland area have special knowledge of, and interest in, the Portland Harbor. ECO interviewed individuals from both the public and private sectors, and reviewed notes on past interviews that had been conducted for recent related studies.

2.2.2 EVALUATING CITY METHODS USED TO ESTIMATE PORTLAND HARBOR BUILDABLE LAND SUPPLY

ECONorthwest used the following methods to address this question:

⁵ Secondary data sources are ones collected and readily available by someone other than the user (in this case ECONorthwest). Typical secondary sources are government agencies (e.g., U.S. Census, ODOT, Metro, Port of Portland).

- Review of studies summarizing industrial and harbor land supply: *Industrial Districts Atlas* (2004) and *Harbor ReDI Industrial Sites Analysis* (2009).
- Review of GIS shape files and cross-referencing to staff aerial analysis of harbor lands and Google Earth aerial photos (August 2011).
- Discussion of methods and BPS staff, and comparison to standard methods for developing land inventories and identifying buildable land.

2.2.3 ADDRESSING THE POTENTIAL SITES FOR NEW MARINE TERMINALS

To determine which sites might best accommodate a public marine terminal, we began by identifying the technical site requirements for a marine terminal. ECO interviewed representatives of the Port of Portland to identify their ideal site requirements, as well as which of these requirements could be reduced while still accommodating a working port facility. Members of the ECONorthwest team with experience running west coast ports looked for creative ways to adjust these site requirements to create a working terminal on smaller or otherwise constrained sites.

BPS staff identified sites that could potentially meet these criteria, based upon an aerial analysis of existing development in the Portland and Vancouver harbors.⁶ ECO, reviewed the sites identified by the City of Portland, and toured the sites, conducting a visual inspection, documenting conditions affecting the suitability of each site for the proposed development.

2.2.4 ADDRESSING THE ROLE OF VANCOUVER IN HARBOR INDUSTRIAL LAND SUPPLY

We began by attempting a data-driven analysis. In principle, if we knew the capacity of existing marine terminals in Portland and Vancouver, and subtracted the forecast future demand for these areas, then we could identify the amount of demand that could not be accommodated by existing facilities. This demand (in tons of cargo) could then be translated into the acres of land necessary for new terminals to accommodate this growth. Comparing the required acres to support new terminals with the available land supply in the Portland Harbor and in Vancouver, we could identify how much of Portland's demand might need to be accommodated

⁶ Aerial photos were taken in 2010 and 2011.

in Vancouver, and whether or not Vancouver had sufficient land to accommodate it.

This analysis established a high and low boundary for the potential land need. We also defined a “most-likely” scenario that falls between the two extremes. In order to give these numbers more context, and to help us arrive at the most-likely scenario, we conducted numerous interviews with representatives of the ports of Portland and Vancouver.

2.2.5 ADDRESSING THE POTENTIAL FOR INCREASED EFFICIENCIES

The City is interested in knowing if industrial land in the Portland Harbor can be used more efficiently in the future. To answer, we looked at recent economic trends in the Portland Harbor and in the City of Portland as a whole for changes in land-use efficiency for industrial users. For this analysis, we considered several measures of output in an efficiency measure: employment, real market value, value added, and tonnage.

We began by identifying all parcels in the Portland Harbor using GIS. We examined data from two different years: 2002 (one of the earliest years that data are available using North American Industry Classification System codes), and 2008 (the most recent year Quarterly Census of Earnings and Wages data are available). Comparing data from the two years we calculated the change in developed acreage in the Harbor, the corresponding change in real market value, and the net change in employment.⁷

We also collected data from different sources for two alternative measures of output (for the denominator): value added and cargo (volume, tonnage, and value). Unlike employment and real market value, data for value added and cargo tonnage is not tracked at a parcel-specific level. Instead, data is available at the regional, City, zip code or Census tract level. For our analysis, we used Port of Portland data on historical levels of cargo tonnage in the Portland Harbor, and the IMPLAN economic model for the zip codes that most closely align with the boundaries of the Portland Harbor for value added. We used the same years (2002 and 2008) as were used for other measures of efficiency.

⁷ The time period used in this analysis, 2002 to 2008, does have limitations. Only having data for two years, doesn't allow for a detailed view of trends during the interim years. Moreover, a six-year period is relatively short, and may not be indicative of long-term trends. Nonetheless, these years allowed us to make the most efficient use of available data for our analysis. Moreover, the analysis focused on comparing how these different measures of efficiency changed relative to each other over the same period of time, and not on establishing long-term trends for each measure.

Chapter 3 ANALYSIS

Section 3.1 addresses whether or not the methods used by the City to estimate the location of buildable land in the Portland Harbor area yields reasonable estimates: it concludes that they are. **Section 3.2** addresses the potential for land in Portland Harbor (not including West Hayden Island) to accommodate a new Port terminal. It finds that the two areas that might have enough vacant land to be assembled into a development site of sufficient size are relatively constrained: they could, theoretically, accommodate small terminals of various types, but some of the costs of development would be high relative to alternative sites. **Section 3.3** addresses the potential for the Port of Vancouver to accommodate regional demand for expanded Port facilities. It concludes that under the most-likely scenario, the Port of Vancouver has about the right amount of land to accommodate the bulk of the region's forecast growth in marine cargo through 2040, but that alternative and reasonable assumptions lead to the conclusion that more land than what the Port of Vancouver now controls will be needed. **Section 3.4** addresses the potential for increased efficiency for the use of industrial land in the Portland Harbor. It concludes that value added and tonnage of cargo per acre are more appropriate than traditional measures of efficiency for harbor industrial lands, and that recent historical trends demonstrate the Portland Harbor has become more efficient by most efficiency measures.

3.1 EVALUATION OF METHODS USED BY THE CITY TO ESTIMATE BUILDABLE LAND

The question is whether the methods used by BPS to identify vacant and buildable land are likely to be accurate. Will they systematically over or under estimate the land supply? In particular, are they likely to miss areas of vacant, buildable land that are big enough for a marine terminal (sites of at least 50 acres of contiguous vacant or underutilized land that has river access and could be serviced)?

To begin to answer these questions, we looked at recent studies that sought to determine the supply of buildable land in the Portland Harbor. Exhibit 3-1 summarizes the findings of the City of Portland Economic Opportunities Analysis (EOA), including the first draft (Hovee, 2009), and final report (Hovee, 2012), as well as the West Hayden Island Economic Foundation Study (Entrix, 2011), and the City of Portland Bureau of Planning and Sustainability's internal effort to quantify buildable lands, described in Exhibit 3-2 as "BPS Aerial Survey."

Exhibit 3-1. Summary of previous study estimates of Portland Harbor buildable land supply

Study	Year	City of Portland Harbor Land Supply		Parcels of Size: (3)	
		Gross Acres (1)	Effective Acres (2)	50-250 Acres	250+ Acres
EOA Draft 1, Hovee	2009	266	61	0	0
EOA, Hovee, BPS	2012	326	108	0	0
Entrix, Inc.	2010	299	<50	2	0
BPS Aerial Survey	2011	590	178	3	0

Compiled by the City of Portland Bureau of Planning and Sustainability, from the following original data sources: City of Portland Economic Opportunities Analysis, (E.D. Hovee and Company, 2012), and first draft (2009) West Hayden Island Economic Foundation Study (Entrix, 2011)

Notes:

- (1) Total acres of vacant land, without regard to environmental or contamination constraints
- (2) Total acres adjusted for environmentally sensitive land, contaminated land, or land with insufficient infrastructure
- (3) Number of individual parcels or polygons of the stated acreage

Although these recent studies come to different conclusions on the amount of vacant, buildable land, all of the studies show a relatively small supply of effective acres, ranging from less than 50 acres in the Entrix study, to 178 acres in the BPS Aerial Survey. For the purpose of identifying sites for public marine terminals, we need to consider not only the total acreage, but the size of the individual parcels. Scattered small parcels of vacant land cannot accommodate a marine terminal, a single site (typically of 50 acres or more) is needed. These recent studies show that no more than three such sites are present in the Portland Harbor.

The City asked ECONorthwest to confirm that the methods used to identify these sites were reasonable. Some simple ideas and calculations help to answer that question:

- The state of the practice for land inventories is quite advanced. The Oregon statewide planning program’s requirements for “buildable land analysis” (from the mid-1970s) spurred the use of Geographic Information Systems (GIS) throughout the state. All large cities and Metropolitan Planning Organizations in Oregon have been developing their GIS tools and datasets for over 25 years. Metro is looked to as a leader in the country on the use of GIS for land-use evaluation. The City of Portland has advanced its data in parallel with Metro. Databases that started as crude approximations have improved substantially. They have been reviewed and updated many times; data from more and more sources have been added (e.g., tax assessment, public works); computer power and software have improved; digitized mapping of aerial photographs now allows accurate registration of those photographs to underlying layers of thematic maps. In short, the data are current and accurate, and the

ability to manipulate and summarize them is substantial, fast, and technologically reliable.

- The Portland Harbor area is not big by regional standards. The detailed BPS GIS data put it at just over 4,000 acres. As a back-of-the-envelope corroboration using different datasets and tools, ECO used Google-Earth to draw the approximate boundaries of the study area (Exhibit 1-1 above) and calculate areas: the result was 4,100 acres, the equivalent of a square 2.5 miles on a side. Just inspecting aerial photographs would allow one to find large, undeveloped acreages.
- The City has conducted three extensive studies of industrial and harbor land that resulted in detailed mapping: *Industrial Districts Atlas* (2004), *Harbor ReDI Industrial Sites Analysis* (2009), and the GIS-based inventory (2011). The 2011 inventory maps and data table are included as an Appendix to this report.
- ECO has worked on a dozen buildable land evaluations, and has written many reports on the steps for working from “all land” to “vacant, buildable land.” ECO’s conversations with BPS staff led to the conclusion that staff had used state-of-the-practice techniques. In summary, (1) from “all land” the land not in parcels is removed (e.g., water bodies, street and other rights of way); (2) of the land in parcels, the land that is developed and judged unlikely to redevelop easily (usually based on the value of improvements) is removed; (3) from the undeveloped or under-developed land, the land with physical or policy constraints is removed (e.g., wetlands, in flood ways, steep slopes).

