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SUMMARY REPORT

# MASTER PLAN UPDATE
# PORTLAND INTERNATIONAL AIRPORT

Prepared for
Port of Portland
Portland, Oregon

March 2010

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CONTENTS

**CONTENTS** *(continued)*

**CONTENTS** *(continued)*

**CONTENTS** *(continued)*

**CONTENTS** *(continued)*

# TABLES

# FIGURES

**FIGURES** *(continued)*

# 1. INTRODUCTION

Airport Futures was a collaborative process involving the Port of Portland, the City of Portland, and the Portland-Vancouver metropolitan community. Beginning in fall 2007 and concluding in spring 2010, the Port updated its 2000 master plan for Portland International Airport (referred to herein as PDX or the Airport) and the City developed a land use plan to manage its infrastructure and livability while recognizing the Airport's role in the regional economy. The 3-year Master Plan Update process reinforced Portland's planning legacy and the Airport's reputation as one of the premier airports in the country, and incorporated principles of sustainability and livability.

This *Summary Report* summarizes the Master Plan Update and land use plan completed as part of Airport Futures.

## 1.1 Background

### *1.1.1 Differences between the 2000 Master Plan and the 2010 Master Plan Update*

The 2000 master plan was completed in a time of steady economic growth, with the expectation of continued expansion and the need for major Airport improvements. Thus, a process was designed to maintain the viability of the Airport, preserve capacity, evaluate potential environmental impacts, and involve the public in the planning process. At the conclusion of the 2000 master plan, the expectation was that, during the 2010 Master Plan Update, significant Airport expansion would be considered, including a potential third parallel runway and new passenger terminal.

Numerous events since the 2000 master plan was completed, including the terrorist attacks on the United States on September 11, 2001; the worst economic recession since the great depression of the 1930s; and climate change, have resulted in more modest expectations for the future. The long-range development plan from the 2010 Master Plan Update maintains the viability of the Airport and preserves capacity while providing the flexibility to accommodate the level of activity previously anticipated; however, it also recognizes that a third parallel runway and new terminal are not needed in the foreseeable future.

### *1.1.2 Genesis of Airport Futures*

Before Airport Futures, the Port operated the Airport under a Conditional Use Master Plan approved by the City of Portland. The approval had to be renewed every 8 to 10 years. The current permit expires in 2011. During the approval process, the City would evaluate specific Airport development projects based on criteria in the City's zoning code, with the intent to mitigate the impacts of development. This process is

problematic from the perspectives of the Port, the City, and the community for the following reasons:

- The Port must justify the Airport's existence at its current location and complete a burdensome process even if development proposed in the current Airport master plan is relatively minor.
- The City does not have adequate staff or the expertise to properly examine the complex issues of Airport growth.
- The community is frustrated that the conditional use permitting process provides limited opportunities for public and City involvement in planning Airport development.

In 2001, the Portland City Council and the Port of Portland Commission jointly resolved to replace the Airport's conditional use designation and permitting process with a permanent land use designation to address the complex issues of Airport growth. What followed was a series of intergovernmental agreements (the Agreements) between the City and the Port that defined an integrated planning process, subsequently referred to as Airport Futures, in which the City would complete a legislative land use process at the same time the Port was updating its 2000 Airport master plan.

## 1.2 The Airport Futures Process

The Airport Futures process was developed in accordance with the Agreements and included three elements:

- Participants
- Planning framework and decision-making structure
- Public involvement program

These elements are described in the following subsections.

### *1.2.1 Participants*

Nine participants or entities were involved in Airport Futures:

- **Public**—The public was involved through a comprehensive public involvement program that afforded opportunities for meaningful input throughout Airport Futures.
- **Planning Advisory Group (PAG)**—The PAG was a broad-based 30-member group that served as an advisory body to the City and the Port and helped

guide and inform the Airport Futures process. The chair and vice chair of the PAG were appointed by the Mayors of Portland and Vancouver, respectively, to ensure a balanced and fair process. All other committee members were appointed by the City Planning Director and the Port Aviation Director.

- **Technical Advisory Pool (TAP)**—The TAP consisted of a pool of resource experts provided by organizations and agencies who were available throughout Airport Futures to address specific technical questions posed by the participants.

- **PAG Subcommittees**—Subcommittees helped inform the planning process on specific topics requiring more detailed analysis and discussion. Numerous subcommittees (e.g., Forecast, Land Use/Transportation, Master Plan/ Sustainability, and Public Involvement) were formed and participation was open to PAG members and other interested persons.

- **Port and City staff**—Project staff developed analyses, conclusions, and recommendations related to the 2010 Airport Master Plan Update and the City Land Use Plan based on input from all stakeholders.

- **Portland Planning Commission**—The Planning Commission, a City commission charged with making land use policy recommendations, advised the City Council on the City's Land Use Plan for the Airport.

- **Portland City Council**—The Portland City Council held public hearings, discussed public policy issues, and approved the City's Land Use Plan for the Airport.

- **Port Commission**—The Port Commission, appointed by the Oregon Governor and ratified by the Oregon legislature to oversee the Port, held a public hearing and approved the 2010 Master Plan Update for the Airport.

- **Federal Aviation Administration (FAA)**—The FAA approved the aviation demand forecasts and the Airport Layout Plan (ALP) for the Master Plan Update.

### *1.2.2 Planning Framework and Decision-making Structure*

The framework for Airport Futures planning, as outlined in the Agreements, was the basis for Port and City staff analyses, PAG discussions, and decision making. The key elements of the planning process included:

- Evaluation of two alternative full buildout concepts for PDX as well as a no-build alternative. The two full buildout concepts were selected as the preferred alternatives in the 2000 PDX master plan.

- Continued inclusion of a future third parallel runway, which is included in each of the two alternative full buildout concepts discussed above, as a conceptual element of the long-range plan for developing PDX. Prior to initiating Airport Futures, the Port disclosed that need for the third parallel runway is not anticipated in the next 20-30 years and that the Port would not be requesting Portland City Council approval of the third runway in the City's Land Use Plan. However, as part of the long-range planning for PDX, the location of such a runway if and when it is needed will be considered.

- Reliance on the PDX noise study and cargo feeder recommendations developed in 2006, with the understanding that, if the PAG determined that additional information were needed, the Port would endeavor to provide such information.

The PAG served in an advisory role to the City and Port and helped inform staff recommendations. Final decisions on the Airport Master Plan Update were made by the Port of Portland Commission, with approval of the forecasts and ALP by the FAA. Final decisions on the City's land use plan were made by the Portland City Council based on recommendations from the Portland Planning Commission.

In making recommendations, Port and City staff attempted a fair and balanced presentation of areas of agreement and disagreement with the PAG and other stakeholders. The chair of the PAG represented the PAG at all presentations to City and Port decision-makers.

### *1.2.3 Public Involvement Program*

The goal of the public involvement program for Airport Futures was to provide an open, fair, honest, and transparent program emphasizing early opportunities for the public to provide input to Port and City staff regarding Airport development. The public involvement program included the following principles:

- Clearly define opportunities where the public can provide timely input to Airport Futures so that opportunities exist to affect change.

- Ensure that the process is accessible, inclusive, meaningful, regular, timely, open, fair, and honest.

- Ensure collaboration among the City, Port, and stakeholders and meet the Airport Futures planning schedule.

- Provide citizens with ways to remain informed and involved with Airport Futures.

- Include periodic community-based meetings in Portland-Vancouver where the public will be updated on Airport Futures activities and have the opportunity to inform policy-making.

- Conduct interactive meetings with small group breakouts that distinguish between information and input opportunities.

- Provide an ongoing record of citizen input, questions, and responses and make this information available to the public.

Port and City staff made extensive efforts—very early in Airport Futures—to involve the public. For example, Port and City staff met with the PDX Land Use Advisory Committee and representatives from the Columbia Slough Watershed Council, PDX Citizen Noise Advisory Committee, and Airport Issues Roundtable on November 13, 2006, December 6, 2006, and February 12, 2007, respectively, to solicit input on the public involvement program and work scopes for the aviation consultant, PAG facilitator, and City Land Use Plan. Public meetings were held to gather additional input on these work scopes on February 1 and 6, 2007. In spring and summer 2007, Port and City staff met with over 43 stakeholder groups to discuss refinements to the planning process. Representatives of the public participated in the consultant selection process.

Public involvement was sought to inform decision-making at milestones coinciding with work related to the following elements of Airport Futures:

- Scope of work development and project initiation

- PAG kickoff, issues identification, and goal setting

- Development of aviation demand forecasts

- Development of City land use plan and PDX facility requirements

- Review of PDX follow-on studies

- Analysis of Airport alternatives and the City land use plan

- Adoption of PDX Master Plan Update and City land use plan

To ensure adequate input at these milestones, the City and Port held 25 PAG meetings, 13 public meetings, 6 City Planning Commission meetings, 4 Portland City Council meetings, 5 Vancouver City Council meetings, and 6 briefings of the Port Commission. In addition, regular meetings were held with neighborhood coalitions, key stakeholder groups, and the TAP to provide updates on the planning and afford opportunities to provide input. City and Port staff provided Airport Futures updates in business and community newsletters, met with individuals and other stakeholder groups as

requested, and worked with ethnic, minority, and low income communities to provide information and opportunities for input.

The project website provided opportunities for the public to (a) obtain current project information (e.g., PAG and subcommittee meeting notes and technical project documents), (b) obtain answers to frequently asked questions, and (c) provide input. On the website and at public meetings, stakeholders had the opportunity to request email notification of project meetings, updates, media releases, and newsletters.

The PAG and public involvement processes were reviewed and refined periodically based on the feedback received.

## 1.3 Sustainability

For the purposes of Airport Futures, sustainability was defined to mean meeting the region's air transportation needs without compromising the livability and quality of life for future generations. The Airport Futures process involved exploring requirements, alternatives, and solutions that fairly, realistically, and optimally balance economic, environmental, and social objectives. The desired balance was achieved through the application of sustainability criteria developed by the PAG.

Sustainability was a core consideration in the Master Plan Update and resulted in a significantly better plan, including:

- An inventory emphasizing natural resources located on Airport property
- Probabilistic forecasts of aviation demand, identification of key issues and trends affecting future demand, and a logical structure to incorporate stake-holder input to the forecasts
- Future requirements that were minimized to reflect the anticipated benefits of technology, changing processes, and common-use facilities
- Development alternatives conceived, evaluated, and recommended based on sustainability criteria
- A long-range development plan that will meet the region's aviation needs, is flexible, enhances capacity by increasing operational efficiency, and favors reuse over development
- An implementation strategy that is affordable and based on demand

## 1.4 Results

Portland International Airport is one of the best planned and managed airports in the United States. Development over the past 15 years included numerous projects that have contributed to the Airport's success, including terminal expansions north and south, roadways, the roadway canopy, an aircraft engine runup facility, award winning concessions, and the P2 parking garage.

Continued development at PDX will be required. However, the long-range development plan is modest, largely as a result of the quality of the Airport's existing facilities, the application of sustainability principles, and the notion that future changes will provide opportunities to increase the use of existing facilities and the efficiency of operations.

The subsequent sections of this *Summary Report* summarize the results, conclusions, and recommendations documented in four technical memoranda, a briefing paper, *Sustainability Report,* and the ALP completed in preparing the Master Plan Update for Portland International Airport. The topics of the technical memoranda are as follows:

- *Technical Memorandum No. 1 – Inventory of Existing Conditions*, September 2008
- *Technical Memorandum No. 2 – Aviation Demand Forecasts*, September 2008
- *Technical Memorandum No. 3 – Facility Requirements*, December 2008
- *Technical Memorandum No. 4 – Alternatives*, November 2009

Jacobs Consultancy reviewed the Master Plan Update forecasts in September 2009 and documented its review in *Briefing Paper—Review of Aviation Demand Forecasts*, dated September 22, 2009.

In March 2010, Port staff and Jacobs Consultancy prepared *Sustainability Report* to summarize how sustainability concepts shaped the Airport Futures process and results. This report also reinforces the widely held belief that these concepts make a difference and can bring about positive change.

The ALP, completed by Port of Portland staff with technical assistance from Jacobs Consultancy, consists of a series of drawings prepared in accordance with FAA standards.

# 2. THE AIRPORT AND MASTER PLAN UPDATE STUDY AREA

Portland International Airport is located on the south shore of the Columbia River, 5 miles northeast of downtown Portland and 4 miles southeast of Vancouver, Washington. It provides commercial airline service to northwest Oregon and southwest Washington.

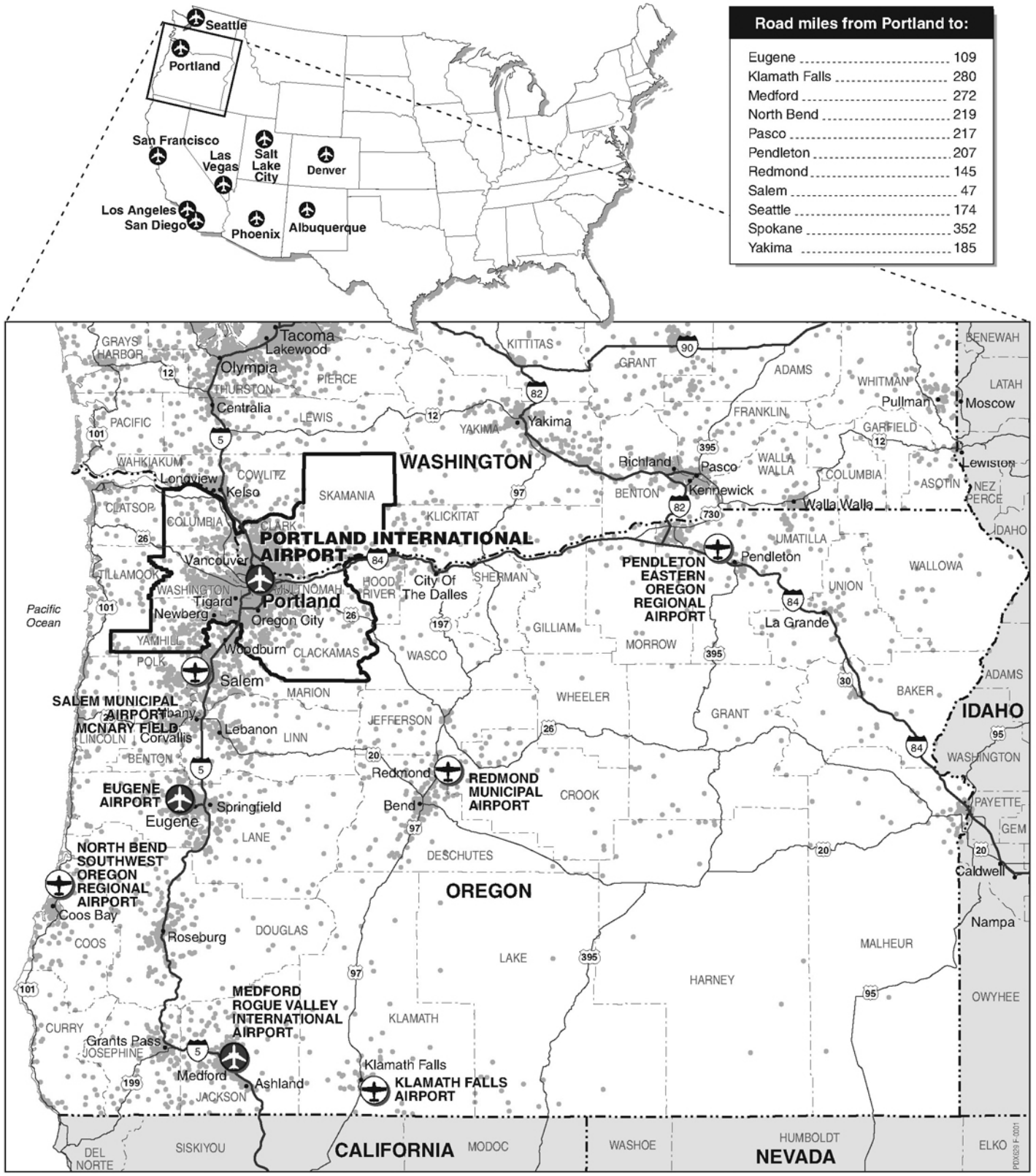
The Airport's primary service region, the Portland-Vancouver region, includes Clackamas, Multnomah, Washington, and Yamhill counties in Oregon and Clark County in Washington. The population densities in the five counties underline the importance of this region, as shown on Figure 2-1. The secondary region served by the Airport, which includes many of the counties surrounding the Portland-Vancouver region, is defined by the location of (and airline service provided at) other commercial service air carrier airports. The nearest such airports are in Seattle (174 miles to the north) and Eugene (109 miles to the south).