All of the previous points strongly suggest that the information about the supply of developable industrial land in the Portland Harbor area that BPS has generated is very reliable. The buildable land inventory using GIS data that was done for the update of the Economic Opportunity Analysis looks reasonable by the tests we noted.

But despite good intentions and good analysis, there are details in any such analysis that require assumptions, and the assumptions can make a difference to the outcomes. For example:

- Which constraints are absolute, and which are restrictive? Does a slope of more than 10% preclude industrial development? 15%? What if the average slope on a large parcel is 10%, but half of the parcel has slopes less than 5%? What about soil contamination: can the site be remediated, or is the extent of the contamination and legal complexities such that the site is effectively off the market for the foreseeable future?
- When is land “underutilized”? Some vacant areas around buildings may be necessary for vehicle movement, production staging, or

occasional storage. Are large parking lots “vacant” or are they an essential part of the operations in the buildings adjacent to them? A low value for improvements does not necessarily mean that the owner has any interest in redevelopment.

- Ownership patterns. What might look like relatively large areas of vacant land on an aerial photograph may be in many parcels with many different owners. Land assembly and development may be very difficult. This point is illustrated by the findings in Exhibit 3-1, which show up to three sites with at least 50 acres using the BPS methods (ignoring parcel boundaries and looking at aerial photographs), but no sites of that size when using the methods in the Economic Opportunities Analysis (which did look at parcel boundaries).

For the Harbor Area land evaluation, our evaluation is that the buildable land inventory using GIS data that was done by BPS to update of the Economic Opportunity Analysis has generally made inclusionary rather than exclusionary assumptions: we think that is appropriate. BPS did not, for example, eliminate from its search for large, buildable parcels those with arbitrarily defined thresholds for buildability (e.g., proximity to services or the river, steep slopes, contamination), or those that had a particular ownership. All those parcels are still part of the dataset from which large sites were identified. The result, as Section 3.2 shows, is that the large sites identified have several challenges for development: challenges that were not screened out by earlier assumptions about buildability criteria. In other words, on that score, the methods used by BPS were inclusive, and the result is that there would be less chance of screening out land that might eventually prove to be capable of contributing to a large site for a marine facility.

An assumption that BPS did make, and that all buildable land evaluations that we are familiar with also make, is that developed parcels are, in general, not buildable parcels. They can, of course, become buildable parcels if their buildings are removed. Thus, it is theoretically possible that parcels that look developed (from assessment data, aerial photographs, and field surveys) could eventually be part of a land assembly large enough to accommodate a large marine terminal. The kind of detailed, property-level analysis needed to make judgments about land redevelopment and site assembly is not done as part of a regional or city buildable land evaluation.

But there is still the issue of “underutilized” land. A buildable land dataset, like the one BPS has developed, will be quite good (after field testing – and there has been plenty in the Harbor Area over the last 10 years) at distinguishing developed parcels from vacant parcels in most cases. But it is more difficult to determine when a generally vacant parcel is underutilized, and more difficult still to determine whether parcels that are

developed have underutilized remainders that might be considered as vacant and eligible for consolidation into a larger, developable site.

The documentation of the City of Portland's GIS-based Development Capacity Model⁸ says that it (1) identifies (and presumably flags as undevelopable) "constrained" properties (i.e., significant environmental or historic resources), and (2) identifies developed parcels "significantly underutilizing their allowed development capacity (using less than 20% of available capacity, not including any development bonuses or incentives)" [that determination can be over-ridden by a judgment by BPS staff that a property is "likely" or "not likely" to redevelop]. The dataset has detailed information on parcel attributes (around 100 attributes per parcel), including building footprint (which allows a calculation of the amount of land not currently developed as a building). It has an algorithm for calculating "site area" by combining the acre of contiguous "underutilized" lots. In short, this is an extensive and well-documented dataset.

The BPS identification of potentially developable sites in the Portland Harbor did not rest entirely on technical analysis using GIS. Additional analysis done as part of the specific to the Harbor Lands Inventory also relied extensively on a review of aerial photographs, with staff performing a visual inspection of all sites along the Willamette River to ensure that any large areas of apparently vacant land had been included in the database of potential terminal sites, and that all of the sites identified by GIS appeared to have the development potential that was suggested by the data. Additionally, BPS staff made reasonable efforts to acquaint themselves with the sites, talking to Port of Portland officials, and visiting the areas, to make sure that the BPS analysis was grounded in a solid understanding of what was actually occurring on key sites in the Portland Harbor. In short, land uses and vacant lands identified in the visual survey were compared with the GIS/BLI data to ensure there were no large information gaps.

As a final check on the site inventory, we relied on our familiarity with the study area, the City documents cited above, and aerial photographs to see whether there were any large areas of vacant or underutilized land besides the two (Atofina and Time Oil sites) that the City identified as the best candidates for a new marine terminal. On the west bank of the Willamette River, we found nothing beyond the Atofina site: the north reach has only a narrow strip of mainly developed land; the south reach has a wider land area but is entirely developed along the waterfront. We found the following candidates on the east bank:

⁸http://www.portlandonline.com/cgis/metadata/viewer/display.cfm?Meta_layer_id=52965&Db_type=sde&City_Only=False

- Swan Island Industrial Park. Land at the south edge on the NE bank of the Willamette River could be classified as underutilized: it is an operation for transshipment of aggregate (10 acres). But even if the parking and storage on both sides of the site is counted, the site would still fall way short of the minimum threshold of 50 acres.
- McCormick and Baxter site, SE of BNSF bridge on east side of the Willamette River. Depending on what land is counted (e.g., backing out land for rail right of way, some existing buildings), this site may be 50 – 70 acres in size. This site was excluded from the City’s analysis, primarily because it was recently proposed to be rezoned as EG2 in the River Plan, which (although it allows industrial development) does not allow rail yards, and requires greater setbacks and landscaping than other industrial zones (like IH for heavy industrial). Conversations with BPS staff indicate that the EG2 zone designation is one element of the River Plan that has been challenged, and there is a good chance that a revised River Plan will not propose the EG2 zoning for the site, which would make this site potentially available for marine terminal development.
- “Underutilized” land north of St. John’s Bridge on east side of the Willamette. What may seem underutilized from a high-level aerial photograph is actually space for parking new cars from Asia – this is the Port of Portland’s Terminal 4 operation (about 260 acres total, handling autos, forest products, steel, and dry and liquid bulks). This site is already part of the Portland area’s supply of marine terminals and cannot be counted to add new capacity, unless it were redeveloped. Evaluating that possibility is beyond the scope of our study.
- Sites in the Terminal 5 and Terminal 6 area. There are some sites for infill (e.g., 50 acres off North Lombard in Terminal 6) but there is no water frontage available for a new terminal. Evaluating redevelopment of Port terminals is beyond the scope of our study.
- Kelly Point Park. About 50 acres at the confluence of the Willamette and Columbia Rivers, abutting Port properties of Terminals 5 and 6 is park land that is not available for development.

Of all the sites examined (beyond the Atofina and Time Oil sites already identified by BPS), the only one that met the minimum size requirements (and was not parkland) was the McCormick and Baxter site. The development potential of this site was studied extensively by the City in the past, and the results are described in the *McCormick & Baxter Site Reuse Assessment: Final Report* (June, 2001). The site could have potential for marine terminal development, but (as detailed in the 2001 site assessment) it is heavily constrained in several areas: relatively shallow water at the shoreline, inability to expand to adjacent parcels due to existing uses (Metro

open space and University of Portland campus), isolation from truck routes that require traveling through residential neighborhoods and up a relatively steep bluff, other infrastructure insufficiencies, and significant liens and encumbrances. While the challenges are substantial, they are not necessarily insurmountable, and the other sites identified by BPS face some similar challenges.

Ultimately, the site was excluded from further analysis, because it is less likely that adjacent lands could be assembled into the site, due to the adjoining zoning, and because past brownfield remediation work on the site was carried out in a way that limits future industrial uses, unlike the Atofina and Time Oil sites. Our brief review of the site constraints suggest it is at least as constrained as the Atofina and Time Oil sites, and would not be a better site for marine terminal development, due to the access constraints mentioned above. Thus, our answer to question posed is:

- BPS has used appropriate measures to identify vacant and buildable land.
- The two sites it has identified as meeting the minimum size requirements for a new marine terminal (Atofina and Time Oil) appear to be the two best sites that meet that size requirement with vacant land. Any other location would require assembling and redeveloping properties that now have buildings on them.⁹

3.2 POTENTIAL SITES FOR NEW MARINE TERMINALS

This section addresses the question: How suitable for a public marine terminal are the few sites in the Portland Harbor that have been identified by the City as having the best potential to accommodate such a terminal? Through previous planning efforts,¹⁰ the City of Portland Bureau of Planning and Sustainability (BPS) identified the following minimum criteria to meet forecasted demand for new marine terminal sites in the Portland Harbor:

- Industrial zoning
- Deep-water harbor access
- Railroad access

⁹ Whether such redevelopment could be, in some cases, financially feasible is a question beyond the scope of this study.

¹⁰ West Hayden Island Economic Foundation Study, prepared by Entrix and Bonnie Gee Yosick LLC for the City of Portland Bureau of Planning and Sustainability, May 2010. City of Portland Economic Opportunities Analysis: Working Draft, prepared by E.D. Hovee and Company, LLC for the City of Portland Bureau of Planning & Sustainability, June 2011.

- Truck street access
- Vacant (unimproved or unoccupied brownfield) site-assembly area approaching 100 acres.

Using the methods described in Section 3.1 above, BPS staff identified only two sites that could potentially meet all these criteria. These are the two largest vacant sites in the Portland Harbor area: the 59-acre Atofina site, and the 43-acre Time Oil site. Both are brownfields, and both could potentially be assembled with nearby vacant sites.

This analysis looked only at vacant sites. It is always possible that some sites that are non-vacant today could be redeveloped as marine terminals in the future. When considering the opportunity to redevelop non-vacant sites, it is important to look at the net impact in economic activity. In other words, redeveloping existing sites would only be beneficial to the economy if the new use of the site were more efficient and able to accommodate more economic activity (whether measured by employment, output, cargo volumes, etc.) on the same acreage. Evaluating all non-vacant sites in the Portland Harbor to attempt to determine which might be most likely to redevelop in the future was beyond the scope of our analysis.

The ECONorthwest team reviewed the two vacant sites identified by the City of Portland, and evaluated maps of the Portland Harbor, including zoning, infrastructure and aerial photographs. Our preliminary review confirmed the City's findings: most of the Portland Harbor has active development on it, and these two sites have the greatest opportunity to accommodate new public marine terminals.

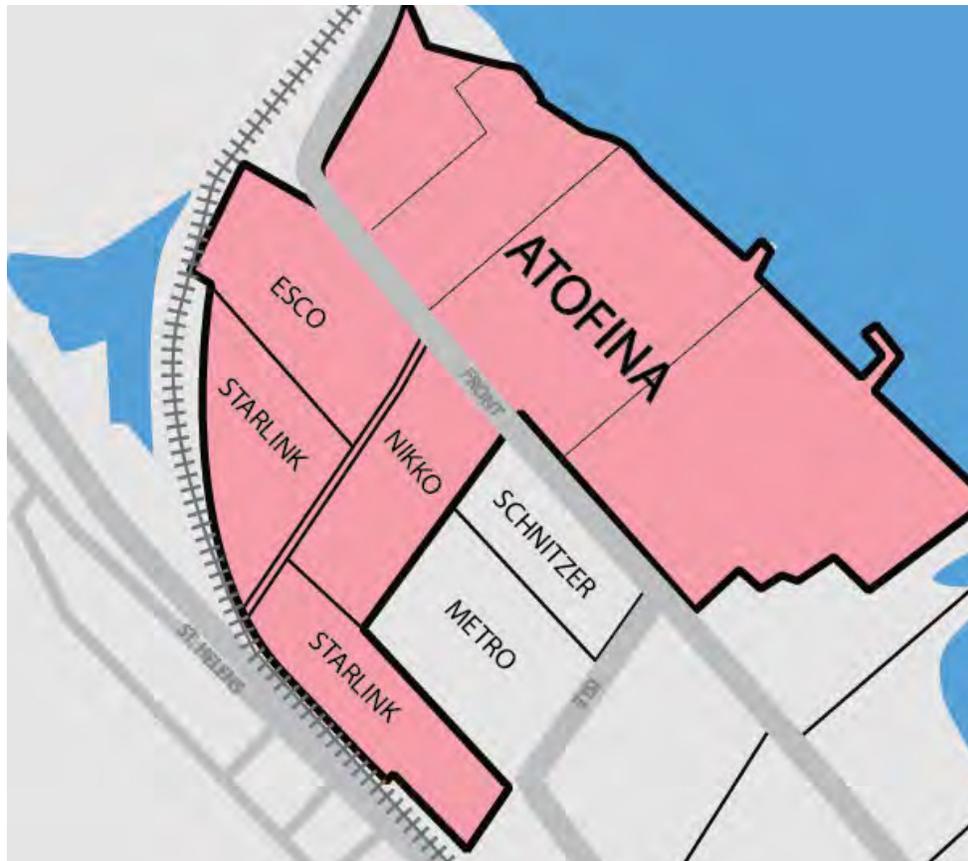
Staff from ECONorthwest and Maul Foster & Alongi toured these sites with BPS staff, documenting conditions affecting the suitability of each site for the proposed development. Key factors considered in the evaluation were: site access, existing uses, natural features, and contamination / remediation. After conducting this site visit, Maul Foster & Alongi developed a set of criteria for evaluating site feasibility for typical port terminals (see Appendix B).

Using these criteria, Maul Foster & Alongi evaluated the potential opportunities and constraints of these sites to accommodate development of a public marine terminal. A cursory site visit is insufficient to make a final determination of site feasibility. Nonetheless, the methods are consistent with the scope and budget, and are sufficient for identifying major opportunities and constraints for these potential sites, and for making a preliminary determination of site feasibility. Further investigation of these sites could be conducted to refine our feasibility findings.

3.2.1 ATOFINA

The Atofina site is a collection of parcels under several ownerships, which total approximately 114 acres (59 acres in the four main Atofina parcels, and an additional 55 acres in adjacent parcels across Front Ave.). The parcels are zoned heavy industrial (IH), and are bordered by industrial uses. The site is adjacent to SR 30 and fronts the Willamette River within the Portland Harbor. Exhibit 3-2 shows a map of the Atofina site.

Exhibit 3-2. Atofina site



Source: ECONorthwest, 2011.

The parcels that the Atofina site comprises have the following owners:

- Atofina: four vacant parcels totaling 59.14 acres
- Schnitzer: an 8.32-acre parcel, currently occupied by Air Liquide America Corporation
- Metro: a 10.43-acre parcel housing the regional solid waste transfer station
- Nikko (Gould Electronics): a 9.21-acre parcel, which is partially occupied by an operating RCRA C hazardous material landfill
- ESCO: a 10.51-acre parcel, which is a former landfill

- Starlink (Aventis Cropscience USA LP; Rhone Poulenc Ag): two significantly contaminated parcels totaling 16.42 acres, currently under remediation.

Access

Water depth in the Willamette River near the Atofina site ranges from 30 to 40 feet. The site has historically been used as a bulk-commodity manufacturing and shipping terminal. The waterside parcels (Atofina) provide a total of 2,700 feet of shoreline, and currently accommodate three existing piers on leases from the State of Oregon, Department of State Lands.

The aggregated Atofina site is served by a rail siding from the BNSF mainline. The siding is approximately 2,200 feet in length with three road 'at grade' crossings. While the site has rail access, it appears to be of insufficient size to accommodate a loop track, which would hamper efforts to build an efficient, modern port facility. Highway 30 access has been somewhat hampered by the closure of local streets accessing the highway.

Existing uses

Current industrial uses on the Schnitzer property as well as the Metro property seemingly eliminate 18.75 acres, while the existing Gould Superfund disposal site on the Nikko property reduces the available footprint by an additional 9.21 acres. The Nikko property contains an operational on-site 4.5-acre containment facility (Subtitle C closed hazardous waste landfill), and is approximately 25 to 30 feet higher in elevation than the surrounding property, with a structured fill containing 77,000 cubic yards of contaminated materials. The former ESCO landfill received non-recyclable wastes (e.g., foundry sand, slag, demolition debris) from ESCO's foundry operations from approximately 1953 to 1983. The landfill was closed with the approval of the Oregon Department of Environmental Quality (DEQ) and the Oregon State Health Division in 1983. The Starlink properties are undergoing extensive investigation and remediation.

Natural features

The property generally rises in grade from the Front Street ROW in the east to the rail ROW in the west, and has considerable natural gain exclusive of the Subtitle C landfill mass. Along the north and northwest perimeter of the site is a berm with a steep slope leading up to the BNSF main line on its approach to the rail bridge. Across the rail line, North Doane Lake and an environmental conservation land designation wrap the 'site' to the north and west.

The waterside parcel is partially within the FEMA Special Flood Hazard Area or was partially inundated by a 1996 flood event. The area is in a low to moderate earthquake hazard exposure area.

Contamination and remediation

The Atofina parcels are being remediated by Legacy Site Services (LSS), as the Atofina agent, under a consent order with DEQ, requiring source control and a site-wide feasibility study. The source control measures include both groundwater and stormwater migration controls. The site is included in the area of the Lower Willamette River that was designated a Superfund site in 2000 by the Environmental Protection Agency. Final remediation plans for the Portland Harbor Superfund site have not been determined. The potential liability for remediation of the Superfund adds a high level of risk for all affected properties, making prospective real estate transactions or development unlikely.

Other constraints

In addition to these property encumbrances the Atofina site is transected by Front Avenue (Service Level B; Priority Truck Route; peak-hour volume average of 106 vehicles and an average daily traffic volume of 640 vehicles, of which 92% are automobiles). Front Avenue separates the Atofina-owned parcels from the remainder of the site. Front Avenue provides primary access to the adjacent Siltronic site and is a public right of way. The Siltronic property does have alternate direct highway access to US 30, but there is an 'at-grade' rail crossing, and it does not readily serve the current land use configuration for the site. In addition to the Front Avenue ROW there is a pipeline easement adjacent to the east side of the street ROW.

While the total aggregated acreage appears to adequate for serving as a barge or bulk facility, current encumbrances, uses, and rights of way limit the useable area to 59 acres: the four parcels owned by Atofina to the East of Front Avenue, fronting the Willamette River.

Site assessment

Significant changes would need to be overcome to develop this site as a productive public marine terminal. To develop the entire site, NW Front Avenue would need to be closed, requiring additional infrastructure investments to provide alternative access to the Siltronic property. Without closing NW Front Avenue, this site is practically limited to 59 useable acres, with limited road and rail siding access.

While the site has rail access, site size and dimensions are insufficient to accommodate a rail loop track. Providing adequate rail service for the site is

even more challenging if development is limited to the 59 acres east of NW Front Avenue.

If NW Front Avenue were closed to accommodate development of the 114-acre site, the properties owned by Metro and Schnitzer are in active use, and would be unlikely to relocate. Property acquisition for the remaining parcels would be challenging, as it would require negotiations with five different private property owners. While acquiring these properties would provide additional acreage for development, acquisition would also involve additional costs as well as need for environmental remediation on these sites.