Portland International Airport plays an important role in the national, State, and local air transportation systems. The Airport is the primary commercial service airport for the State of Oregon, supports a large origin-destination (O&D) passenger base, and serves as a secondary hub for Alaska Airlines and Horizon Air.

The Airport Master Plan Update study area, shown on Figure 2-2, is defined to include all Port-owned property associated with the Airport and additional property, as follows:

- Areas within a 300-foot buffer from the secured Airport perimeter fence.
- Areas within the runway protection zones (RPZs, which are trapezoidal areas off the ends of the runways). The function of RPZs is to enhance the protection of people and property on the ground.

Consistent with the Master Plan Update focus on land uses, the study area was divided into 11 on-Airport (land within the Airport's property boundary) land use categories, also shown on Figure 2-2. The facilities within each of these land use categories are shown on Figures 2-3 and 2-4.




(a) MSA forecast region does not include Columbia County in Oregon and Skamania County in Washington.

MSA = Metropolitan Statistical Area

AIRPORT FUTURES
CHARTING A COURSE FOR PDX

*Figure 2-1*

## *Airport Service Region*

*Master Plan Update*
*Portland International Airport*

*Source: Jacobs Consultancy, U.S. 2000 Census data.*

*March 2010*

VANCOUVER, WASHINGTON

GOVERNMENT ISLAND

COLUMBIA RIVER

COLUMBIA SLOUGH

NE Marine Dr.
North Perimeter Rd.
RUNWAY 10L-28R
TAXIWAY A
RUNWAY 3-21
RUNWAY 10R-28L
TAXIWAY B
TAXIWAY C
TAXIWAY D
TAXIWAY E
TAXIWAY F
TAXIWAY G
TAXIWAY J
TAXIWAY K
TAXIWAY L
TAXIWAY M
A4E ROD
Air Cargo Rd.
E Perimeter Rd.
NE Alderwood Rd.
NE Cascades Pkwy
NE Airport Way
NE Mt. Hood Ave.
NE 82nd Ave.
NE Holman St.
NE Comfoot Rd.
NE Elrod Rd.
NE Sundial Rd.
NE 33rd Dr.
NE Portland Hwy
NE Columbia Blvd.
NE Cully Blvd.
Sandy Blvd.
I-205

Legend

- Airfield
- Passenger terminal
- Ground transportation / Parking
- Air cargo
- General aviation
- Military
- Airport / Airline support
- Commercial / Industrial
- Strategic reserve
- Mitigation site
- Natural resources
- Building
- Primary study area boundary
- Airport property line
- MAX light rail

AIRPORT FUTURES
CHARTING A COURSE FOR PDX

0' 2,100'
Scale: 1" = 2,100'

*Figure 2-2*

*Study Area and Airport Land Uses*

*Master Plan Update*
*Portland International Airport*

*March 2010*

*Source: Port of Portland Staff, May 2008.*

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FIGNOV Fig 2-2

RUNWAY 10L-28R

RUNWAY 10R-28L

RUNWAY 3-21

TAXIWAY A

TAXIWAY B

TAXIWAY C

TAXIWAY D

TAXIWAY E

TAXIWAY F

TAXIWAY H

TAXIWAY J

TAXIWAY M

TAXIWAY T

TWY G

ARFF ROAD

Perimeter Road

Military Area

NE Cornfoot Rd.

Southwest Ramp

Air Trans Cargo Center

## Building Legend

1 Fuel farm
2 Aircraft rescue and fire fighting
3 U.S. Forest Service facility
4 Vacant
5 BPA hangar
6 Ameriflight facility
7 Aircraft maintenance hangar
8 FedEx
9 AMB south
10 AMB north
11 Aeroterm Air Cargo
12 Aeroterm Air Cargo
13 United Parcel Service offices
14 United Parcel Service facility
15 Horizon Air maintenance
16 Ground runup enclosure
17 Deicing tank
18 Passenger terminal
19 P1 parking garage
20 Fuel and car wash center
21 Parking toll booth
22 Airport traffic control tower
23 Central utility plant
24 Flightcraft-managed hangars
25 Flightcraft general aviation terminal
26 Flightcraft-managed T-hangars
27 U.S. Postal Service (USPS) facility
28 Flightcraft maintenance hangar
29 PacifiCorp hangar
30 Business aviation hangar
31 PDX Cargo Center
32 North cargo center
33 United Airlines maintenance facility

## Legend

- Terminal building
- Building
- Airport property line
- MAX light rail
- Military area

*Note: Building placements shown were current as of May 2008; ground transportation surface lots are not shown.*

AIRPORT FUTURES
CHARTING A COURSE FOR PDX

0' 900'
Scale: 1" = 900'

*Source: Port of Portland Staff, May 2008.*

*Figure 2-3*

*Airport Facilities – West*

*Master Plan Update*
*Portland International Airport*

*March 2010*

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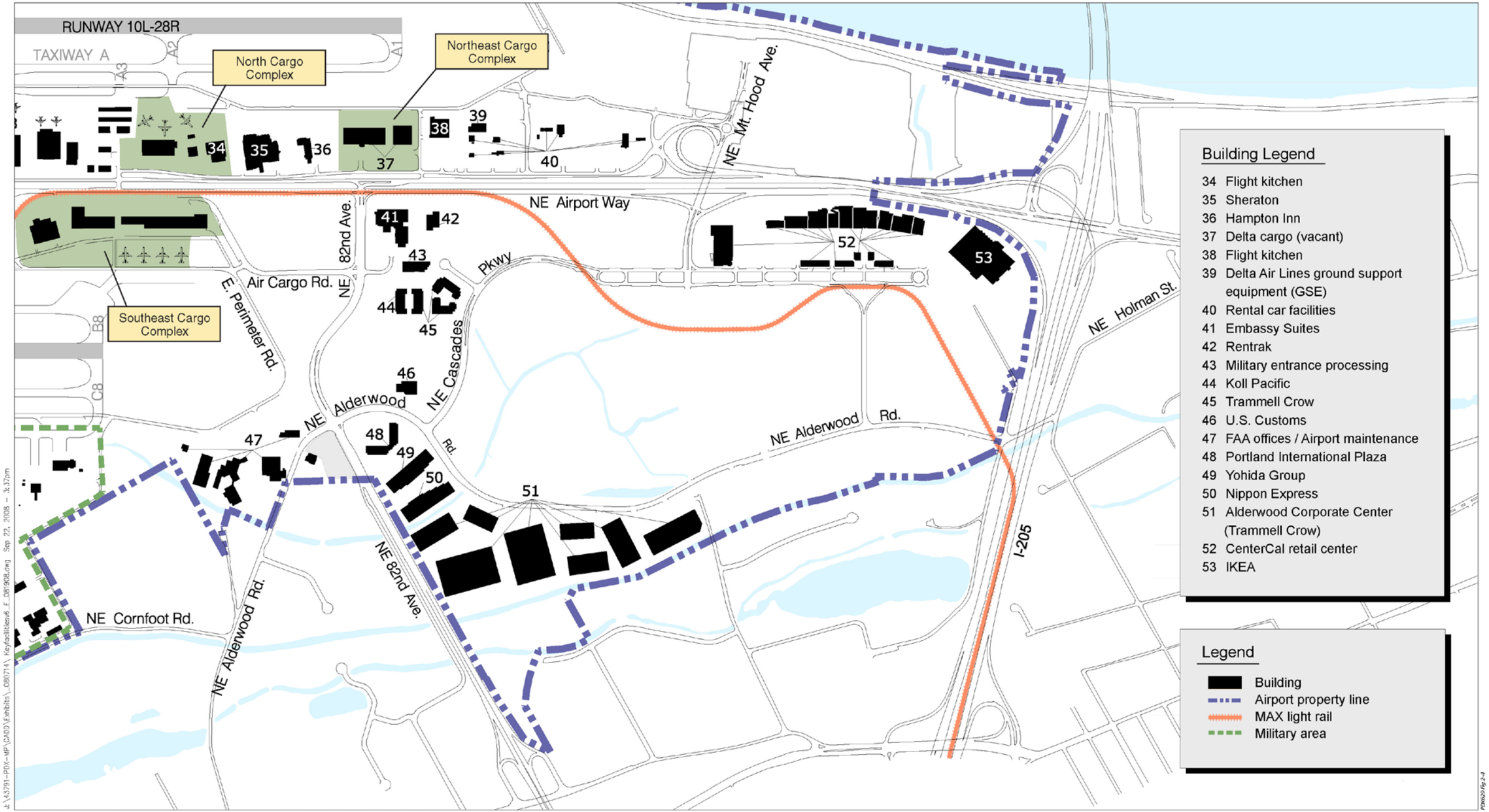



*Note: Building placements shown were current as of May 2008; ground transportation surface lots are not shown.*

AIRPORT FUTURES
CHARTING A COURSE FOR PDX

0' 900'
Scale: 1" = 900'

**Figure 2-4**

*Airport Facilities – East*

*Master Plan Update*
*Portland International Airport*

*Source: Port of Portland Staff.*

*March 2010*

# 3. AVIATION DEMAND FORECASTS

This section presents forecasts of aviation demand in support of the 2010 Airport Master Plan Update. The forecasts are "unconstrained" and, therefore, do not include specific assumptions about the future capacity of the Airport.

## 3.1 Forecast Process

The Master Plan Update forecasts were developed using a collaborative process, which included (a) a review of the 2000 Master Plan and the FAA *Terminal Area Forecast* (TAF), (b) collection and analysis of data related to the key issues and trends affecting future aviation demand at PDX, (c) development of statistical models to define historical causal factors of aviation demand and to provide a logical structure for incorporating input from key stakeholders, (d) supplemental analyses to address technical issues and to reflect stakeholder and peer review input, (e) development of probabilistic forecasts (described later), and (f) coordination with representatives of the Port, the Forecast Subcommittee and the PAG, the FAA, and the public. Figure 3-1 presents a diagram of the forecast process.

### *3.1.1 Forecast Subcommittee*

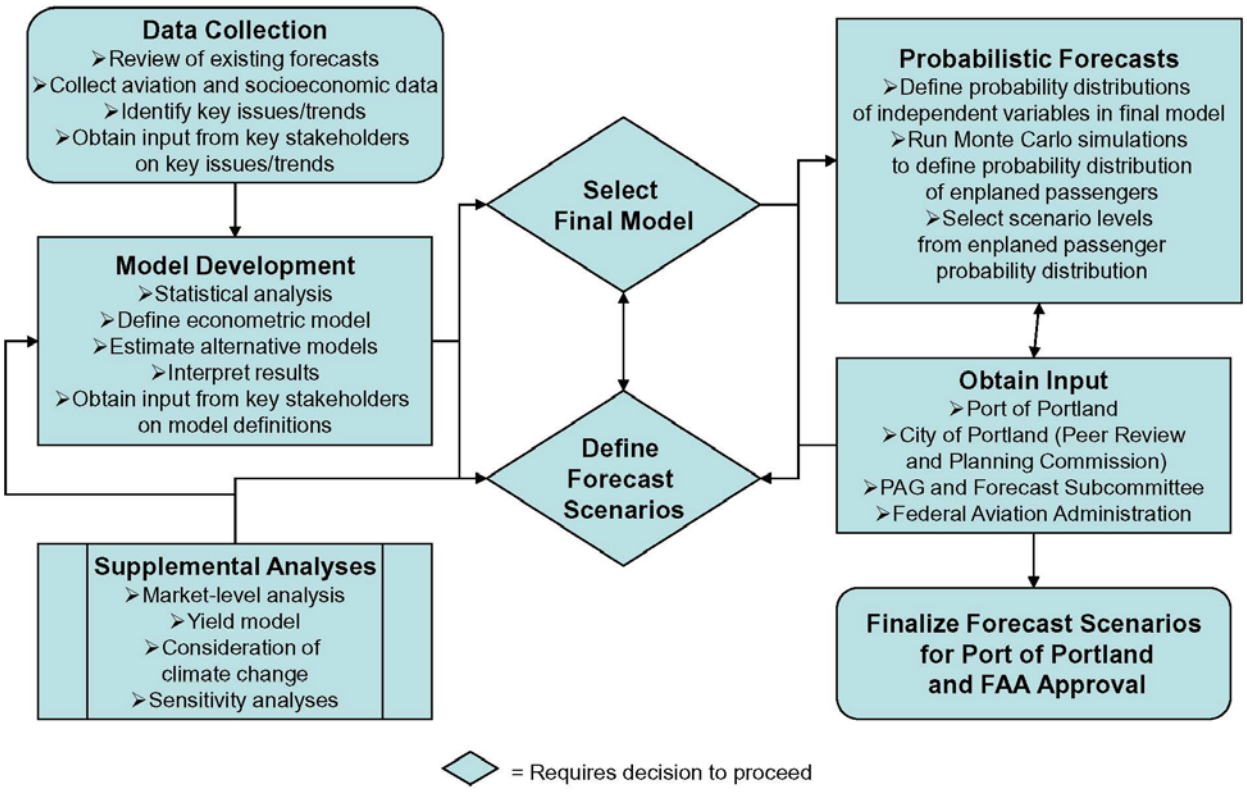
The Forecast Subcommittee was formed to review and comment on the forecast process and included representatives from the PAG, the Port's Aviation Planning Department, the City of Portland, Metro (the Portland-Vancouver region's Metropolitan Planning Organization or MPO), and the public. The Forecast Subcommittee was charged with assisting Jacobs Consultancy and the City's Peer Review Consultant in reviewing the methodology, assumptions, and scenarios that formed the basis of the aviation demand forecasts and assisting in assembling the list of key issues and trends. The Forecast Subcommittee met five times to discuss and review the forecasts and made a final recommendation to the PAG regarding the forecast results.

### *3.1.2 Planning Advisory Group*

Presentations to report on the forecast process and meetings with the Forecast Subcommittee were made to the PAG at five meetings. The PAG reviewed the forecast process, methodology, and forecast results and assisted in refining the forecast assumptions and scenarios. On April 15, 2008, the PAG unanimously recommended that the forecast results be accepted.