Ultimately, the site may be suitable for break bulk commodities, such as project cargoes, but the uncertainty of the planned and ongoing environmental remediation on the Atofina parcels--in addition to the uncertain liability for the Lower Willamette River Superfund remediation--probably make the cost of the land prohibitively high. The site *could* be big enough for a terminal, but the cost of preparing the site to accommodate such a terminal will make the effective land price very high relative to other industrial properties.

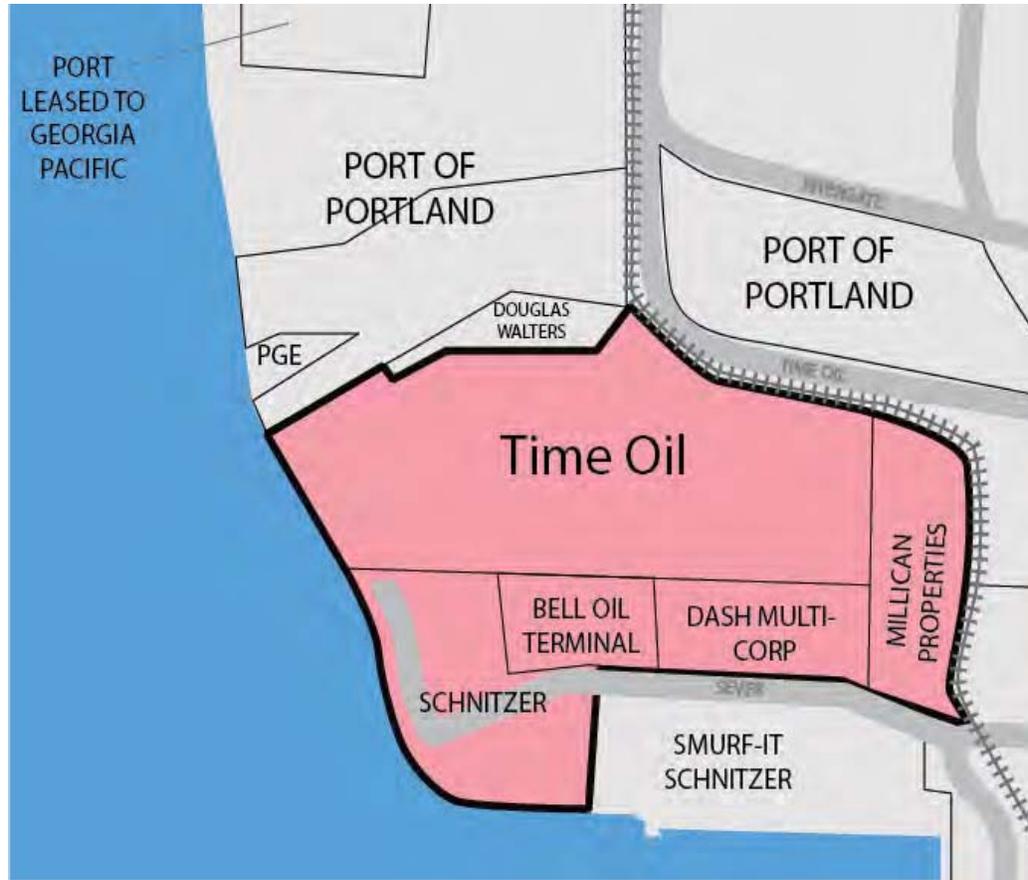
3.2.2 TIME OIL

The Time Oil site includes several separately owned parcels totaling approximately 84.2 acres. The subject parcels are adjacent to the Willamette River within the Portland Harbor and are zoned heavy industrial (IH) with a 'River' overlay designation. The site is bordered by industrial uses and also an area governed by a soon-to-expire natural resource management plan. Exhibit 3-3 shows a map of the Time Oil site.

The Time Oil site comprises parcels with the following owners:

- Time Oil: 43.41 acres
- Schnitzer Investment Corporation: 13.79 acres
- Bell Oil: 6.04 acres
- Dash Multi Corporation: 9.82 acres
- Millican Properties: 11.12 acres

Exhibit 3-3. Time Oil site



Source: ECONorthwest, 2011.

In addition to the aggregated property initially considered for the Time Oil site, there appears to be additional parcels totaling approximately 57 acres to the east of the Time Oil site, and bounded by Time Oil Street and Burgard Street. Including these parcels (not shown in Exhibit 3-3), the total potential aggregate site would be approximately 139 acres.

Access

Water depth in the Willamette River ranges from 30 to 40 feet. The aggregated site has approximately 1,400 feet of shoreline (pier head): the Time Oil parcels with 550 lineal feet, and the Schnitzer parcel with 850 lineal feet.

Historically there have been two piers on the parcels. The side channel serving the Schnitzer parcel is navigable, and is likely to be addressed in the Portland Harbor cleanup project.

The Time Oil site is served by a rail siding from the Union Pacific Railroad mainline of approximately 2,500 feet in length with two road 'at-grade' crossings and on-site railroad access. While the site has rail access, it appears to be of insufficient size to accommodate a loop track, which would

hamper efforts to build an efficient, modern port facility. Access to the specific site would require use of a private or Port-owned right of way, connecting to either Rivergate Blvd. or Burgard St., ultimately connecting to N Lombard St, a district collector and priority truck roadway.

Existing uses

Current industrial uses on the Schnitzer property appear to be temporary in nature. The Bell Oil Terminal is inactive; the Millican parcel is underutilized, and the Dash Multi Corp parcel is an operational tire recycler. There are several existing structures on the Time Oil and Schnitzer site, and evidence of removal of liquid storage tanks. The western half of the site is in a floodplain.

Contamination and remediation

Like most properties in the Portland Harbor, sediment in the adjacent channel and berthing area have known or suspected contamination. The upland properties have known or suspected contamination and are in various regulatory phases of investigation and remediation. The site is included in the area of the Lower Willamette River that was designated a Superfund site in 2000 by the Environmental Protection Agency. Final remediation plans for the Portland Harbor Superfund site have not been determined. The potential liability for remediation of the Superfund adds a high level of risk for all affected properties, making any real estate transactions or development highly unlikely.

Other constraints

To the north of the subject site there are high-tension power lines; a small parcel owned by PGE and a series of parcels owned by the Port of Portland with the presence of wetlands (some of these wetlands have environmental conservation zoning). The site is generally flat with mild slope to the river.

Site assessment

The Time Oil site faces challenges that would need to be overcome to be developed as a productive public marine terminal. While the core of the site (57 acres) has only two different private property owners, the remainder of the site is divided into several different owners. Depending on the desired use and scale of a proposed port terminal, additional property to the east of the site may need to be acquired. The number of private properties and owners makes site assembly a challenge, but not an insurmountable obstacle.

Compared to the Atofina site, the Time Oil site appears to have fewer challenges to redevelopment: it does not require closing a public street, it

appears to have less severe environmental contamination, and the possibility exists to acquire a larger aggregate site. The contamination is mainly along the river, not upland. It may be possible that lower lying contaminated land could be used as fill on other parts of the site and capped under the footprint of a new building.

The site would be a viable candidate for a marine terminal with the appropriate aggregation of key properties. Aggregating 80 to 140 acres would accommodate the transshipment of break bulk and some bulk commodities. Property configuration to make 1,400 feet of pier face accessible is critical to its usability. This site could be explored further for marine terminal use. It will be difficult, however, to negotiate any real estate transactions for this site while the liability for the Lower Willamette River Superfund remediation remains uncertain.

3.2.3 IMPLICATIONS

Public marine terminals have specific land use requirements that are difficult to find. Ideally, sites must be large and flat, inside of an industrial zone, have significant shoreline on a navigable river, be served by both rail and truck, and free of contamination, wetlands, or other environmental constraints. There are no sites in the Portland Harbor that meet these ideal requirements, though there are a few sites that come close. The questions are: how close do they come, and is there a way to cost-effectively develop these sites as productive public marine terminals?

The City of Portland identified the two sites in the Portland Harbor that are most likely to be suitable for development of a new public marine terminal: the Atofina site, and the Time Oil site. Of these two sites, development is technically possible on either, but there are major hurdles that would add significant costs. Both sites have some level of contamination, both sites would require negotiation and property acquisition from numerous property owners, and both sites are smaller than desirable, which precludes the possibility of an onsite rail loop.

Of the two sites, the Time Oil site is most suitable for development, as it does not have certain challenges faced by the Atofina site. The development of the Atofina site is further restricted by NW Front Ave. that bisects the site, and provides primary access to the Siltronic property. With this road in place, the site is limited to just 59 acres. Vacating the road would be costly, and would likely require significant infrastructure investments to be made to provide access to the Siltronic property. Even if the road were vacated, property on the other side of the road is contaminated or in active use. And the nature of the contamination on the Atofina site is considered to be more severe than contamination elsewhere in the Portland Harbor.

Ultimately, issues related to the Superfund cleanup of the Willamette River make all sites in the Portland Harbor unfeasible for development in the near future. Until a final agreement is reached, determining the specific liability for all property owners in the Harbor, there is too much cost uncertainty to negotiate a reasonable price for the land acquisition that would be necessary to assemble a site large enough for a new public marine terminal.

3.3 ROLE OF VANCOUVER IN HARBOR INDUSTRIAL LAND SUPPLY

The third question we were asked by the City is: What role can the Port of Vancouver play in accommodating forecast demand for cargo volumes in the Portland region? To answer this question, we reviewed estimates from recent studies on the current capacity and forecast demand for cargo in the region, and augmented this data-driven analysis through interviews with port officials. A more detailed description of our analysis is found in Appendix C: Analysis of Harbor Land Capacity and Demand, Portland and Vancouver.

3.3.1 EXISTING CAPACITY

The Port of Portland has four marine terminals located along the Willamette and Columbia Rivers. These terminals accommodated 575 ocean-going vessels in 2010, though over the past two decades it was not uncommon for the Port to accommodate 800 to 1,000 ocean-going vessels in a year. Not counting cargos received or shipped via inland barges, the Port of Portland shipped over 13 million short tons of cargo in 2010.