Figure 3-1

**FORECAST PROCESS**




### *3.1.3 Peer Review*

An independent peer review of the forecast process and technical results was conducted by Aviation System Consulting, LLC. The peer reviewer was involved throughout the forecast process. The scope of work of the peer reviewer included (a) participation with Port staff, City staff, the PAG, and Jacobs Consultancy staff in the creation, analysis, and adoption of the forecasts, and (b) analysis of each forecast scenario, including the underlying assumptions and methodology.

## 3.2 Forecast Approach

The Master Plan Update forecasts were developed using a variety of analytical tools, including trend analysis, econometric models, and probability (or risk) analysis—an innovative approach to evaluate the likelihood of future aviation demand. The key components of the forecast approach included (a) definition and evaluation of key issues and trends affecting future aviation demand, (b) identification of the sources of

forecast uncertainty,(c) creation of econometric models to provide a logical structure for testing the forecast scenarios and assumptions, (d) preparation of probabilistic forecasts, (e) consideration of oil price forecasts, (f) inclusion of future carbon costs related to the cost of travel, and (g) translation of forecast passenger and cargo demand generated by these analyses into future aircraft operations.

### *3.2.1 Key Issues and Trends*

A list of key issues and trends affecting future aviation demand was created at the beginning of the forecast process and was the product of extensive public involvement, including input obtained from the Forecast Subcommittee, the PAG, the peer reviewer, and the public. The key issues and trends, shown in Table 3-1, consisted of five main categories: (a) aviation industry, (b) regional and economic, (c) technology, (d) global, and (e) external events. The forecast approaches for addressing each of the key issues and trends included (a) incorporation of data for key variables in the econometric models, if available, and (b) sensitivity tests of the forecast results.

### *3.2.2 Sources of Forecast Uncertainty*

At the beginning of the forecast process, it was recognized that many sources of uncertainty exist related to the development of aviation demand forecasts. Uncertainty is evident in the continuous restructuring of the airline industry and the related changes in service, the fluctuations in the price of oil and the resulting effect on airfares, and future policies related to greenhouse gas emissions and the potential effects on the aviation industry. Uncertainty is also related to how historical aviation demand relationships will be carried forward in the future. The question of whether demand remains unchanged over time or is changed by future events for which there no information exists today was considered continuously throughout the forecast process.

### *3.2.3 Econometric Models*

Econometric models of passenger and cargo activity were created using data for 1976 through 2006. The independent variables in the passenger activity model included population, per capita income in 2006 dollars, a dummy variable for the effects of the September 11 terrorist attacks, and Airport airline yield. In addition, a series of equations defining airline yield were created that (a) related Airport airline yield to U.S. domestic yield, (b) included the price of oil and future carbon costs as independent variables, and (c) allowed for the testing of alternative assumptions regarding oil and carbon costs in the forecast scenarios. The cargo model is a logistic model that relates Airport cargo tonnage to total personal income for the Portland-Vancouver region.

Table 3-1

## KEY ISSUES AND TRENDS

| Key issue/trend | Category |
|---|---|
| **INCLUDED IN ECONOMETRIC MODELS OR OTHER ANALYSES** | |
| Price of oil / jet fuel costs | Aviation industry |
| Fuel as a share of airline costs | Aviation industry |
| Enplaned passenger load factors | Aviation industry |
| Aircraft capacity (seats) | Aviation industry |
| Airfares / yield (cost of travel) | Aviation industry |
| Maturity of Airport markets (airline service) | Aviation industry |
| Visitor vs. resident travel to Airport, domestic | Aviation industry |
| Visitor vs. resident travel to Airport, international | Aviation industry |
| Population | Regional / Economic |
| Nonagricultural employment | Regional / Economic |
| Personal income | Regional / Economic |
| Climate change | Global |
| **SENSITIVITY TESTS OF THE ENPLANED PASSENGER FORECASTS** | |
| Security concerns | Aviation industry |
| Leakage to other airports (in Oregon and Washington) | Aviation industry |
| Leakage to other transport modes (high-speed rail and van shuttles) | Aviation industry |
| New market / airline service development by Port | Aviation industry |
| Airport fees | Aviation industry |
| Congestion at other airports | Aviation industry |
| Airline consolidation / merger | Aviation industry |
| Population age distribution | Regional / Economic |
| Propensity to travel by age group | Regional / Economic |
| Population inmigration | Regional / Economic |
| Income distribution | Regional / Economic |
| Wealth (accumulated income) | Regional / Economic |
| Aircraft related | Technology |
| Fuel (biofuels, solar) | Technology |
| Videoconferencing | Technology |
| Other new technologies | Technology |
| Currency exchange rates | Global |
| Foreign-country airline travel patterns | Global |
| Terrorist event | External event |
| Biological event | External event |
| Global economic crisis | External event |
| National economic recession | External event |
| Oil shocks | External event |
| Airline industry labor strikes / shortages | External event |
| War | External event |

Note: The sensitivity of the final passenger forecasts to changes in assumptions about specific key issues and trends was analyzed. For example, assumptions regarding the increased use of videoconferencing were measured in terms of the potential reduction in the passenger forecasts in a given year.

Source: Jacobs Consultancy; Aviation System Consulting, LLC; PAG; and the PAG Forecast Subcommittee; April 2008.

### *3.2.4 Probabilistic Forecasts*

Probabilistic forecasts express the likelihood of realizing a future value in a given year and provide an indication of the uncertainty or risk associated with future values. For example, a probabilistic forecast would indicate that a 90% probability exists that the number of Airport passengers enplaned in 2035 would be equal to or less than 21 million. In contrast, traditional forecasting methods would provide a single value for 2035, but no indication of the likelihood of realizing that level. The probabilistic forecasts of passenger numbers and cargo tonnage at the Airport were developed using (a) the econometric models described in Subsection 3.2.3, (b) probability distributions of the independent variables used in the models, and (c) Monte Carlo simulations used to randomly generate future values of Airport enplaned passenger numbers.

### *3.2.5 Oil Price Forecasts*

From 2002 through 2006, the price per barrel of oil in 2006 dollars increased an average of 22% per year. According to the Air Transport Association of America (ATA), every penny paid for a gallon of jet fuel costs the U.S. passenger and cargo airline industry an additional $195 million annually. Throughout the forecast process, the potential impact of rising oil prices on airline costs and the cost of passenger travel was considered and evaluated as a source of forecast uncertainty. As a result, additional research and analysis was conducted to (a) include the price of oil as an independent variable in the yield equations, (b) examine alternative forecasts of the price of oil, and (c) test the sensitivity of the passenger forecasts to changes in the future price of oil.

### *3.2.6 Carbon Emission Costs*

According to the U.S. Environmental Protection Agency (EPA), the U.S. aviation industry currently accounts for about 3% to 4% of national greenhouse gas emissions. Although a U.S. policy regarding greenhouse gas emissions has not yet been defined, a number of legislative proposals are under consideration and it is expected that a policy will be in place during the forecast period (through 2035). As a result, additional research and analysis were conducted to (a) include future carbon costs as an independent variable in the yield equations and (b) examine available research to define a range of future carbon costs.

### *3.2.7 Aircraft Operations*

The probabilistic forecasts of passenger and cargo activity for the Airport were translated into aircraft operations by (a) disaggregating total demand into its components (i.e., domestic and international, mainline [air carrier] and regional affiliate) and (b) making future assumptions regarding average aircraft size in terms of seats per departure and average enplaned passenger load factors (percentage of seats occupied, on average). In addition, the future aircraft fleet plans of the airlines serving the Airport were also considered based on available information.

## 3.3 Forecast Results

The forecasts were developed for four future demand years: 2012, 2017, 2027, and 2035. The Master Plan Update 50th percentile aviation demand forecasts (median forecasts) are summarized in Table 3-2. In the table, forecast aviation activity is also shown for 2022—values for 2022 were interpolated from the forecasts for 2017 and 2027. The base year for the forecasts was 2006.

Table 3-2

**50th PERCENTILE AVIATION DEMAND FORECASTS**
Portland International Airport

| | Actual | | Forecasts | | | | |
|---|---|---|---|---|---|---|---|
| | 2007 | 2009 | 2012 | 2017 | 2022 | 2027 | 2035 |
| Enplaned passengers (thousands) | 7,332 | 6,472 | 7,489 | 8,992 | 10,312 | 11,825 | 13,393 |
| Total annual passengers (millions) *(a)* | 14.7 | 12.9 | 15.0 | 18.0 | 20.6 | 23.7 | 26.8 |
| Average annual percent change | -- | -- | 0.4% | 3.7% | 2.8% | 2.8% | 1.6% |
| Total air cargo (thousands of short tons) *(b)* | 280 | 190 | 322 | 414 | 496 | 594 | 732 |
| Average annual percent change | -- | -- | 2.8% | 5.2% | 3.7% | 3.7% | 2.6% |
| Aircraft operations | | | | | | | |
| Passenger airlines | 191,554 | 157,694 | 180,400 | 207,000 | 228,000 | 250,600 | 275,000 |
| All-cargo airlines | 33,324 | 27,188 | 37,980 | 41,240 | 44,840 | 48,760 | 52,320 |
| General aviation | 27,623 | 20,814 | 26,100 | 28,200 | 29,500 | 30,900 | 32,500 |
| Military | 3,707 | 4,223 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 |
| Other *(c)* | 8,310 | 16,629 | 8,000 | 9,100 | 10,100 | 11,100 | 12,000 |
| Total aircraft operations | 264,518 | 226,548 | 258,480 | 291,540 | 318,440 | 347,360 | 377,820 |
| Average annual percent change | -- | -- | -0.5% | 2.4% | 1.8% | 1.8% | 1.1% |

*(a)* Total passengers equal enplaned passengers multiplied by two.
*(b)* A short ton equals 2,000 pounds.
*(c)* Includes nonscheduled and empty flights.

Note: At the time the aviation demand forecasts were completed, 2007 was the last full calendar year for which actual data were available. Actual demand from 2009 has been added to this table for convenience.

Sources: Actual 2007 and 2009 demand from Port of Portland records. Forecast demand from Jacobs Consultancy, *Technical Memorandum No. 2 – Aviation Demand Forecasts*, September 2008.

## 3.4 Comparisons with Prior Forecasts

The forecasts from the 2000 Master Plan, the FAA 2007 TAF, and the Master Plan Update were compared to (a) identify differences between actual activity and previous forecasts and understand the reasons for any differences, and (b) identify differences between the Master Plan Update forecasts and the FAA 2007 TAF for the Airport. The forecasts of enplaned passengers, cargo, and aircraft operations were compared. To facilitate the comparison, the forecasts from the 2000 Master Plan, the FAA 2007 TAF,

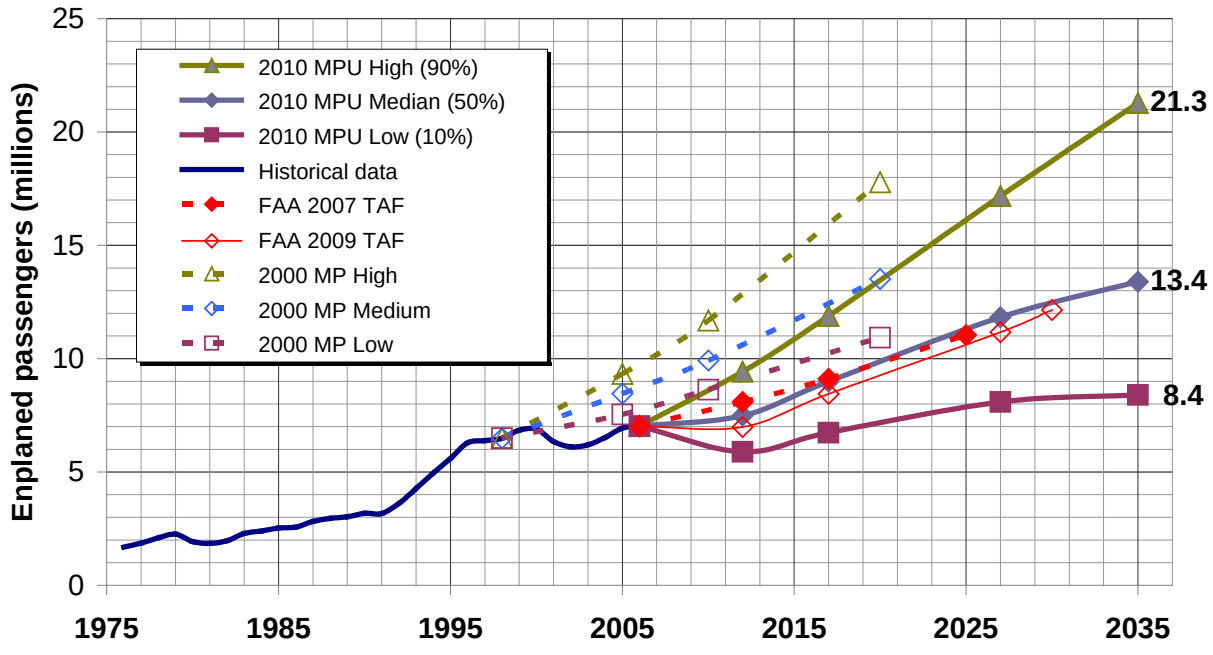
and the Master Plan Update are presented graphically in the following subsections, as appropriate.

### *3.4.1 Enplaned Passengers*

Figure 3-2 presents a graphical comparison of actual enplaned passengers from 1976 through 2006 and enplaned passenger forecasts from the Master Plan Update, the FAA 2007 and 2009 TAF (the 2009 TAF was added, for convenience, at the time this Summary Report was published), and the 2000 Master Plan. The 2000 Master Plan forecasts tracked actual activity in 1999 and 2000, but were 9%, 20%, and 28% higher than actual in 2006 for the low, medium, and high growth scenarios, respectively. The differences between actual and the 2000 Master Plan forecasts are related to the terrorist attacks of September 11, 2001, and the resulting decrease in passenger traffic at the Airport and in the nation as a whole. The Master Plan Update forecasts are based on 2006 data and are within 5.6% of the FAA 2007 TAF for 2011 and 2.6% for 2016. The enplaned passenger growth rate for the median scenario Master Plan Update forecast (an average increase of 2.3% per year from 2006 to 2035) is lower than the annual growth rate forecast by the FAA in its 2007 TAF for the Airport—2.5% from Federal Fiscal Year (FFY) 2006 to FFY 2025.

Figure 3-2

**COMPARISON OF PDX ENPLANED PASSENGER FORECASTS**



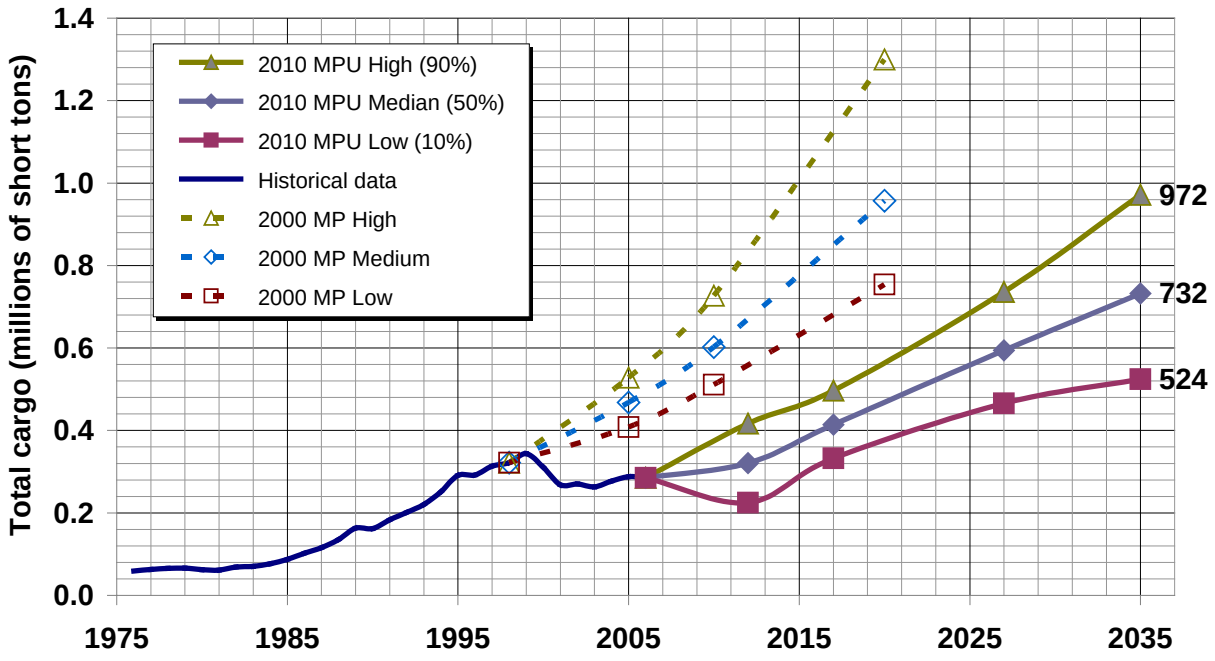

Sources: Historical: Port of Portland records. 2010 Master Plan forecasts (2010 MP): Jacobs Consultancy and NEXTOR, April 2008. FAA 2007 TAF: U.S. Department of Transportation, Federal Aviation Administration, Terminal Area Forecasts, online database, accessed March 2010. 1999 Master Plan forecasts (1999 MP): P&D Aviation, 2000.

### *3.4.2 Cargo*

Figure 3-3 presents a graphical comparison of actual activity from 1976 through 2006 and forecast total air cargo from the Master Plan Update and the 2000 Master Plan. (The FAA does not prepare cargo forecasts for individual airports as part of the TAF.) The 2000 Master Plan forecast tracked actual activity in 1999, but was 33%, 42%, and 49% higher than actual in 2006 for the low, medium, and high growth scenarios, respectively. The differences between actual and the 2000 Master Plan forecasts were related to the events of September 11, consolidation in the air cargo industry, and an increasing trend in the volume of cargo transported by truck. In the median scenario Master Plan Update forecast, the all-cargo airlines are forecast to account for an increasing share of total air cargo, from 85% in 2006 to 92% in 2035. The cargo transported on all-cargo airlines is forecast to increase an average of 3.8% per year from 2006 through 2035, compared with a forecast growth rate of 1.6% per year for the passenger airlines during the same period.

Figure 3-3

**COMPARISON OF PDX TOTAL AIR CARGO FORECASTS**



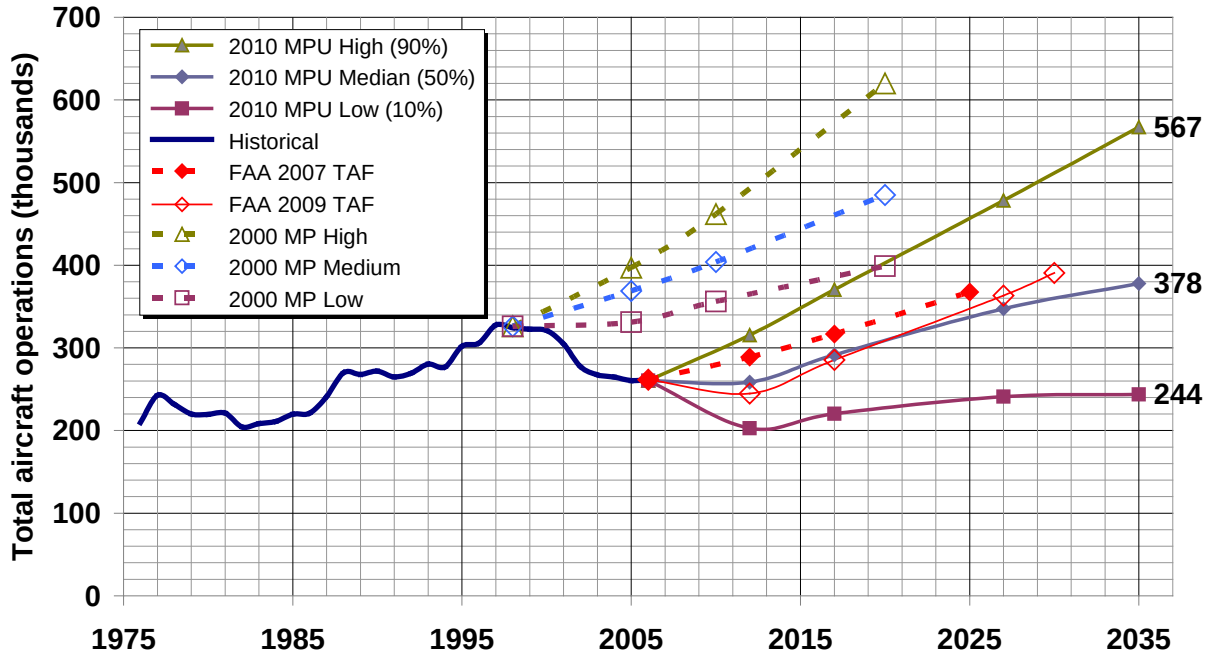

Sources: Historical: Port of Portland records. 2010 Master Plan Update forecasts (2010 MPU): Jacobs Consultancy and NEXTOR, April 2008. 2000 Master Plan forecasts (2000 MP): P&D Aviation, 2000.

### *3.4.3 Aircraft Operations*

Figure 3-4 presents a graphical comparison of actual aircraft operations from 1976 through 2006 and forecast total Airport aircraft operations from the Master Plan Update, the FAA 2007 and 2009 TAF (the 2009 TAF was added, for convenience, at the time this Summary Report was published), and the 2000 Master Plan. The 2000 Master Plan forecasts tracked actual activity in 1999, but were 22%, 31%, and 36% higher than actual in 2006 for the low, medium, and high growth scenarios, respectively. The differences between actual and the 2000 Master Plan forecasts were related to the events of September 11; considerable increases in enplaned passenger load factors, which contributed to slower growth in passenger airline aircraft operations; slower growth than forecast in the average aircraft size; slower growth than forecast in air cargo aircraft operations; and declines in general aviation and military activity. The Master Plan Update forecasts are based on 2006 data and are within 8.5% of the FAA 2007 TAF in 2011 and 2016. In the median scenario Master Plan Update forecast, total aircraft operations at the Airport are forecast to increase from 260,386 in 2006 to 377,820 in 2035, an average increase of 1.3% per year. The total aircraft operations forecast growth rate for the median forecast scenario is lower than the annual growth rate forecast in the FAA 2007 TAF for the Airport—1.8% per year from 2006 to 2025.

Figure 3-4

**COMPARISON OF PDX TOTAL AIRCRAFT OPERATIONS FORECASTS**




Sources: Historical: Port of Portland records. 2010 Master Plan Update forecasts (2010 MPU): Jacobs Consultancy and NEXTOR, April 2008. FAA 2007 and 2009 TAF: U.S. Department of Transportation, Federal Aviation Administration, Terminal Area Forecast, online database. 2000 Master Plan forecasts (2000 MP): P&D Aviation, 2000.

## 3.5 Review of Aviation Demand Forecasts

Aviation demand forecasts for the Master Plan Update were completed in April 2008 and presented to the Port Commission on May 14, 2008, and to the Portland City Council on June 25, 2008. Since the forecasts were completed, a number of changes have occurred that affected passenger demand at PDX and in the nation. These changes included the national and global economic recession, a credit crisis in October 2008, airline industry seating capacity reductions, and continued volatility in the price of oil. Although these and other factors were considered in developing the forecasts, it was the intention of the Planning Advisory Group to revisit the forecasts and, in particular, to review the key industry issues and trends that drive aviation demand before completion of the Master Plan Update.

Jacobs Consultancy reviewed the Master Plan Update forecasts in September 2009 and documented its findings in *Briefing Paper—Review of Aviation Demand Forecasts*, dated September 22, 2009. The key findings of the review were as follows:

- The forecasts are still appropriate planning inputs for the Master Plan Update.
- Although the events of the past 2 years have resulted in lower enplaned passenger numbers at PDX than the 50th percentile forecast, the forecast range continues to reflect likely future levels of passenger demand. The numbers of PDX enplaned passengers in 2009 were within the forecast range, with an estimate of 2009 activity tracking the low (10%) forecast scenario.
- Air cargo at the Airport decreased significantly in response to the national economic recession, with actual air cargo tonnage decreasing in 2008 and 2009 to levels lower than the low (10%) forecast.

The trend in passenger and all-cargo airline aircraft operations at the Airport followed the trend in enplaned passengers and air cargo. The number of PDX total aircraft operations was within the forecast range in 2008, but below the low (10%) forecast in 2009 (estimated).

The decreases in passenger traffic at the Airport in 2008 (2.5%) and 2009 (9.6%) were smaller than:

- The decreases in Airport passenger traffic during the 1980-1981 recession (decreases of 14.3% in 1980 and 4.1% in 1981)
- The decreases in passenger traffic at certain other West Coast airports during the current economic recession

Although considerable near-term uncertainty regarding an economic recovery remains, the timing of Airport facilities development will be based on activity levels rather than specific years. Continued efforts to monitor passenger and cargo activity and adjust expectations will be necessary.

# 4. FACILITY REQUIREMENTS

This section summarizes the facilities and associated land areas required to accommodate the forecast aviation demand presented in *Technical Memorandum No. 2 – Aviation Demand Forecasts,* September 2008, and summarized in Section 3. Facility requirements were developed for the airfield (runways, taxiways, and navigational aids), passenger terminal complex, ground transportation and parking, air cargo, general aviation, military, and support facilities.

## 4.1 Introduction

### *4.1.1 Summary of Requirements*

The most significant findings of the analyses to determine facilities requirements were that (a) a third parallel runway will not be required during the planning period, and (b) passenger terminal complex and ground transportation and parking requirements can continue to be satisfied within the existing terminal envelope through the planning period (2035).

### *4.1.2 Planning Activity Levels*

Recognizing the uncertainties associated with long-range aviation demand forecasting, five planning activity levels (PALs) were identified to represent future levels of activity at which key Airport improvements will be necessary. Activity levels could be achieved at different periods from those anticipated when the forecasts were developed for any number of reasons; therefore, the use of PALs allows for facilities planning that is realistically tied to milestone activity levels as they occur, rather than arbitrary years. PALs 1, 2, 3, 4, and 5 correspond to the 50th percentile aviation demand forecasts for 2012, 2017, 2022, 2027, and 2035, respectively. The aviation demand associated with each PAL is shown in Table 4-1. For convenience, subsequent references to PALs in this *Summary Report* are followed by a year in parentheses—the year indicates when the referenced PAL would occur if activity grows according to the 50th percentile forecasts.

### *4.1.3 Process*

The process of developing facility requirements involved not only the consultant team, but also Port staff, City staff, the airlines, the PAG, and the Master Plan/Sustainability Subcommittee.

- Focus groups, consisting of Port and City staff, were formed for every functional element of the Airport. The consultant team met with each focus group to discuss the scope and proposed approach for the analyses and to learn about particular issues. These meetings occurred during the week of June 9, 2008.

Table 4-1

**RELATIONSHIPS AMONG PLANNING ACTIVITY LEVELS, YEARS, AND ACTIVITY BASED ON 50TH PERCENTILE FORECASTS**

| | | Actual and forecast activity | | |
|---|---|---|---|---|
| PAL | Year | Total passengers (millions) | Cargo (short tons, thousands) | Aircraft operations |
| Actual | 2009 | 12.9 | 190 | 227,000 |
| 1 | 2012 | 15.0 | 322 | 258,000 |
| 2 | 2017 | 18.0 | 414 | 292,000 |
| 3 | 2022 | 20.6 | 496 | 318,000 |
| 4 | 2027 | 23.7 | 594 | 347,000 |
| 5 | 2035 | 26.8 | 732 | 378,000 |

PAL = Planning activity level.

Note: Projects will be implemented as needed based on demand; the years shown indicate when demand corresponding to various PALs would occur if activity grows according to the 50th percentile forecast growth rates.

Sources: Actual 2009 activity from Port of Portland Records. Forecast activity from Jacobs Consultancy, Technical Memorandum No. 2 – *Aviation Demand Forecasts*, September 2008.

- The focus groups, City staff, the airlines, and the Master Plan/Sustainability Subcommittee were briefed on the preliminary results of the requirements analyses and provided comments to the consultant team during the week of September 8, 2008. The PAG was briefed and provided comments to the consultant team during the week of September 15, 2008.

- Written descriptions of the analyses, results, and conclusions related to requirements for each functional area of the Airport were distributed to the focus groups in September and October 2008. Followup meetings and telephone conferences were held with the focus groups to receive verbal comments on the written descriptions; Port planning staff provided written comments.

- The Master Plan/Sustainability Subcommittee was briefed on the final results of the requirements analyses and provided comments to the consultant team during the week of October 6, 2008. The PAG was briefed on the final results and provided comments to the consultant team during the week of October 20, 2008.

Many valuable comments were received from the focus groups and, to the extent possible, those comments are reflected in the analyses and results. To the extent that some issues raised are outside the scope of the Master Plan Update, every attempt was made to record the issues so that they may be addressed in future studies as appropriate (please refer to Section 9 for a discussion of the recommended future studies).

## 4.2 Airfield

### *4.2.1 Airplane Design Group*

For the purposes of airport planning and design, aircraft are grouped according to wingspans. In preparing the Master Plan Update, it was assumed that aircraft belonging to Airplane Design Group (ADG) V, such as the B-747-400, would continue to be the most demanding aircraft operating at the Airport in terms of facilities and clearances required. ADG V includes aircraft with wingspans of 171 feet up to but not including 214 feet.

### *4.2.2 Airfield Capacity*

Estimated and actual aircraft delays indicate that delay levels at the Airport will remain low, even at the PAL 5 (2035) activity of 377,820 annual aircraft operations, at which level the average annual aircraft delay is estimated at about 2.1 minutes per aircraft operation. Therefore, the Airport's existing airfield has adequate capacity to accommodate demand forecast through PAL 5 (2035) with low aircraft delays. The FAA previously estimated an upper limit (i.e., capacity) of about 500,000 annual aircraft operations for the Airport. This estimate remains reasonable.

Key conclusions regarding the airfield from the 2000 master plan were that a third parallel runway (a) would be needed in the planning period considered during this Master Plan Update, (b) should be shown on the ALP because it affects the location of other facilities, and (c) should be planned to the standards then in effect for new large aircraft. The key conclusions regarding the airfield from this Master Plan Update related to the third parallel runway are that (a) it is not needed during the planning period considered herein (i.e., through PAL 5, 2035), (b) it should remain on the ALP because it may eventually be needed and it would affect the location of other facilities, and (c) it does not need to be planned to the standards for new large aircraft.