While the Port's existing marine terminals have excess capacity, that capacity is limited. As demand increases over time, the Port will reach a point when existing facilities are unable to accommodate the demand that is forecasted. If the Port is unable to find new ways to improve the efficiency of existing terminals, or find suitable sites to build new terminals, then the Port of Portland may miss potential cargo opportunities. The Port of Vancouver, located across the Columbia River from the Port of Portland, could accommodate some unmet demand.

Exhibit 3-4 summarizes the estimated capacity of public marine terminals in the Port of Portland. Total capacity for all cargo types in the Port of Portland is estimated to be over 21,000,000 metric tons. This capacity is significantly above current cargo volumes for all cargo types, except for grain, which saw a reduction in capacity when the Port closed the terminal

4 grain elevator in recent years, and is unable to accommodate historical levels.

Exhibit 3-4. Estimated capacity of public marine terminals, and recent peak cargo volumes, Port of Portland

Cargo Type	Estimated Capacity	Recent Peak Volume	Peak Year
Automobiles (units)	675,000	460,000	2006
Containers (TEUs)	700,000	330,000	1995
<i>Metric Tons</i>			
Automobiles	889,000	606,000	
Containers	3,999,000	1,885,000	
Breakbulk	2,100,000	1,130,000	2007
Grain	4,100,000	5,400,000	1995
Dry Bulk	10,700,000	5,460,000	2008
Liquid Bulk	-	-	N/A
Total	21,788,000	14,481,000	

Source: Estimates of capacity are from Port of Portland, reported in West Hayden Island Economic Foundation Study (Entrix, 2010), and confirmed through interviews with Port of Portland officials. Reported recent peak cargo volumes are from Port of Portland Marine Terminal Statistics, 1980-2010.

3.3.2 FORECAST OF FUTURE CARGO VOLUMES

Our analysis did not include forecasting future cargo demand for the region. Instead, we were tasked with obtaining and reviewing the most recent forecasts. These forecasts were contained in the *Portland and Vancouver Harbor Forecast Update* (BST Associates, 2012). These forecasts were based on a 2010 study by BST Associates, but were refined to specifically call out cargo demand for the City’s of Portland and Vancouver, and were updated with the most recent economic data.

Exhibit 3-4 shows the *capacity of existing public* marine terminals. Exhibit 3-5 shows the forecast *demand for existing and future public and private* marine terminals (measured as cargo volume) in the City of Portland in 2040. The forecast demand ranges from 28 million to 43 million metric tons. For context, in 2010 (the most recent year for which data is available) the Port of Portland reports it moved 13 million tons of cargo. Even the low scenario forecasts demand to be more than double 2010 levels by the year 2040, with an average annual growth rate of 1.5% per year.

Exhibit 3-5. Forecasted cargo volume, public and private, City of Portland, 2040

Cargo Type	Low	Medium*	High
Automobiles (units)	811,000	912,500	1,014,000
Containers (TEUs)	379,000	452,500	526,000
<i>Metric Tons</i>			
Automobiles	1,076,000	1,206,000	1,336,000
Containers	2,162,000	2,583,500	3,005,000
Breakbulk	1,132,000	1,242,000	1,352,000
Grain	6,686,000	9,078,000	11,470,000
Dry Bulk	10,278,000	14,093,500	17,909,000
Liquid Bulk	6,912,000	7,461,500	8,011,000
Total	28,246,000	35,664,500	43,083,000

Source: Low and High forecasts were made by BST Associates for the *Portland and Vancouver Harbor Forecast Update* (2012).

*Medium scenario is calculated by ECONorthwest as the average of the BST low and high scenarios.

Note that 2040 is an arbitrary date. It is not a key milestone. Demand for cargo does not stop growing for some assumed reason in 2040. It is simply the last date for which there is a forecast for cargo demand. Thus, our advice is not to focus on exact tonnage requirements, or exact acres needed to accommodate demand in 2040. It is more important to focus on the big picture. The City of Portland has a limited supply of land suitable for marine terminal development, and this supply will not increase. Demand for cargo has increased steadily for decades, and is forecast to continue to do so in the future. Over a long-enough period, the City will use its capacity to accommodate future growth. As it does, land prices will increase and redevelopment will become more possible than it appears now.

Nonetheless, the inevitable reduction of vacant land available for water-dependent uses in the Portland Harbor area is the motivation for considering ways to use the land efficiently, and whether neighboring jurisdictions might accommodate some additional amount of the forecasted growth. Looking at the 2040 gives good idea of how close the City (and the region) is to reaching its full capacity for public marine terminals.

3.3.3 CAPACITY SHORTFALL

Comparing the capacity of existing facilities with the forecast demand provides an estimate of the potential capacity shortfall for the Port of Portland in 2040. Two factors complicate this analysis: (1) private marine terminals also handle a portion of the City’s cargo volume, and there are not accurate estimates of the capacity of private terminals in the City; and (2) if the growth in cargo volumes comes from a different mix of clients and commodities than the terminals are currently handling, then the existing facilities may not be able to accommodate the new opportunities, which

means these facilities may not reach 100% of their capacity before new terminals are needed.

Our analysis needed to make assumptions on how to deal with these two issues. Variations in assumptions, combined with the wide range of the BST forecasts for cargo demand in 2040, result in an even wider range of estimates for capacity shortfall. To bookend our analysis, we created assumptions that would give us the lowest and highest possible shortfall, and then selected assumptions for a “most-likely” scenario.

The lowest shortfall scenario assumes the low demand forecast from BST, and assumes that existing facilities would be able to operate at 100% efficiency to accommodate forecast demand, and that private terminals will be able to continue accommodating cargo at their recent peak levels. The highest shortfall scenario uses the high demand forecast from BST, and assumes that existing facilities would continue operating at their historical peak levels, with all additional demand coming from new market opportunities that require new terminals. The most-likely scenario uses assumptions that fall between the range of these two bookends. Key assumptions for the most-likely scenario are existing facilities operate at 90% of capacity (i.e. to accommodate the forecast growth in cargo, we do not assume that existing facilities are able to use 100% of their capacity, since part of the growth in cargo volumes may be due to new users and new commodities that cannot use existing facilities), and we use the medium demand scenario, calculated as the average of the low and high scenario by BST Associates.

The results of these three scenarios are shown below in Exhibit 3-6. Note that the potential capacity shortfall ranges from less than 200,000 metric tons in the low shortfall scenario to more than 17 million metric tons in the high scenario. Ultimately, our most likely scenario shows a potential shortfall of 5,760,000 metric tons, with all of the shortfall occurring in dry bulk, grain, and automobiles.

Exhibit 3-6. Potential capacity shortfall, City of Portland, public and private marine terminals, 2040 (metric tons)

Cargo Type	Low	High	Most Likely
Automobiles (units)	(136,000)	(554,000)	(310,000)
Containers (TEUs)	-	(196,000)	-
<i>Metric Tons</i>			-
Automobiles	(187,000)	(730,000)	(410,000)
Containers	-	(1,120,000)	-
Breakbulk	-	-	-
Grain	-	(4,370,000)	(2,390,000)
Dry Bulk	-	(10,949,000)	(2,960,000)
Liquid Bulk	-	-	-
Total	(187,000)	(17,169,000)	(5,760,000)

Source: Calculated by ECONorthwest, with demand forecasts from BST Associates (2012).

3.3.4 LAND NEED FOR NEW PORT TERMINALS

Translating cargo volumes into acres for port terminals is challenging, and depends on a host of variables for which we have little or no data for this analysis. Will the terminal need rail access, if so will it need a dedicated rail loop, or will it be able to share rail infrastructure with adjacent terminals? Would another rail configuration like a ladder track work?¹¹

The composition of the demand is important as well. For example, if you have demand for 10 million pounds of dry bulk, will that all be the same commodity type? If not, you may not be able to use the same terminal (for example a coal exporter and potash exporter may need to have completely separate terminals even though they are both dry bulk and would have very similar needs. Even the ownership of the cargos makes a difference (e.g., one exporter with a throughput of 10 million tons of potash may require different facilities, than 5 exporters each handling 2 million tons of potash a piece).

Because of the many variables, it is difficult to translate the potential shortfall numbers shown in Exhibit 3-6 into the number of terminals that would be needed to service that demand, and even more difficult to translate the number of terminals into acres. For the purposes of our analysis, we first looked to recent studies to find an industry standard or a rule of thumb for the size of marine terminals for various cargo types. The three sources we looked at were the *West Hayden Island Economic Foundation Study* (Entrix, 2010), the Draft Report on *Operational Efficiencies of Port/Terminal World Wide* (Worley Parsons, 2012), and the Maul Foster and Alongi evaluation criteria included with this report as Attachment B.

Unfortunately, there is little consensus among these sources on the land needed for each terminal. This is because the unique characteristics of each site, the needs of each unique user and commodity, and the market conditions and technologies available at the time existing facilities were built result in a wide-range of variables that are difficult to control for. In short, no conclusive rule of thumb exists, and if it did exist, it would not necessarily be applicable to each of the sites in the Portland and Vancouver harbors. Nonetheless, for the purposes of our analysis, we needed to make some assumptions on the acreage requirements for new terminals for various commodities. We again sought to use different assumptions to present a high and low bound on our analysis, and then to select

¹¹ Representatives of businesses in the Portland Harbor, as well as Port Officials, and other consultants with expertise in marine terminal development and cargo forecasts have stressed that there is no equal substitute for a loop track, and that other rail configuration such as a ladder track will not work, for attracting new port users in a competitive global economy.

assumptions in the middle of the range that we believe resulted in a most-likely scenario.