### *4.2.3 Runway Length*

As part of the recent Runway 10L-28R Extension Feasibility Study, the Port completed comprehensive analyses to determine the appropriate lengths for the Airport's existing runways: Runway 10L-28R, Runway 10R-28L, and Runway 3-21. The following were concluded:

- The existing 11,000-foot length of Runway 10R-28L is adequate.

- Extending Runway 10L-28R to a length of 9,825 feet is adequate (this extension is now under construction).

- Shortening Runway 3-21 to a length of 6,000 feet to eliminate an intersection with Runway 10L-28R and facilitate operational efficiency is appropriate.

From analyses completed during the Master Plan Update, it was concluded that the third parallel runway to be shown on the ALP should be 150 feet wide and 8,500 feet long.

## 4.3 Passenger Terminal Complex

The requirements of the key functional elements of the passenger terminal complex were assessed using design-day flight schedules and a range of modeling and analysis tools, which included an aircraft gate model and a high-performance fast-time simulation.

### *4.3.1 Aircraft Gates and Remain Overnight Parking*

The existing terminal gates have sufficient capacity to accommodate much of the increased demand associated with the future planning schedules. Increased demand can also be accommodated by increasing gate use, i.e., the number of daily turns per gate. The requirements analysis indicated that, by increasing gate use from the current 4.3 daily turns per gate to 6.0 turns per gate by PAL 5 (2035), no additional gates would be required.

To achieve higher gate use, additional aircraft remain overnight (RON) parking positions will be required. Additional RON parking would allow individual gates to accommodate multiple originating aircraft (i.e., aircraft that depart in the morning after remaining overnight at the Airport). As many as 31 remote aircraft parking positions will be needed by PAL 5 (2035).

### *4.3.2 Main Terminal and Concourses*

With upgrades and modifications that should reasonably be anticipated through PAL 5 (2035), the existing passenger terminal complex is capable of accommodating the demand associated with the 50th percentile forecasts for PAL 5.

Multiple facilities within the passenger terminal concourses may need to be modified in the future, including the holdrooms on Concourse A, the regional airline holdroom on Concourse E, and the Federal Inspection Services (FIS) facilities on the lower level of Concourse D. However, these potential modifications are either deferrable given the current economy or, in the case of the FIS facilities, market-driven. Moreover, modifications within the concourses are being deferred and their potential future need will be reconsidered when appropriate.

### *4.3.3 Passenger Security Screening*

The results of the requirements analysis indicated that an additional checkpoint lane will be needed by 2017, and that as many as five additional checkpoint lanes may be needed by 2035. The additional processing capacity will be required at the south checkpoint, which accommodates a greater passenger volume than the north checkpoint.

Additional queuing space will be required at both the north and south checkpoints. This requirement was determined assuming that future screening will continue to be performed at separate north and south checkpoints and that the current airline concourse allocations will be similar to today's allocations.

It is recommended that the Port examine checkpoint options that incorporate new Transportation Security Administration (TSA) technologies and processes that are expected to be adopted in the near future, once the specific details of the new technologies are available.

### *4.3.4 Holdrooms*

Holdroom space on Concourse A is currently deficient and will become more deficient in the future as larger capacity aircraft anticipated in the planning schedules come into service. However, this deficiency is somewhat mitigated by adjacent concession spaces that provide passengers with alternative seating areas.

Overall holdroom space on Concourses B, C, and E are expected to be sufficient throughout the planning period, except for the commuter holdroom serving Gates E6 through E13. A shift to smaller aircraft in the future planning schedules for the airlines using the jet gates on Concourses B and E will result in an increasing surplus of holdroom space on these concourses. The existing surplus on Concourse C will diminish as the gates are more efficiently used, but the aircraft types anticipated to use these gates will generally have smaller capacities than the existing holdrooms were designed to accommodate, resulting in a continuing overall space surplus. The lower level holdroom on Concourse E that serves commuter aircraft at Gates E6 through E13 is currently deficient and will remain so in the future. To the extent that the number of commuter aircraft served from this holdroom increases, or the size of the aircraft served from this holdroom increases, the level of service will deteriorate.

Holdroom space on Concourse D is currently somewhat deficient and could become more deficient in the future. The current deficiency is caused by the larger capacity aircraft that typically use Concourse D gates. An increasing deficiency in the outer planning years could occur if international operations increase.

### *4.3.5 Checked Baggage Security Screening*

The Port is currently implementing major improvements to provide an in-line baggage screening system on the terminal's lower level. The requirements analysis indicated that the new in-line baggage screening system design will provide sufficient capacity through the planning period (2035).

### *4.3.6 Outbound Baggage Makeup*

Cart staging capacity in the outbound baggage makeup room will be deficient at PAL 4 (2027) and PAL 5 (2035) by 12 positions and 22 positions, respectively. It was assumed that such deficiencies will be addressed by operational measures, such as limiting the number of carts per flight that are staged simultaneously.

### *4.3.7 Baggage Claim*

Although existing domestic baggage claim facilities will provide sufficient capacity throughout the planning period (2035), multiple issues should be addressed in future studies. These issues include managing meeters and greeters awaiting the arrival of international passengers, managing the needs (e.g., temporary check-in desks) of tour groups, the potential need for additional or expanded baggage storage areas or baggage offices, and the effect on circulation of the flight information display screens located at the bottom of the escalators.

### *4.3.8 Federal Inspection Services Facilities*

The FIS facilities, located at the end of Concourse D on the lower level, accommodate passenger and baggage processing functions for arriving international flights.

The existing baggage claim devices in the FIS facilities are undersized. The largest aircraft served by the devices today is the A340-300 with 247 seats. The existing devices provide 145 linear feet of presentation frontage. The estimated frontage per device that would provide an acceptable level of service for this size aircraft is 210 linear feet. Similarly, 2,970 square feet should be provided for the retrieval and peripheral area for each device versus the existing 2,520 square feet.

The potential exists for the future international arrivals peak-hour to include arrivals by three widebody aircraft, which is one more than is accommodated during the current peak. Should that demand materialize, the number of peak-hour passengers would increase by approximately 50% and one additional primary processing module, additional primary queuing space, and a third baggage claim device would be required.

The amount of secondary queuing space is currently deficient, and the deficiency would increase with the addition of a third widebody aircraft arrival in the peak hour.

## 4.4 Ground Transportation and Parking

Ground transportation and parking requirements at Portland International Airport are primarily based on (a) the assessment of 2008 peak-period activity, as described in Section 5.3 of *Technical Memorandum No. 1 – Inventory of Existing Conditions*, (b) the projected need for each type of ground transportation facility to accommodate forecast peak period activity, as presented in *Technical Memorandum No. 2 – Aviation Demand Forecasts*, at an acceptable level of service, and (c) key assumptions, as described in Section 4.1 of *Technical Memorandum No. 3 – Facility Requirements.*

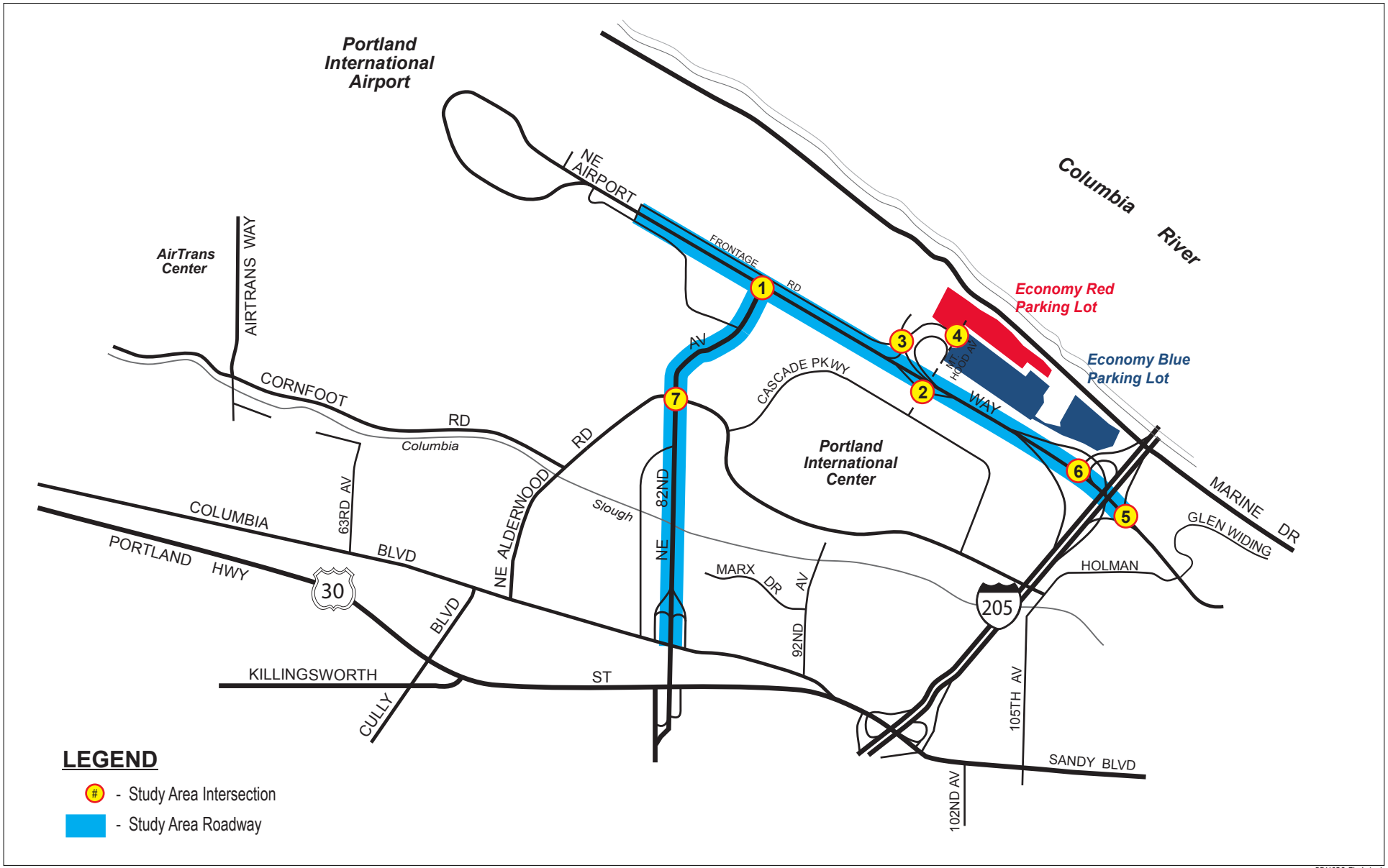
The results and conclusions summarized in this section are related to on-Airport transportation requirements related to key intersections, key terminal area roadways, curbside roadways, commercial vehicle facilities, public transit, public parking, employee parking, and rental car facilities. Off-Airport ground transportation requirements are reported by DKS Associates in *Airport Futures Transportation Impact Analysis*, March 2010, and summarized in Section 8.7 of this report.

### *4.4.1 Key Intersections*

**NE 82nd Avenue/NE Airport Way (Figure 4-1, Intersection 1).** This signalized intersection is the point at which motor vehicles enter or exit the terminal area roadway system.

When severe congestion occurs, vehicle access to and from the terminal can be significantly delayed. Currently, NE Airport Way has three eastbound and three westbound travel lanes that traverse through the signal at this intersection. In addition, the TriMet MAX light rail system operates on the south side of this intersection at 15-minute headways, which affect the westbound left turn, the northbound approach, and the eastbound right turn. The limiting factor at this intersection is eastbound through traffic because it must stop more frequently than westbound traffic. Eastbound traffic stops for westbound traffic turning left, as well as for northbound traffic, while westbound traffic only stops for the northbound left turning movement. Based on the requirements analysis, the intersection of NE 82nd Avenue/NE Airport Way becomes capacity-constrained during the midday peak hour before the afternoon peak hour, and additional capacity is forecast to be required at PAL 2 (2017). One potential improvement included in the Regional Transportation Plan is a grade-separated interchange at this location.

**Mt. Hood Interchange Area (Figure 4-1, Intersections 2, 3, and 4)**. This area consists of three intersections (one signal controlled, one unsignalized, and one roundabout). The interchange is the primary access point for both the Portland International Center and the economy parking lots (Blue and Red). These intersections have available capacity to accommodate future traffic demand.




PDX629 Fig4-1.ai

AIRPORT FUTURES
CHARTING A COURSE FOR PDX

MAP NOT TO SCALE

*Figure 4-1*

## *Terminal Access Intersections and Roadways*

*Master Plan Update*
*Portland International Airport*

*Source: Port of Portland staff.*

*March 2010*

**NE Airport Way/I-205 Interchange Area (Figure 4-1, Intersections 5 and 6)**. This area consists of two signalized intersections and provides access to and from NE Airport Way and Interstate 205 (I-205). Capacity constraints occur at times with the eastbound left turn and the westbound right turn to access I-205 northbound.

Only the northbound intersection would be expected to have a capacity constraint in the future. The northbound access would be constrained by the combined eastbound left turns and westbound right turns from NE Airport Way by 2012.

Studies completed in 2008 indicated two additional requirements at this interchange. The first was the need for an additional southbound right turn from the I-205 offramp to westbound NE Airport Way. This additional lane has been constructed and is in operation.

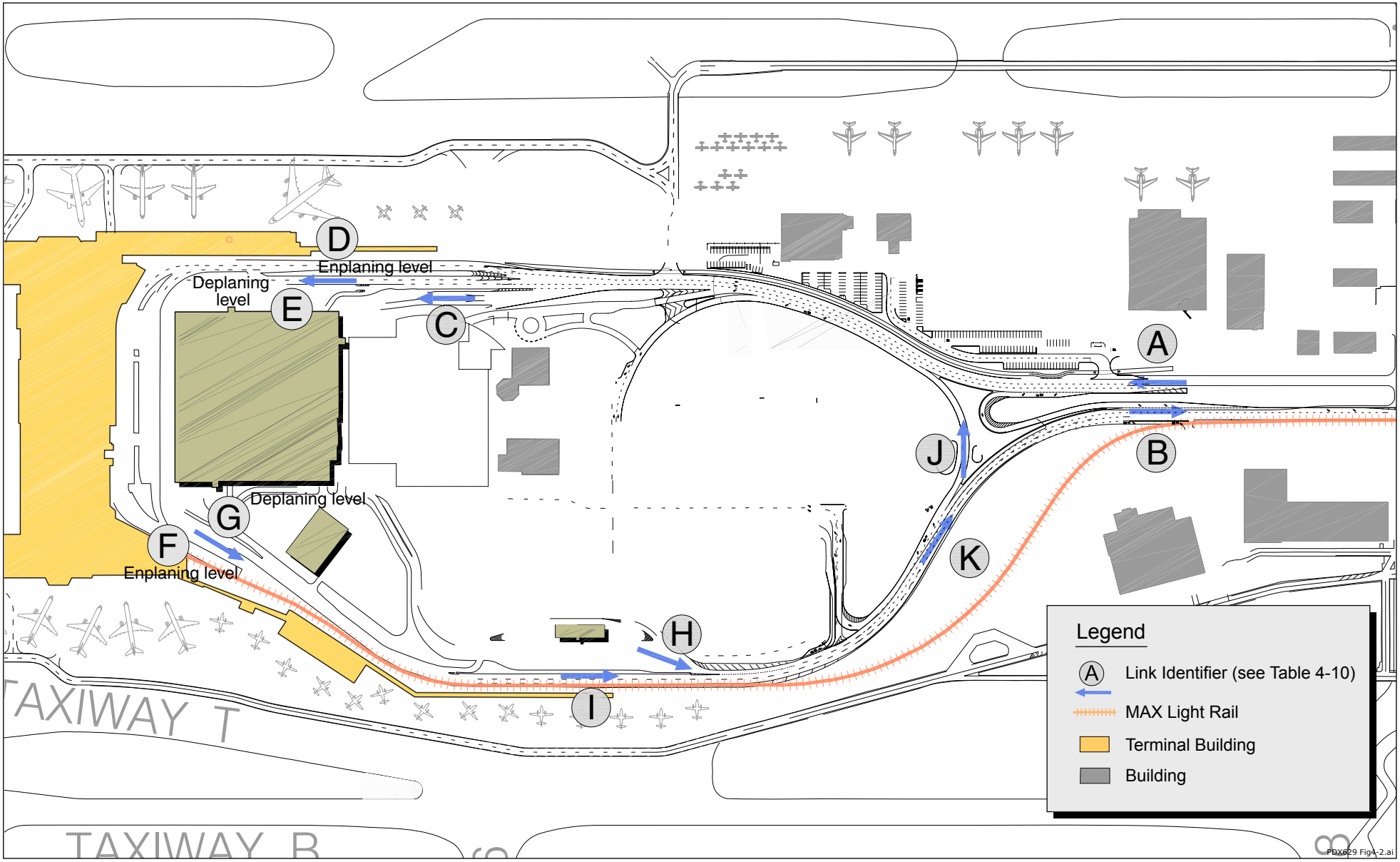
The second is the need to relocate the eastbound to northbound I-205 access. The Oregon Department of Transportation (ODOT) has conducted a study to determine and evaluate alternatives associated with relocating this access via a flyover, loop ramp, or other means. Addressing the eastbound left turning movement at this intersection would allow for adequate intersection operations during the afternoon peak period through PAL 5 (2035). ODOT has selected the preferred alternative. The design process is under way and construction is expected to be completed in 2012.

**NE 82nd Avenue/NE Alderwood Road (Figure 4-1, Intersection 7).** Similar to the Mt. Hood interchange signalized intersection, this intersection is a major access point to and from the Portland International Center, as well as being located on a key roadway providing access to the terminal area. Improvements to this intersection in addition to those currently being planned or constructed are expected to be in place by PAL 1 (2012). These improvements include modifying the eastbound approach geometry to include two left turn lanes, one through lane, and a separate right turn pocket (i.e., a limited-length lane that allows vehicles to wait for a turning opportunity without blocking through traffic). The westbound approach geometry is expected to be similar with dual left turn lanes, one through lane, and a separate right turn pocket. The southbound approach is expected to include a left turn lane, two through lanes, and a separate right turn pocket.

By PAL 5 (2035), the signal cycle would need to be lengthened to accommodate additional demand.

### *4.4.2 Key Terminal Area Roadways*

Key terminal area roadways were analyzed to determine the number of lanes needed to accommodate future peak period volumes at an acceptable level of service. The roadways analyzed are identified on Figure 4-2 and the number of additional roadway lanes required at each PAL is shown in Table 4-2.




AIRPORT FUTURES
CHARTING A COURSE FOR PDX

0" 400'
Scale: 1" = 400'

**Figure 4-2**

## *Roadway Link Locations*

*Master Plan Update*
*Portland International Airport*

*Source: Port of Portland Staff.*

*March 2010*

Table 4-2

**ADDITIONAL TERMINAL AREA ROADWAY LANES REQUIRED**

| Roadways (links identified on Figure 4-2) | Existing Roadway lanes | Additional roadway lanes required *(a)* | | | | |
|---|---|---|---|---|---|---|
| | | PAL 1 (2012) | PAL 2 (2017) | PAL 3 (2022) | PAL 4 (2027) | PAL 5 (2035) |
| NE Airport Way, westbound (link A) | 3 | -- | -- | 1 | -- | -- |
| NE Airport Way, eastbound (link B) | 3 | -- | -- | -- | 1 | -- |
| Parking entrance (link C) | 1 | -- | -- | -- | 1 | -- |
| Enplaning level approach (link D) | 2 | -- | -- | 1 | -- | -- |
| Deplaning level approach (link E) | 3 | -- | -- | -- | -- | -- |
| Enplaning level departure (link F) | 1 | 1 | -- | -- | 1 | -- |
| Deplaning level departure (link G) | 2 | -- | -- | -- | 1 | -- |
| Parking exit (link H) | 1 | -- | -- | -- | 1 | -- |
| Terminal exit (link I) | 2 | 1 | -- | -- | 1 | -- |
| Return-to-terminal road (link J) | 1 | -- | -- | -- | 1 | -- |
| Terminal area exit (link K) | 2 | -- | 1 | -- | 1 | -- |

Note: The requirements shown are incremental (e.g., the total requirement for NE Airport Way, westbound, at PAL 3 is 3 + 1 = 4 lanes) based on the 50th percentile forecasts.

Source: Jacobs Consultancy, *Technical Memorandum No. 3 – Facility Requirements*, December 2008.

### *4.4.3 Curbside Roadways*

The terminal curbside is a two-level configuration, with enplaning passengers dropped off on the upper roadway (i.e., the enplaning level curbside) outside the ticketing lobbies and deplaning passengers picked up on the lower roadway (i.e., deplaning level curbside) outside baggage claim.

**Enplaning Level Curbside**. On the enplaning level, the inner roadway is used by private vehicles and the outer roadway is predominantly used by commercial vehicles (the outer roadway also serves valet parking customers).

The existing inner and outer roadway lengths available for unloading would accommodate the requirements until PAL 3 (2022). The inner roadway, however, would require an additional travel lane by PAL 4 (2027). This requirement could be addressed by reducing the outer roadway area reserved for noncurbside functions and encouraging drivers to use the outer roadway for passenger unloading.

**Deplaning Level Curbside.** On the deplaning level, the inner roadway is used exclusively by private vehicles. The other curbside roadways are used by commercial vehicles.

The existing area available for loading will accommodate the projected requirements until PAL 2 (2017). An additional travel lane will be required by PAL 3 (2022).

### *4.4.4 Commercial Vehicle Facilities*

Commercial vehicle facilities consist of three curbside roadways used for passenger loading on the deplaning level and the Transportation Providers Hold Lot. The results of the commercial vehicle roadway requirements analysis indicated that the existing number of roadways is adequate to accommodate the low design-hour total volume of commercial vehicles. Furthermore, the total capacity of the three roadways for passenger loading was determined to be sufficient to meet requirements through PAL 5 (2035). However, areas allocated for individual modes (e.g., taxicabs, courtesy vehicles, and parking shuttle buses) may need to be adjusted to meet mode-specific requirements.

Currently, commercial vehicle operators waiting for dispatch to the commercial vehicle loading area park in the Transportation Providers Hold Lot, located east of the Airport traffic control tower. This area accommodates taxicabs, door-to-door vans, long-haul vans, other scheduled vehicles, and charter buses waiting to be dispatched to curbside.

The results of the requirements analysis indicated that relatively small increases in the area of the Transportation Providers Hold Lot will be required at each planning activity level, beginning at PAL 2 (2012).

### *4.4.5 Public Transit*

Requirements for public transit facilities at the Airport are predominantly driven by (a) the number of individual services and/or routes serving the Airport and (b) the functional requirements of the service. Currently, only one public transit service, TriMet's MAX light rail, is provided at the Airport. As demand for the service increases, it was assumed that more passengers would board each train and/or that TriMet would increase the frequency of trains serving the Airport.

In the event that a new transit operator (e.g., C-Tran, based in Clark County, Washington) begins service at the Airport (C-Tran currently provides service to the Parkrose Transit Center, where passengers can transfer to the MAX light rail), the Port will attempt to accommodate the service vehicle within the commercial vehicle loading area on the deplaning level.

### *4.4.6 Public Parking*

Public parking is currently provided in the P1 parking garage, the Long-Term Lot, the Economy Lots, and in privately operated off-Airport parking lots. In 2010, the P2 parking garage will also be available.

The results of the public parking requirements analysis, summarized in Table 4-3, indicated that additional parking capacity will be required at each planning activity level, beginning at PAL 2 (2017).

Table 4-3

**ADDITIONAL PUBLIC PARKING SPACES REQUIRED**

| Parking | Existing parking spaces *(b)* | Additional parking spaces required *(a)* | | | | |
|---|---|---|---|---|---|---|
| | | PAL 1 (2012) | PAL 2 (2017) | PAL 3 (2022) | PAL 4 (2027) | PAL 5 (2035) |
| Total close-in and remote facilities | 15,168 | -- | 1,912 | 3,190 | 3,240 | 4,030 |

*(a)* The requirements shown are incremental (e.g., the total requirement at PAL 2 is 15,168 + 1,912 = 17,080 spaces) based on the 50th percentile forecasts.

*(b)* Assuming completion of the P2 parking garage by 2010, which will add 3,000 public parking spaces and replace the spaces lost in the P1 parking garage and the Long-Term Lot during construction.

Source: Jacobs Consultancy, *Technical Memorandum No. 3 – Facility Requirements*, December 2008.

### *4.4.7 Employee Parking*

Employee parking is provided on Airport property in the Portland International Center off NE Alderwood Road and in the North Employee Lot located near the Transportation Providers Hold Lot. The existing employee parking capacity will be adequate until PAL 4 when 256 additional spaces will be required (an additional 300 spaces will be required at PAL 5).

### *4.4.8 Rental Car Facilities*

The rental car facilities requirements analysis was based on four key assumptions:

- Through PAL 3 (2022), 80% of the Airport rental car market would be accommodated in on-Airport facilities.
- At PAL 4 (2027) and beyond, the facilities needed to accommodate 100% of the Airport's rental car market would be provided.

- Rental car ready/return facilities will remain in the P1 and P2 parking garages at a static capacity (981 and 500 spaces, respectively) through PAL 3 (2022). This static capacity will be accommodated by increasing the size of the adjacent at-grade storage and service facilities and shuttling cars between the storage facilities and the ready/return stalls during peak rental and return periods.

- At PAL 4 (2027), appropriately sized (i.e., balanced) ready/return and storage facilities will be provided at a consolidated rental car facility. Beyond PAL 4, growth in ready/return and storage facilities will continue to be balanced.

The rental car requirements are summarized in Table 4-4.

Table 4-4

**ADDITIONAL RENTAL CAR FACILITIES REQUIRED**

| Facility | Existing *(b)* | Additional facilities required *(a)* PAL 1 (2012) | PAL 2 (2017) | PAL 3 (2022) | PAL 4 (2027) | PAL 5 (2035) |
|---|---|---|---|---|---|---|
| Ready/return parking (spaces) | 1,481 | -- | -- | -- | 909 | 310 |
| Storage and service (acres) | 2.4 | 4.5 | 1.0 | 2.6 | 0.0 | 1.1 |

*(a)* The requirements shown are incremental (e.g., the total requirement at PAL 4 is 1,481 + 909 = 2,390 spaces) based on the 50th percentile forecasts.
*(b)* Assuming completion of the P2 garage by 2010.

Source: Jacobs Consultancy, *Technical Memorandum No. 3 – Facility Requirements*, December 2008.

## 4.5 Air Cargo

Two general types of air cargo facilities are available at the Airport. The first type is primarily related to air freight distributors and passenger airlines that carry cargo in the belly compartment of the aircraft. Collectively, the air cargo facilities related to air freight distributors and passenger airlines are referred to in this report as belly-cargo facilities.

The second type of air cargo facilities is primarily related to air freight distributors, integrated carriers (such as FedEx and United Parcel Service, which provide complete door-to-door cargo services), and all-cargo carriers, which provide airport-to-airport service using all-cargo aircraft. Collectively, the air cargo facilities related to air freight

distributors, integrated carriers, and all-cargo carriers are referred to in this report as all-cargo facilities.

The Airport's belly-cargo facilities are located to the north of Runway 10R-28L in the PDX Cargo Center, the North Cargo Center, and the Northeast Cargo Complex as shown on Figure 2-4. All-cargo facilities are located to the south of Runway 10R28L, in the AirTrans Cargo Center and the Southwest Ramp as shown on Figure 2-3.

The relationship between capacity and demand and, therefore, the requirement for additional facilities, is very different for belly-cargo facilities than for all-cargo facilities.

### *4.5.1 Belly Cargo*

The PDX Cargo Center, the North Cargo Center, and the Northeast Cargo Complex currently provide a capacity of approximately 236,000 square feet of processing and warehousing space suitable for belly cargo. This capacity far exceeds the requirement for belly-cargo facilities, even at PAL 5 (2035), when the total requirement is estimated to be 93,000 square feet.

### *4.5.2 All Cargo*

Three principal components constitute the all-cargo facilities at the Airport—warehouse and office, aircraft ramp, and landside facilities (i.e., shipping and receiving docks as well as employee and customer parking). It was assumed that (a) these components will be developed concurrently, as appropriate for the available sites, and (b) the timing of the need for these three components is indicated by the timing of the need for warehouse facilities. The requirements for all-cargo warehouse facilities, by PAL, are shown in Table 4-5. As indicated, additional all-cargo facilities will be required at every planning activity level, beginning with PAL 1 (2012).

Table 4-5

**ADDITIONAL ALL-CARGO WAREHOUSE FACILITIES REQUIRED**

| | | Additional warehouse capacity required *(a)* | | | | |
|---|---|---|---|---|---|---|
| Facility | Existing | PAL 1 (2012) | PAL 2 (2017) | PAL 3 (2022) | PAL 4 (2027) | PAL 5 (2035) |
| Warehouse capacity (square feet) | 413,000 | 19,000 | 129,000 | 114,000 | 138,000 | 192,000 |

*(a)* The requirements shown are incremental (e.g., the total requirement at PAL 1 is 413,000 + 19,000 = 432,000 square feet) based on the 50th percentile forecasts.

Source: Jacobs Consultancy, *Technical Memorandum No. 3 – Facility Requirements*, December 2008.

## 4.6 General Aviation

It is recommended that an additional 10 to 20 acres be reserved for future general aviation facilities. This recommendation is consistent with the Port's management philosophy of compliance with FAA grant assurances, reserving land area to accommodate additional general aviation service providers (if demand materializes), ensuring a competitive environment, and promoting balanced use of the region's system of airports in a way that is reasonable, appropriate, and applicable to each airport's distinct role.

## 4.7 Military

Military units at the Airport are located on 246 acres of land leased to the Oregon Air National Guard (ORANG) until 2029, when the lease expires. The ORANG has indicated that it intends to request an extension to its lease.

The scope of this Master Plan Update related to the military is limited to planning the appropriate location on the Airport for military area requirements, as determined by the ORANG. At present, that requirement is being reviewed by the 142nd Fighter Wing of the ORANG. For the purposes of this Master Plan Update, it was assumed that the current lease area, 246 acres, will satisfy the requirement for military facilities at the Airport through PAL 5 (2035).

## 4.8 Support Facilities

Support facilities at the Airport consist of airline maintenance and support, fuel storage, aircraft rescue and fire fighting (ARFF), Airport maintenance, the central utility plant (CUP), and utilities.