The details of these scenarios are shown in Appendix C: Analysis of Harbor Land Capacity and Demand, Portland and Vancouver. The most-likely scenario uses our most-likely capacity shortfall estimates, and assumptions on throughput (tons per acre of terminal land) from the *Operational Efficiencies of Port/Terminal World Wide* (Worley Parsons, 2012), based on tons per acre for case study ports in North America and Europe. It is optimistic, however, to think that all new terminals would achieve the level of efficiency identified in the Worley Parsons draft report, so we have shown another column for the “practical” (i.e., more conservative assumption of land need) land need, based on an average value of the assumptions in the various supporting documents used in our analysis. A final column was added to show the land need if a dedicated rail loop is included with the terminals that would require rail access. Exhibit 3-7 shows the results of our most likely scenario, with at least 170 acres of land needed, and up to 470 acres if rail access is included.

Exhibit 3-7. Acres of land needed for new public marine terminals in the City of Portland, 2040

Cargo Type	Capacity Shortfall (Tons)	New Terminal Space Needed	Acres Needed		
			Minimum	Practical	w / rail
Automobiles	(410,000)	Yes	120.0	270.0	270.0
Containers	-	No	-	-	-
Breakbulk	-	No	-	-	-
Grain	(2,390,000)	Yes	30.0	50.0	100.0
Dry Bulk	(2,960,000)	Yes	20.0	70.0	100.0
Liquid Bulk	-	No	-	-	-
Total	(5,760,000)		170	390	470

Source: Calculated by ECONorthwest

Note: This table estimates acreage needed, not the number of terminals needed. Terminal size can range from 150 to 200 acres for automobiles and containers, to as small as 5 acres for liquid bulk. Depending on terminal size assumptions, the acreage need for automobile cargo could be accommodated by anywhere from one to five terminals in the City of Portland.

Comparing the demand for land for public marine terminals in the City of Portland shown in Exhibit 3-7, with the supply of land in the Portland Harbor shown in Exhibit 3-1, shows an insufficient land supply. As described in Sections 3.1 and 3.2, the Portland Harbor has the potential for two (or perhaps three, if the barriers to development at the McCormick and Baxter site can be overcome) sites to accommodate public marine terminals. These sites (Atofina and Time Oil) have serious development constraints, and even if these constraints can be overcome, they would each only be able to accommodate one terminal of practical size.

The Portland Harbor probably has insufficient land to accommodate the forecast growth for public marine terminals in the City of Portland. An optimistic scenario would show the Portland Harbor with capacity to

accommodate perhaps two terminals of relatively small size (and without a modern rail loop to serve these terminals). A more conservative outlook (and a real possibility) is that the two potential sites in the Portland Harbor may be unable to overcome their significant barriers to redevelopment, which would mean the Harbor may not have any capacity to accommodate future development of marine terminals.

Given the expected growth in demand over the next 30 years, there are few easy solutions to accommodate the City of Portland's anticipated shortfall in land for public marine terminals. The City can take action to address the existing constraints to facilitate redevelopment, or look elsewhere for buildable land for public marine terminals. The following section addresses the latter solution: looking outside of the City of Portland for land for new marine terminals.

3.3.5 PORT OF VANCOUVER DEVELOPABLE LAND

This analysis presupposes that from a regional perspective, there is no benefit to having port development occur in Portland vs. Vancouver. Leadership for the ports, and for the cities, counties, and states they are located in, may have different opinions. Indeed many public policies exist that emphasize the importance of retaining and attracting industrial jobs, like those created by marine terminal development. However, the purpose of this analysis was to determine if it was *technically* possible (as opposed to *politically* desirable) to accommodate future marine terminal demand at the Port of Vancouver.

Additionally, our analysis assumed that the type of port users that would be attracted to the Port of Portland if land were available, would find the Port of Vancouver equally as attractive if there were no developable sites in Portland. This assumption may be true for many, but not necessarily all public marine terminal users. Portland and Vancouver are similar in many ways, sharing the same regional infrastructure and labor pool. But differences do exist between the two jurisdictions, and more so for specific sites within each jurisdiction. For the purposes of our analysis, we have assumed land at the Port of Vancouver would be an acceptable substitute for potential marine terminal users unable to find developable land in the Port of Portland.

Ideally, our analysis for the supply and demand for public marine terminals in the Port of Vancouver would have used the same methods as were used for the Port of Portland. Unfortunately, our analysis was constrained by both data limitations, and time/budget. Thus, we were asked to conduct a less rigorous analysis of the Vancouver land supply, making use of the best available data, gathered mostly from conversations and correspondence with officials from the Port of Vancouver.

ECO interviewed officials with the Port of Vancouver to understand their long-term plans for harbor industrial lands, and the challenges and opportunities that would arise from a greater share of regional industrial development locating in Vancouver versus Portland.

The Port of Vancouver is located along the banks of the Columbia River, with access to the same markets and same multi-modal transportation infrastructure as the Port of Portland. The port handles more than 500 ocean-going vessels each year, as well as river barges, with total annual cargo of more than 5 million metric tons.

The Port of Vancouver has room to grow. An analysis of aerial photos of Port land indicate roughly 750 vacant acres. The Port of Vancouver sent a memorandum to the City of Portland that further clarified their intentions for these 750 acres. The land includes approximately 450 acres of undeveloped greenfield land called Columbia Gateway. Approximately 350 acres of this property is planned to be developed as maritime, and the remaining 100 acres planned for heavy industrial. In addition, the port has 110 acres of available undeveloped light industrial land called Centennial Industrial Park. The light industrial properties could be available for development within 12-14 months, while the Columbia Gateway area is not expected to be ready for development for another 8-15 years. The Centennial properties are not waterfront parcels.

Terminal 5, now under development, added 200 acres of heavy industrial and maritime land. All but four acres of this property is river-dependent maritime land. The maritime portion has been, or will be, filled with rail infrastructure, new tenants, and cargos, including wind energy exports and a dry bulk exporter with up to 16 million ton export capacity. The sole industrial tenant is a rail-dependent propane distributor.

The Port of Vancouver is in a period of rapid growth and is currently undertaking a number of public and private development projects, including the West Vancouver Freight Access project. This public rail improvement project will create a unit train facility, more than doubling the miles of track within the port, along with adding a new, grade separate entrance from the BNSF Railway mainline. This project will increase capacity from 45,000 rail cars per year, to more than 160,000 per year, with 40 percent less delay.

Given the Port of Vancouver's holdings of vacant land, the recent dredging of the Columbia River to a depth of 43 feet, and ongoing investment in new rail infrastructure (i.e., the West Vancouver Freight Access project), the Port of Vancouver is well positioned to capture growth in the future. Officials from the Port of Vancouver believe that neither the Port of Portland or the Port of Vancouver have sufficient land and resources to accommodate **all** of the region's future growth on their own.

Instead, ports on both sides of the Columbia River will need to supply land for new public marine terminals.

The Port of Vancouver’s undeveloped, unpermitted maritime and industrial land will accommodate some regional growth – from those businesses selecting the Washington business environment and requirements. Using the BST forecasts of cargo demand for the City of Vancouver, we conducted a similar capacity shortfall analysis for Vancouver as we did for Portland (as was described in sections 3.3.1 to 3.3.4).

Combining these analyses allows us to view the regional demand for and supply of land for public marine terminals. The result of this analysis is shown in Exhibit 3-8. Our most likely scenario shows that regional cargo volumes in 2040 could require between 210 and 570 acres of land for new marine terminals.

Exhibit 3-8. Acres of land needed for new public marine terminals in the Portland Metro Region (including Portland and Vancouver), 2040

Cargo Type	Capacity Shortfall (Tons)	New Terminal Space Needed	Acres Needed		
			Minimum	Practical	w / rail
Automobiles	(570,000)	Yes	160.0	370.0	370.0
Containers	-	No	-	-	-
Breakbulk	(90,000)	No	-	-	-
Grain	(2,390,000)	Yes	30.0	50.0	100.0
Dry Bulk	(2,960,000)	Yes	20.0	70.0	100.0
Liquid Bulk	-	No	-	-	-
Total	(6,010,000)		210	490	570

Source: Calculated by ECONorthwest with demand forecasts from BST Associates, and other assumptions based on conversations with officials from the Port of Portland and Port of Vancouver, as well as supporting documents including: *Operational Efficiencies of Port/Terminal World Wide* (Worley Parsons, 2012) and *West Hayden Island Economic Foundation Study* (Entrix, 2010).

Note: This table estimates acreage needed, not the number of terminals needed. Terminal size can range from 150 to 200 acres for automobiles and containers, to as small as 5 acres for liquid bulk. Depending on terminal size assumptions, the acreage need for automobile cargo could be accommodated by anywhere from one to seven terminals in the Portland Region.

If each new port terminal requires a dedicated rail loop, the total acreage needed to accommodate regional cargo volumes in 2040 exceeds the current supply of 350 acres of vacant developable land at the Port of Vancouver planned for marine terminal development.¹² However, the Port of Vancouver has about 200 acres of vacant developable land that could technically accommodate marine terminal development, but is planned for other industrial uses. But about 100 acres of this amount is part of

¹² It is important to note that these projections are based on our “most-likely” scenario. The range of possible assumptions that could be used in this analysis is significant. When using our most conservative assumptions, our analysis showed a regional land need as low as 70 acres, and our most aggressive assumptions resulted in a land need of over 2,250 acres.

Centennial Industrial Park and are not on the waterfront parcels or linked to waterfront parcels, so 100 acres might be a more appropriate estimate. If these acres were included in the total supply, then the Port of Vancouver comes close to having a supply of land to accommodate regional cargo demand through 2040.

While this scenario is technically possible, it may not be politically feasible or consistent with adopted policies of the affected jurisdictions: Vancouver's land supply could fall short. The high and low demand forecasts differ by + or - 20% from the most-likely forecast, and assumptions about whether a new terminal has rail loop access or not can easily double the need for land. Portland and Vancouver probably have adequate land now to accommodate a low-demand forecast with few new terminals sized for loop trains. But in our simulations, high demand plus loop-train access at all new terminals led to a overall land shortfall of almost 1,500 acres. If only 350 acres at the Port of Vancouver are available for marine terminal development (its current estimated based on policy) then unmet demand for public marine terminals in the region would be around 1,100 acres.¹³

3.3.6 IMPLICATIONS

The most recent forecasts for future cargo demand show the Port of Portland will be unable to accommodate forecast demand by 2040 without adding new capacity. However, the extent of that capacity shortfall depends on the assumptions used. Interviews with officials from the Port of Portland, and the author of the most recent cargo forecasts indicate that although actual tonnage for specific cargo types may differ from the forecasts, long-term trends have shown past forecasts for total cargo volume to be fairly accurate, and the most recent forecasts should be seen as reliable.

Taken at face value, these forecasts suggest that additional port capacity will likely be utilized in the future; however, accurately and reliably forecasting the future is impossible. Although our forecasts (and the BST forecasts which underpin them) include a broad range of assumptions, reflecting the high degree of uncertainty, there is no way to guarantee that the future will fall within our forecast range, let alone our "most-likely" scenario. No one knows exactly how demand for port facilities in the lower

¹³ Although this is the "high-scenario," it is not also "highly unlikely." BST Associates, authors of the cargo forecasts used in this analysis, note that the high-scenario calls for 3.1% growth in cargo volumes per year, which is actually lower than the 4.1% average annual growth experienced on the Columbia River between 1962 and 2011.

Columbia will change in the future. Economist HE Haralambides effectively summarizes the difficulty forecasting port demand, stating:¹⁴

“As a result of intertwined and extended hinterlands; abundant land infrastructure and short-sea feeding networks; continuously evolving liner shipping networks; and the infamous ‘mobility’ of the container, demand is very volatile and unpredictable. Port market shares are unstable; investments in one region or country have an impact on another ... In such a ‘fluid’ environment, how could one forecast port demand with any degree of credibility?”

Competitive and volatile environments do not support reliable forecasting because outcomes depend on many randomly moving variables. Ultimately, whether or not demand for additional port facilities on the lower Columbia materializes will depend on market conditions – demand (what’s produced and consumed in the Portland region), supply (what technologies are used to ship goods, what competing port capacity exists), and price. These factors will inevitably change over the next 30 years in ways that no one can predict, which means any attempt to forecast them should be taken with a grain of salt.

In other words, individual cargo types fluctuate year to year and are difficult to predict with accuracy, but long-term historical trends show that demand for total cargo volumes is less volatile, more predictable, and tends to grow at a pace that is linked to the global economy. While the Port’s four public marine terminals are not operating at 100% of capacity today, it is very likely that they will reach the limits of their capacity in the next several decades, as demand increases. Once these facilities reach capacity, the Port of Portland will need to develop new facilities, or else turn away demand.

The Port of Vancouver shares many of the same attributes that make the Port of Portland an attractive place for marine shipping. Thus the Port of Vancouver is a logical place to site new marine terminals, if sites are unavailable in Portland.

From a regional perspective, it makes no difference whether terminal development occurs in Portland or Vancouver. Both cities function as part of the same regional economy, and share the same infrastructure and labor pool. However, at a local level, if demand for public marine terminals is shifted from Portland to Vancouver, the City of Portland would lose out on high-paying industrial jobs (and some of the residents that fill those jobs), which would have a detrimental effect on the Portland economy, and a

¹⁴ Haralambides, H.E. (2002), Center for Maritime Economics and Logistics, “Competition, Excess Capacity, and the Pricing of Port Infrastructure”.

positive impact on Vancouver's. In other words, some amount of economic activity (measured any number of ways: jobs, wages, output, value added, etc.) would occur in Vancouver, rather than Portland, and Portland would miss out on the resulting direct, indirect, and induced economic benefits.

Given the most recent forecasts of demand, and reasonable assumptions on current capacity and the likely size of new terminals, it would appear that the Port of Vancouver has a surplus of vacant industrial land to accommodate their likely future demand, and should the Port of Portland be unable to accommodate forecast growth, the Port of Vancouver could accommodate some (and perhaps all) of that growth. However, officials from the Port of Vancouver stress that a regional strategy will be necessary to respond to future demand for public marine terminals in the region, and if actual cargo volumes reflect the high-scenario projections from the BST forecasts, then the region is likely to have a significant shortfall of suitable land for new public marine terminals.

3.4 POTENTIAL FOR INCREASED EFFICIENCIES

What is the potential for more efficient use of industrial harbor land? The total amount of land inside the Portland city limits is essentially fixed. Unless submerged land is filled to create new dry land, the only way the City can get more land is to expand its boundaries, which is unlikely to occur due to the constraints of surrounding land. Therefore, the City is interested in using its supply of industrial land as efficiently as possible to accommodate the most economic activity.

3.4.1 RECENT TRENDS IN EFFICIENCY OF PORTLAND HARBOR LANDS

We examined trends in efficiency in the Portland Harbor using several measures. Because of data limitations (see Chapter 2 and Appendix A) we focused our analysis on the period between 2002 and 2008. We calculated the economic activity in the Portland Harbor for these years, measured in terms of employment, real market value, value added, and cargo tonnage. We then divided each of these measures by the number of developed industrial acres in the Portland Harbor for each year to get a measure of land efficiency: i.e., some amount of some measure of economic activity, per acre. We then looked at the change in that measure of efficiency over this period of time.

Recent trends in the Portland Harbor show different results, depending on the measure of efficiency used. These results are summarized in Exhibit 3-9.

**Exhibit 3-9. Measures of economic activity
per acre, Portland Harbor, 2002 and 2008**

	2002	2008	AAGR
Value Added	\$1,147,614	\$1,217,173	1.0%
Real Market Value	\$776,715	\$838,091	1.3%
Employment	6.21	5.75	-1.3%
Cargo Tonnage	3,873	4,928	4.1%

Calculated by ECONorthwest with data from:

Value Added: IMPLAN

Real Market Value: Metro RLIS

Employment: Oregon Employment Department, Quarterly Census of Employment and Wages

Cargo Tonnage: Port of Portland

Acreage: Metro RLIS and Multnomah County Office of Assessment and Taxation

From 2002 to 2008, developed industrial land within the Portland Harbor increased from 2,757 acres to 2,863 acres, an average of 18 acres per year. Value added, real market value, and cargo tonnage all grew at a faster pace than developed industrial acres. By those measures, land was used more efficiently. Employment in the Portland Harbor, however, declined over that period (both in absolute terms, and per acre of developed industrial land). The measure of efficiency that is chosen makes a difference when evaluating trends in land use efficiency.

The next section explains each of these measures in more detail.

Employment

Employment density is a traditional measure of land-use efficiency. In fact, it is typically the basis for forecasting supply of and demand for employment land for all jurisdictions across the State, as they conduct periodic Economic Opportunity Analyses that are required by State law.

For our analysis, we obtained employment data from the Oregon Employment Department for all businesses in the City of Portland for 2002 and 2008. We used GIS software to isolate all employment located within the Portland Harbor for these two years. Total employment in the Portland Harbor declined from 17,134 to 16,466 over this period, a decline of roughly 111 jobs per year (or -0.7% per year).

The Oregon Employment Department QCEW data do have limitations that are worth noting:

- Although the geocoding process OED uses produces accurate results, it is possible that the exact location of some employers could be wrong by one or two hundred feet. This means that some employment in the Portland Harbor may appear outside the harbor boundary when using QCEW data, and conversely, some employment that is actually outside of the Portland Harbor may appear inside the harbor boundary.

- Some firms have multiple locations, but may only report employment at one location (such as at a company headquarters). Depending on how a company reports multi-site employment, all of the company's employment may be incorrectly reported as being inside or outside of the Portland Harbor boundary.
- QCEW data represents the number of *covered workers*. The data excludes members of the armed forces, the self-employed, proprietors, domestic workers, unpaid family workers, and railroad workers covered by the railroad unemployment insurance system. In the case of the Portland Harbor, the most important of these omissions is likely railroad workers. Other studies have shown a significant economic impact from railroad activity in the Portland Harbor, but these workers are excluded from the data.

We do not wish to imply that tracking employment density as a measure of economic activity is wrong or pointless. It is indeed an important measure, and one that the policy-makers, and the general public find useful for understanding the scale of economic activity. Despite the limitations listed above, the QCEW data is widely recognized as one of the most accurate employment data sources updated on an annual basis with site-specific data on all industries. We are just acknowledging that employment isn't the **only** measure of economic activity, and due to its limitations, other alternative measures may prove more useful for evaluating the economic performance of the Portland Harbor.

Real market value

Real market value is another typical measure of land-use efficiency. The relationship is a fundamental principle of urban economics: higher prices reflect the relative scarcity of some type of land or location, and that relative scarcity causes developers to substitute capital for land (i.e., to build more intensively). Higher-value development typically translates into higher assessed values and property taxes, which is seen as a benefit to local governments.

For our analysis, we obtained real market value for all parcels in the Portland region from Metro RLIS data for 2002 and 2008. Using GIS software, we calculated the sum of the real market value of all parcels within the Portland Harbor. The Harbor saw real market values grow from \$2.14 billion in 2006 to \$2.40 billion in 2008, an average annual increase of 1.9%. However, the US Consumer Price Index grew by 3.0% per year over this same time period, indicating that real market value in the Portland Harbor grew at less than the pace of inflation.

Data on real market value for this time period should be treated cautiously. The local and national real estate markets were booming during

this period. Multnomah County real estate values grew at above average rates: more than 8% during this period. The region has now had three consecutive years of declining real market values since 2008; a detailed analysis of property values in the Portland Harbor would probably mirror these broader regional trends. Over a long period (long enough to include the ups and downs of several business cycles – say, 20 years) inflation-adjusted changes in real market value in the Portland Harbor might be a useful indicator of land-use efficiency. For shorter periods, it is not a measure that can be used without interpretation.