### *4.8.1 Airline Maintenance and Support*

Approximately 28 acres of land at the Airport are allocated to airline maintenance and support functions. Two facilities are used for airline maintenance: the Horizon Air maintenance facility, located just south of the ground runup enclosure near the intersection of Runway 10R-28L and Runway 3-21 and the aircraft maintenance hangar, located in the AirTrans Cargo Center at the south end of Runway 3-21. Other, limited maintenance facilities include the Ameriflight facility located on the Southwest Ramp and the SkyWest Airlines facility located north of NE Airport Way.

Airline maintenance hangars and facilities are typically constructed by the airlines based on corporate business decisions and are not necessarily related to the volume of airline traffic at a given airport. The factors that typically influence the construction of such facilities include the location of airline headquarters, hubbing characteristics, fleet size, maintenance scheduling, climate, and the amount of time aircraft can available for maintenance at a specific airport. Moreover, requirements for such facilities were not estimated.

### *4.8.2 Fuel Storage*

Fuel storage facilities at the Airport, situated on approximately 4 acres of land, provided a 5-day reserve supply of jet fuel in 2007 (approximately 3.4 million gallons). By PAL 5 (2035), storage requirements are projected to range from approximately 2.8 million gallons for a 3-day reserve to 9.3 million gallons for a 10-day reserve, occupying land areas ranging from 3.3 acres to 11.1 acres.

The number of days' supply of fuel stored onsite in reserve is a business decision to be made by the airlines, which own the storage tanks and distribution system. In addition, the number and configuration of the tanks to be provided are ultimately determined by the airlines based on operating considerations, such as the tank filling and fuel settling process, as well as the reserve supply desired. Preserving land for 5 days of reserve fuel capacity (approximately 1 to 2 additional acres) would ensure an adequate reserve fuel capacity throughout the planning period, and would be consistent with the historical capacity provided at the Airport.

### *4.8.3 Aircraft Rescue and Fire Fighting*

The aircraft rescue and fire fighting facility, located on approximately 5.8 acres, does not have enough capacity to store all of the Airport's ARFF vehicles. The former Delta Cargo building, located in the Northeast Cargo Complex, is being used to temporarily house two backup ARFF vehicles (a fire truck and a crash truck).

Regulatory changes are being considered that could result in the need for a supplemental ARFF facility. Should that need arise, the total land area required for ARFF facilities at PDX could increase from 5.8 acres to 9.0 acres.

### *4.8.4 Airport Maintenance*

It is recommended that an additional 2.2 acres be reserved to permit the existing 14.4 acre Airport maintenance facility site to be expanded as appropriate to provide additional storage space for maintenance vehicles, workshop space, office space, and employee parking.

### *4.8.5 Central Utility Plant*

The existing heating system is adequate for current Airport needs. Sufficient space is available to accommodate an additional boiler if additional capacity is required.

The existing cooling system is adequate for current Airport needs. However, redundant cooling is not available. Sufficient space exists in the CUP to accommodate a future cooling tower.

The CUP contains three 1,000-kilowatt generators, one 1,500-kilowatt generator, and sufficient space to accommodate one future 1,500-kilowatt generator. This reserved space is expected to be sufficient through PAL 5 (2035).

### *4.8.6 Utilities*

The Airport's water distribution system is in good condition. Water pressure and capacity will be adequate for the foreseeable future.

The wastewater system at the Airport has additional capacity through PAL 5 (2035).

There are three primary electrical feeds to the Airport from different Pacific Gas and Electric Company substations. The feeds terminate at the CUP, from which electrical power is distributed to all facilities. Near-term improvements to the electrical distribution system are needed, as described in *Technical Memorandum No. 3 – Facility Requirements*.

# 5. ALTERNATIVES

This section summarizes the alternative concepts considered for fulfilling the facility requirements summarized in Section 4. Alternative concepts were developed for airfield (i.e., runways and taxiways), passenger terminal complex, ground transportation and parking, air cargo, and general aviation facilities.

## 5.1 Background, Process, and Key Assumptions

The process for identifying and evaluating Airport development alternatives involved the planning team (consisting of both consultant and Port staff), City staff, the PAG, the Master Plan/Sustainability Subcommittee, and the Land Use/Transportation Subcommittee. The following subsections summarize the evolution of the work plan, approach, and key assumptions that resulted in the proposed projects presented in Section 6.1.

### *5.1.1 Initial Work Plan*

When the Master Plan Update process began in September 2007, it was with the understanding that decisions would be made related to two passenger terminal concepts and a third parallel runway. The two concepts, referred to as the Centralized Concept and the Decentralized Concept, were developed during the 2000 Airport master plan and are illustrated on Figures 5-1 and 5-2, respectively.

The Centralized Concept includes a satellite concourse located to the west of the existing passenger terminal. The Decentralized Concept includes a second access roadway and a second passenger terminal and concourses located south of the existing terminal, where the military facilities are currently located. Both the Centralized and Decentralized concepts include an 11,925-foot-long, 200-foot-wide third runway parallel to and south of existing Runway 10R-28L.

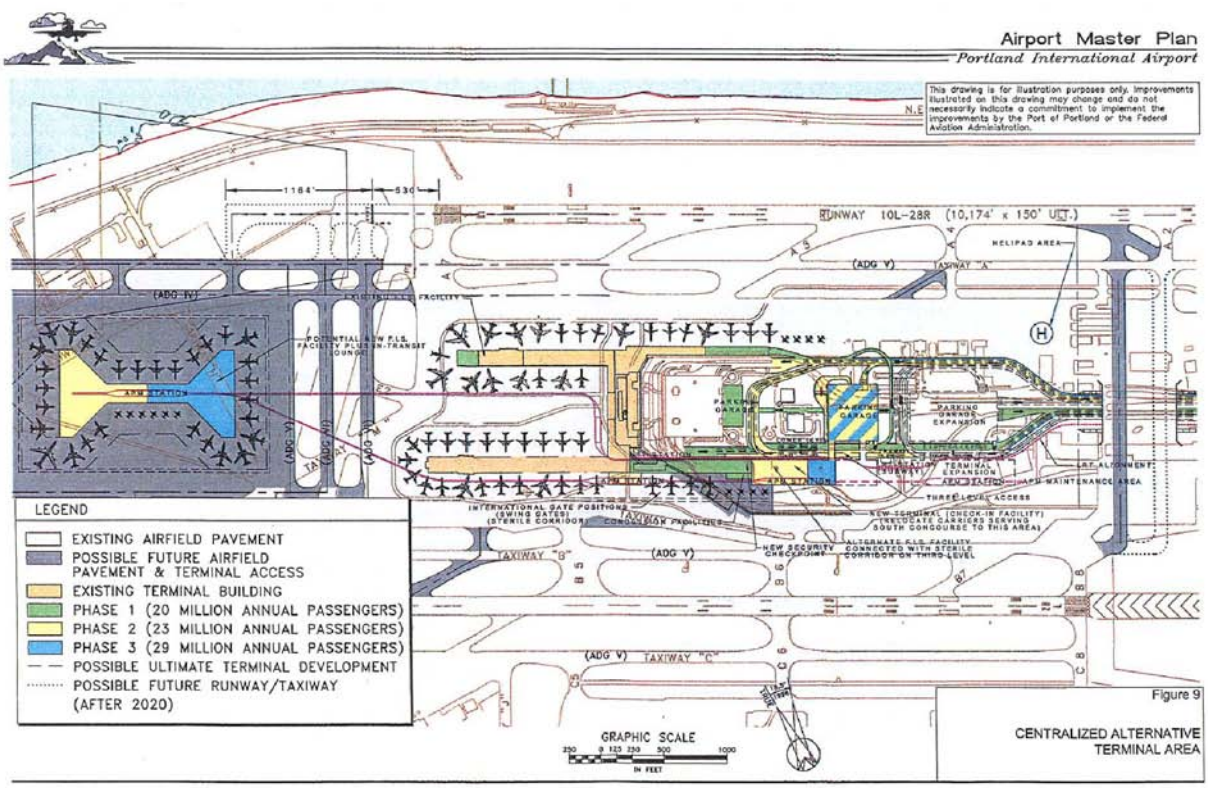
The expectation was that the PAG would analyze the Centralized and Decentralized concepts and recommend the one that would meet the region's air transportation needs without compromising the livability and quality of life for future generations.

Furthermore, the master planning process began with the understanding that the need for a third parallel runway would likely occur beyond the planning period (i.e., beyond 2035). However, it was also generally acknowledged that demand in 2035 would likely reach a level at which preparation for a third parallel runway would be appropriate, given the long lead time for runway implementation.

The Port agreed that it would not seek City Council approval for construction of a third parallel runway to be included in the City Land Use Plan being developed through Airport Futures. The City and the Port agreed that a planning-level review of the potential impacts of a third parallel runway, including noise, height, and natural resources impacts, needed to be completed and that the City Land Use Plan would incorporate a land use review process for a potential third parallel runway.

Figure 5-1

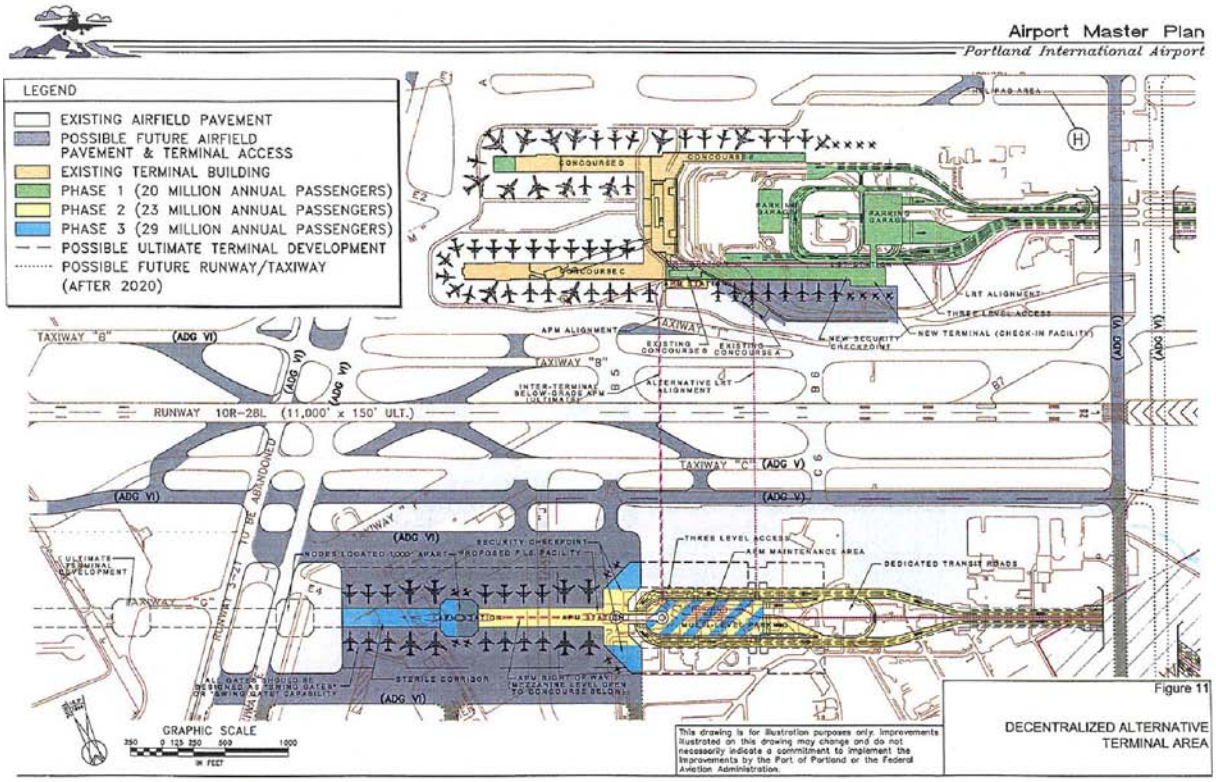
**CENTRALIZED AIRPORT DEVELOPMENT CONCEPT**




Source: P&D Aviation, *Portland International Airport Master Plan*, 2000.

Figure 5-2

**DECENTRALIZED AIRPORT DEVELOPMENT CONCEPT**




Source: P&D Aviation, *Portland International Airport Master Plan*, 2000.

### *5.1.2 Evolution of Initial Work Plan*

The aviation industry has changed considerably since the 2000 Airport master plan was completed; those changes are reflected in the aviation demand forecasts discussed in Section 3. The facility requirements for this Master Plan Update are significantly reduced from the facility requirements included in the 2000 Airport master plan.

It was concluded that the 50th percentile forecast of 378,000 annual aircraft operations for 2035 could easily be accommodated by the Airport's existing airfield. This is in contrast to the 2000 Airport master plan, in which 485,000 aircraft operations were forecast for 2020. Accordingly, construction of the third parallel runway is not required as part of this Master Plan Update.

Furthermore, it was concluded that, with some strategic investments and operational and technological enhancements, the existing passenger terminal will likely serve the

50th percentile forecast passenger demand in 2035 without the need to build outside the existing passenger terminal envelope.

At the October 21, 2008, PAG meeting, all but one member present voted to continue the planning process using the Master Plan Update's then-current facility requirements and assumptions, provided that there would be an opportunity to re-evaluate them relative to the PAG's sustainability criteria before a final decision was reached to recommend, modify, or reject them. The agreed-upon process provided for that opportunity.

### *5.1.3 Approach for Moving Forward*

The approach for moving forward involved planning for a sustainable future, identifying investment decisions needed at PAL 1 (2012) through PAL 5 (2035), and evaluating assumptions related to the Centralized Concept, the third parallel runway, and the military. This approach is described below.

**Planning for a Sustainable Future**. At a meeting of the Master Plan/ Sustainability Subcommittee on November 18, 2008, it was concluded that, from a sustainability perspective, it would be prudent in developing the Master Plan Update to consider levels of activity that are both higher and lower than the 50th percentile demand forecasts. The consideration of additional activity levels is particularly important for the City's long-term land use planning for land adjacent to the Airport.

Accordingly, although the majority of the planning work was based on the 50th percentile or "most likely" demand forecasts, key facilities were evaluated to determine their ability to accommodate demand ranging from the 90th percentile to the 10th percentile forecasts. The purpose of this analysis was to ensure that options remain open and that the plan would have sufficient flexibility to respond to an ever-changing region, economy, and aviation industry.

**Assumptions Related to the Centralized Concept**. The Master Plan/ Sustainability Subcommittee, the Land Use/Transportation Subcommittee, and the planning team recommended that facility improvement plans for PAL 1 (2012) through PAL 5 (2035) be based on the assumption that the Airport will be developed consistent with the Centralized Concept. This recommendation was based on the following considerations.

- **Cost**—The cost differential between the two development concepts has widened since completion of the 2000 master plan, in which the Decentralized Concept was estimated to cost at least $1 billion more than the Centralized Concept in 1997 dollars (of this amount, approximately $400 million was the estimated cost to relocate the military facilities).

- **Phasing**—Construction of the Decentralized Concept would be difficult, as it would require relocation of the military facilities to build access roadways, parking, and the terminal building. The complexity of phasing contributes to the high cost, the long lead time for development, and difficult financing.

- **Environmental impact**—The Centralized Concept would have a less impervious surface, fewer associated air pollutant emissions, and less overall effect on natural resources than the Decentralized Concept.

- **Operational efficiency**—The Centralized Concept can be operated more efficiently with the existing two parallel runway configuration than the Decentralized Concept.

- **Viability**—The Centralized Concept is sufficiently flexible to accommodate the 90th percentile forecast demand, should it occur. The challenges of accommodating this level of demand are understood and manageable, and potential solutions have been identified. Moreover, the ability to switch to the Decentralized Concept will exist for years.