Value added

Value added is a measure of economic activity that is not commonly used to measure land use efficiency. Value added, simply defined, is the difference between the sale price and the production cost of a good or service.¹⁵ It is directly comparable to Gross Domestic Product (GDP) at the national level. Value added only considers the final cost of goods and services (the total of four components: wages, business income, other income, and indirect business taxes), and excludes the value of intermediate goods, to avoid double counting.

While value added is a good measure of economic activity at a regional level, the data are not typically collected at smaller geographic levels, and certainly are not available as time-series data at a parcel-specific level. This presents challenges for using value added as a measure of efficiency for the Portland Harbor.

We used the IMPLAN economic modeling software to obtain value added information for the smallest geographic areas possible (zip codes). ECO used the IMPLAN forecast of value added for the four zip codes that overlap the Portland Harbor for 2002 and 2008. Using a geographic boundary that is close to, but not exactly the same as, that of the Portland Harbor means that the measure of value added per gross developed acre should not be viewed as accurate in an absolute sense. But because our geographies and data sources were consistent in both years, the measure is still useful for observing trends over time.

Our analysis showed value added in the zip codes approximating the Portland Harbor increased from \$3.16 billion in 2002 to \$3.48 billion in 2008, an increase of 1.6% per year. However, the US Consumer Price Index grew by 3.0% per year over this same time period, indicating that value added in the Portland Harbor grew at less than the pace of inflation.

¹⁵ More accurately, the production costs are the outside purchases of materials and services, but do not count payments to employees for wages, salaries, and benefits. Thus, a lot of value added is a “return to labor;” it also includes returns to land and capital.

Cargo

The Port of Portland tracks cargo tonnage on a monthly basis and publishes annual data, dating back 30 years. While the data are only available for Port of Portland public marine terminals, and not privately-operated terminals, they are a good proxy for cargo shipped in the Portland Harbor, and the most comprehensive historical data available. The Port data show cargo volumes (measured in short tons¹⁶) increased from 10.7 million in 2002 to 14.1 million in 2008, an increase of 4.8% per year. Over this period, cargo volumes experienced more robust growth than any of the other efficiency measures used in this analysis. In other words, despite a decline in employment, and modest gains in real market value and value added, the Portland Harbor saw strong growth in cargo volumes per developed acre of industrial land.

Note that is not the same as saying that land in the Portland Harbor is what generated or somehow caused that tonnage to go through the Port.

3.4.2 OPPORTUNITIES FOR INCREASED EFFICIENCIES

The available data provide limited answers for understanding the potential for industrial land in the Portland Harbor to be used more efficiently. To supplement them, we interviewed key stakeholders in the Portland Harbor to solicit their input on (1) ways to measure efficiency, (2) challenges to improving efficiency, and (3) strategies to overcome those challenges.

To conduct these interviews as efficiently as possible, ECO staff met with about a dozen members of the Working Waterfront Coalition (WWC), rather than conducting separate interviews with similarly qualified individuals. Established in 2005, the WWC is an organization of businesses concerned about the environmental health and economic vitality of the Portland Harbor. Members of the WWC who were interviewed for this project, included representatives of the following businesses and organizations:

¹⁶ 2,000 pounds per ton, as opposed to metric tons (1,000 kilos, about 2,200 pounds).

- The Greenbrier Companies
- CalPortland
- Northwest Pipe Company
- Schwabe, Williamson & Wyatt
- Kinder Morgan
- Smart Decisions
- Port of Portland
- Perkins Coie
- Schnitzer Steel
- Columbia Pacific Planning
- Evraz Oregon Steel Mills

Group members had different views based on their individual experiences in the Portland Harbor, yet the group as a whole agreed on most key points. Although no votes were taken at the meeting, the following points seemed to achieve consensus:

- **The Portland Harbor has many attributes that provide a competitive advantage for water-dependent industrial activity.** The Harbor benefits from its amazing connectivity: the confluence of two rivers, access to domestic markets via two major rail lines, inland waterways via the Columbia/Snake River system, and I-5 and I-84, and access to global markets via the Pacific Ocean. Having all of this connectivity in the heart of the City of Portland, with strong local policies in place to preserve harbor land for industrial use, creates a special place for water-dependent industrial firms. Members of the WWC recognize the importance of the Portland Harbor, and are committed to maintaining and enhancing its competitive advantages.
- **The constrained land supply is an issue.** Members of the WWC recognize that the industrial harbor land supply in the Portland region is fixed, and vacant developable land is rare and constrained. They believe this limitation is an important issue, and one that will become more important over time.
- **Businesses adjust to these constraints by taking measures that have the effect increasing output on an existing site (i.e., of increasing land efficiency).** Such measures include extra shifts, better machinery, tighter processing procedures, and more.
- **There are bigger public policy issues that are affecting demand for new development in the Portland Harbor.** While members of the WWC were concerned about the constrained land supply, they were more concerned with issues affecting demand: Superfund liability and a burdensome permitting process.
 - **Superfund liability.** The specter of the Superfund is hanging over the heads of all property owners in the Portland Harbor. They know that their liability for the Willamette River cleanup effort will be significant, but they do not know what their individual liability will be, or when a final agreement will be

reached. Members of the WWC expressed concern that it is nearly impossible to sell land in the Portland Harbor for new industrial development until a final agreement has been reached on the Superfund liability.

- **Permitting process.** Members of the group believe the local permitting processes to be time consuming, costly, and uncertain. Such beliefs are typical of most cities. But members of the group who operate facilities across the globe expressed their view that Portland's permitting process is more costly and difficult than most other places they do business. An implication for land efficiency is that permitting, its other intended benefits notwithstanding, makes private sector efforts to improve sites and increase efficiency more difficult. Thus, the City should be sure that the intended benefits are worth the tradeoff, and adjust its permitting process if they do not appear to be.
- **Traditional measures of efficiency do not apply for harbor industrial land, and alternative measures should be used.** Regarding the efficiency of land use, members of the WWC supported the conclusions of this report, that traditional measures (employment, real market value, and FAR) are ill suited for measuring the performance of water-dependent industrial land. The group suggested other measures of economic output, such as value added and cargo tonnage, are more appropriate measures of land-use efficiency in the Portland Harbor.

3.4.3 IMPLICATIONS

In our opinion, the main value of this attempt to measure land-use efficiency was to show what a slippery notion it is, and why simple statements about that efficiency are more likely to derive from opinion and a simple causal model than from an even semi-rigorous empirical analysis. In other words, things are complicated.

For example, many would say that land is being used more efficiently if it accommodates more employees. That kind of definition would be consistent with land-use planning practice and law in Oregon. By that measure, land use efficiency in the Portland Harbor decreased from 2002 to 2008.

But an alternative view – and one more likely to be taken by economists – is that labor (employment) and land are both inputs to a production process. They may be substitutes, or at least there is no necessity that they move together. If a business can use less land and even less labor and still increase its production, it is getting more efficient. If a lot

of businesses in an area are increasing their output on the same land they have always been on, then “land efficiency” can be said to be increasing.

In Portland Harbor the data shows mixed results. Despite declining employment, and growth in real market value and value added that is less than the rate of inflation, the Portland Harbor experienced an increase in efficiency as measured by cargo tonnage. If the City is interested in generating the most economic activity on the fixed supply of harbor industrial land, then value added and cargo tonnage may be more appropriate measures than employment. But these measures are inconclusive on whether the harbor increased in land use efficiency from 2002 to 2008.

That last point leads to a suggestion for policy discussion: instead of talking broadly about “land efficiency,” talk specifically about changes in certain economic output per acre. Accept that there are different measures of output, and track several of them. That is what we did above. Our conclusion is that some measures of economic output have been increasing faster than vacant land is being converted to developed land, and other measures have not. The region should continue to track these measures, and adopt policies with the intention of increasing measures of economic output faster than vacant land is converted to developed land. This seems like a good objective for people with different passions: economic development, environmental amenity, or smart growth.

Finally, our simple analysis does not answer other questions that could be important for policy, such as (1) What is causing the increase or decrease in economic activity? (2) How does that change compare with other areas in the Portland region, or with other port areas in the U.S.? and (3) What policies would allow for even greater growth?

SUMMARY OF FINDINGS

This report focused on issues related to the demand for and supply of land for water-dependent industrial employment in the Portland Harbor (about 4,000 acres of land along the Willamette River, from approximately the I-405 Bridge north of downtown to the confluence of the Willamette and Columbia Rivers). Its main conclusions are:

- The City and its partner agencies have spent years in study and data development for the study area. The City's mapping of vacant parcels is detailed and support its conclusion that outside of land already in Port of Portland Terminals, the best potential sites in the study area of a location and size that a new marine terminal would require are Atofina and Time Oil.
- These two sites meet mandatory criteria for minimum size (more than 50 acres) and location (frontage on the Willamette River) for a new marine terminal. That makes them *possible* sites, but not necessarily *likely* sites. The analysis in this report reconfirms findings of previous studies: small size and a lot of site constraints (especially the need to deal with the legal liabilities of prior soil contamination) make development of these sites for a marine terminal challenging.
- Even using the most detailed and recent data available, it is difficult to predict future land needs for public marine terminals with precision. While the potential land need through 2040 varies greatly depending on key assumptions, the most-likely scenario shows that the Port of Vancouver may, in theory, have enough developable land to accommodate regional growth in cargo volumes through 2040. In practice, however, competing demands for Port of Vancouver lands, competition among and public policies of affected jurisdictions, and the potential for higher growth in cargo volumes all make it possible, if not likely, that the land controlled by the Port of Vancouver would not be able to accommodate all of the regional demand for marine cargo.
- Regarding the efficiency of land use, for the time periods evaluated, we found a decline in employment, modest growth in real market value and value added (though less than the rate of inflation), and stronger growth in cargo volumes per developed acre of industrial land. The mixed results of the various measures of economic activity prevent us from drawing a strong conclusion. The region should continue to track these measures, and adopt policies with the intention of increasing measures of economic output faster than vacant land is converted to developed land. This seems like an objective that could appeal to people with different interests: economic development, environmental amenity, or smart growth.