While the Decentralized Concept is acknowledged to offer some long-term capacity advantages over the Centralized Concept, its advantages are not great enough to warrant its significant cost differential, phasing difficulties, and greater environmental impacts.

**Assumptions Related to the Third Parallel Runway**. During the planning process, the planning team explored how a future decision on the third runway might be made within the context of the City's land use approval process, even though a third parallel runway may not be implemented for a very long time. Among other things, this exploration included a discussion of noise, natural resources, and height impacts, on and off the Airport, and a discussion of strategies as to how these impacts might be avoided, minimized, or mitigated. The National Environmental Policy Act (NEPA) process that would be undertaken by the FAA for a third parallel runway was also discussed, as well as how the NEPA process would be coordinated with the City land use approval process.

**Assumptions Related to the Military**. The space occupied by the military is not needed for development to accommodate PAL 1 (2012) through PAL 5 (2035). Currently, the cost to relocate the military is high. If the military's situation should change (for example, if the military were to leave the Airport, receive approval to substantially update or expand its facilities, or begin operating the F22, F35, or other new aircraft), the Port should undertake a new master plan or reconsider the then-existing plan. Any new lease between the Port and ORANG should include provisions that would allow both parties to reopen negotiations to address any major changes. In the meantime, given the uncertainty and lack of demand for the space occupied by the

military within the planning period, it is reasonable to assume that the military facilities will remain in their present location.

### *5.1.4 Sustainability Criteria for Facilities Planning*

The planning team carefully considered sustainability in identifying and evaluating the development alternatives for each functional area of the Airport. The application of new technologies, changes in passenger behavior, and changes in the airline industry are among the many uncertain factors that will influence the capacity, design, use, and reuse of the Airport's facilities in the future. While the effects of these factors cannot be known with certainty, the Port embraces the notion, discussed at numerous PAG and PAG subcommittee meetings, that some future changes have the potential to significantly increase the use of existing facilities and the efficiency of operations, thus extending the life of Airport facilities and ultimately postponing the need to develop new facilities.

The approach employed to ensure that the alternatives reflect the PAG's vision and values was to carefully evaluate the alternatives against criteria that were developed through collaborative discussions on sustainability. The sustainability criteria for facilities planning are as follows:

- Preserve future development options
- Minimize environmental impacts
- Use land resources efficiently
- Maximize operational efficiency
- Ensure that development can be effectively phased
- Comply with FAA airport design criteria

The evaluation of alternatives in relation to the sustainability criteria is presented in *Technical Memorandum No. 4 – Alternatives*.

## 5.2 Viability of the Centralized Concept

Although the facility requirements in the Master Plan Update were based on the 50th percentile forecast demand, the PAG and the planning team agreed that the Centralized Concept would be considered viable only if it has the flexibility to accommodate aviation demand beyond the 50th percentile forecast for PAL 5. For the purposes of testing the viability of the Centralized Concept, the 90th percentile demand was determined to be appropriate.

From the analyses described in Section 2 of *Technical Memorandum No. 3 – Facility Requirements,* it was concluded that, at the 90th percentile forecast demand at PAL 5, a third parallel runway would be needed. Furthermore, the Airport has sufficient land to accommodate a third parallel runway, which was included in the Centralized Concept developed during the 2000 Airport master planning process.

To assess the viability of the Centralized Concept, the analyses were focused on the ability of the relatively narrow core development area and other major elements of the Airport to accommodate the 90th percentile forecast demand at PAL 5 (2035). Key terminal and landside elements were assessed to determine if (1) the 90th percentile forecast demand could be accommodated within the core development area and (2) displaced facilities could be accommodated elsewhere on the Airport. The results of this assessment are summarized below.

### *5.2.1 Terminal Elements*

Passenger processing, aircraft parking positions (i.e., gates), and aircraft RON positions are the primary drivers of the land envelope required for terminal facilities. The following conclusions were reached regarding the ability of the Airport's passenger processing, aircraft parking, and aircraft RON facilities to be expanded and modified within the core development area to reasonably accommodate the 90th percentile forecast demand at PAL 5 (2035):

1. Passenger processing requirements can be met by constructing an additional facility, such as Terminal Expansion East (TEE), which has been the subject of studies by the Port and Port staff.

2. Aircraft parking requirements can be met by constructing a satellite concourse and extending Concourse E. Aircraft parking requirements cannot be met without a satellite concourse—even if both Concourses A and E are extended and reduced aircraft wingtip clearances are assumed.

3. Satisfying RON aircraft parking requirements in the core development area would be expensive because of the need to displace and relocate existing facilities.

One potential concept for developing facilities within the core development area—if the 90th percentile forecast demand were to occur—is shown on Figure 5-3.

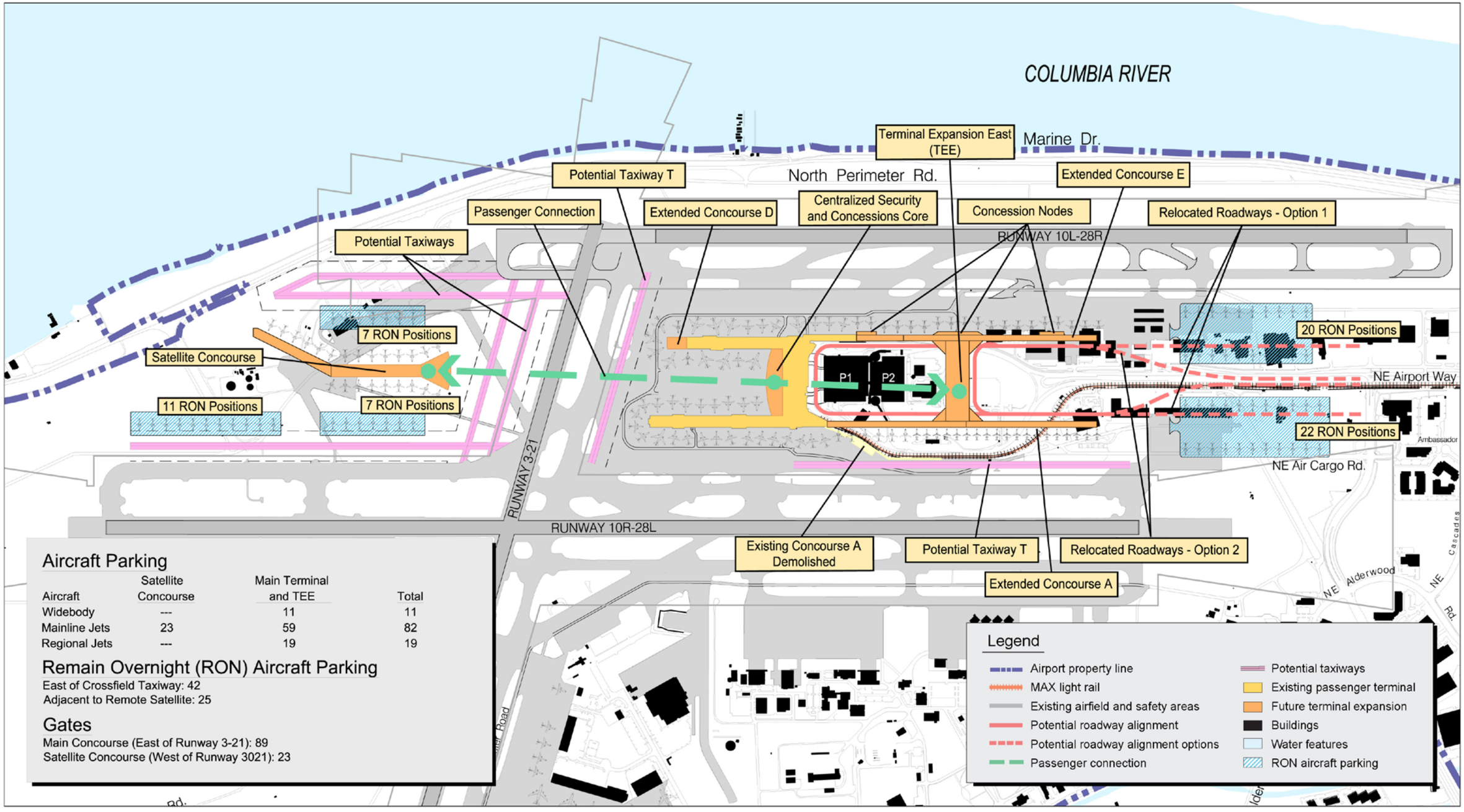



*Figure 5-3*

*Concept for Developing Passenger Terminal Facilities to Accommodate 90th Percentile Forecast Demand*

*Master Plan Update*
*Portland International Airport*

*Source: Jacobs Consultancy, November 2009.*

*March 2010*

### *5.2.2 Landside Elements*

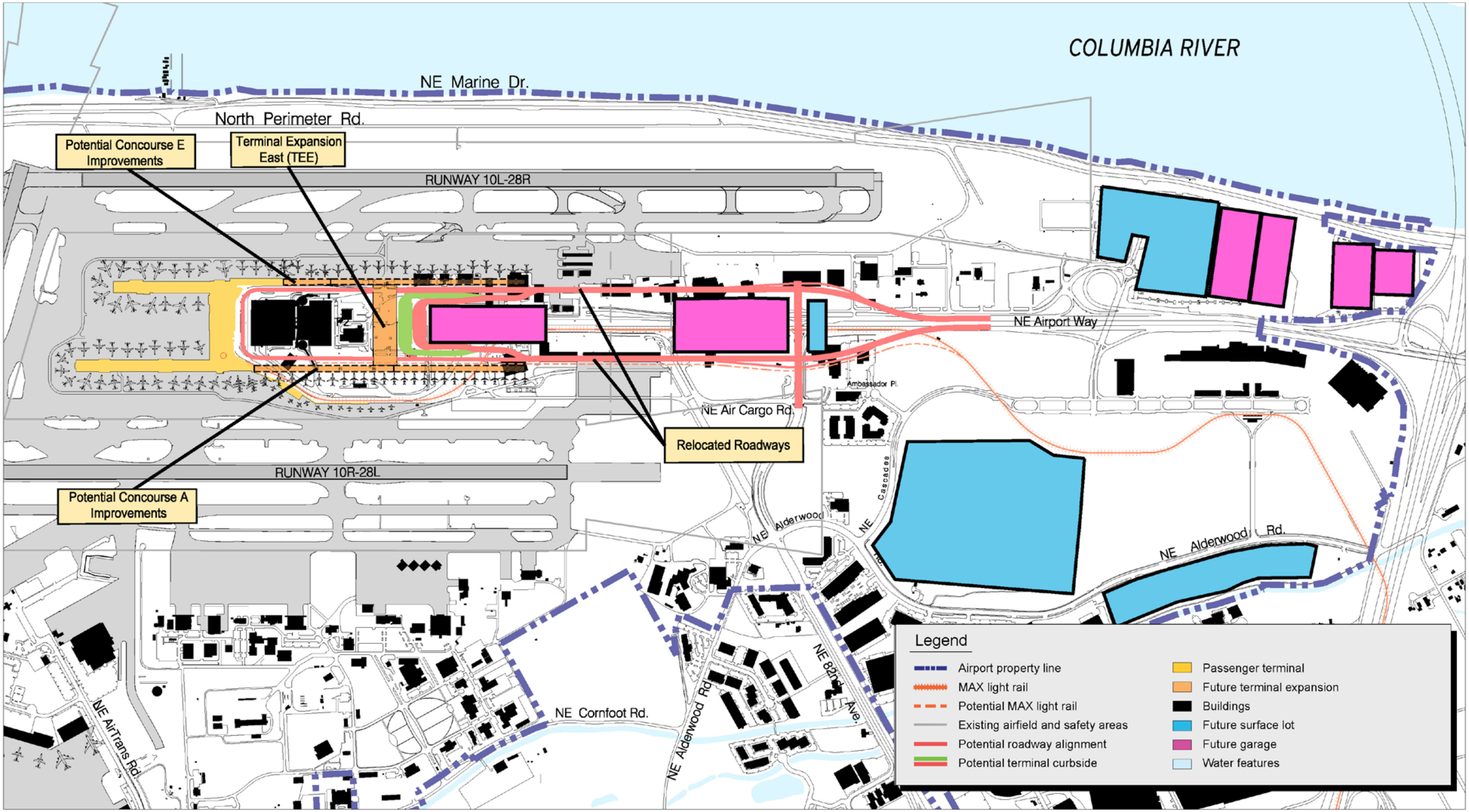
Seven key landside elements were assessed:

- Access and circulation roadways
- Curbsides (enplaning, deplaning, commercial)
- Parking (public, employee)
- Rental car facilities
- MAX light rail
- Transportation Providers Hold Lot
- Cell phone lot

These elements were selected because they are the primary drivers of the overall land envelope required for landside facilities. Similar to the assessment of terminal elements, the assessments were generalized, with the objective of determining if these landside elements can be expanded and modified within the core development area to reasonably accommodate the 90th percentile forecast demand at PAL 5 (2035). The conclusions from the assessments were as follows:

1. The primary challenge is the narrow core development area.
2. Curbside requirements could be met by encouraging changes in behavior, for example, by:
   - Reducing the use of curbsides by private vehicles
   - Encouraging the use of alternate curbsides during peak periods
   - Requiring some commercial vehicles to pick up/drop off passengers at the same location
   - Relocating selected commercial vehicle services to an alternate location
   - Considering an automated people mover (APM) to serve rental car and public parking facilities

One potential concept for developing landside facilities within the core development area—if the 90th percentile forecast demand were to occur—is shown on Figure 5-4.




AIRPORT FUTURES
CHARTING A COURSE FOR PDX

0' 1,000'
Scale: 1" = 1,000'

*Figure 5-4*

*Concept for Developing Landside Facilities in Response to 90th Percentile Forecast Demand*

*Master Plan Update*
*Portland International Airport*

*Source: Jacobs Consultancy, November 2009*

*March 2010*

### *5.2.3 Land Available for Displaced Facilities*

From the concepts illustrated on Figures 5-3 and 5-4, it is apparent that, should the 90th percentile demand materialize, the potential exists for many facilities currently located in the core development area to be relocated. Adequate Airport land is available to accommodate these facilities, as well as to accommodate growth for other functions.

### *5.2.4 Summary and Conclusions*

The key observations from the assessments of major terminal and landside facilities relative to the 90th percentile forecast demand at PAL 5 (2035) were as follows:

- **Passenger terminal**—Adequate passenger terminal facilities could be provided.
- **Aircraft parking positions**—An adequate number of aircraft parking positions could be provided by realigning and extending Concourse A, extending Concourse E, and constructing a satellite concourse.
- **RON aircraft parking**—It is not likely that all the needs for RON aircraft parking could be met in ideal locations; however, this is not a fatal flaw.
- **Taxiways**—Taxiway T must be extended to the east.
- **Roadways**—On-Airport roadways can meet the requirements with modifications. The most significant concern is with off-Airport roadways, which are beyond the scope of this Master Plan Update.
- **Curbsides**—Requirements could be met by implementing operational strategies.
- **Parking**—Parking demand could be served; however, the percentage of parking provided close in would not be as great as exists today.
- **Travel distances**—An APM system might be appropriate.
- **Land use**—Sufficient Airport land exists to accommodate facilities displaced from the core development area.

From the assessments, it was concluded that the Centralized Concept:

- Could accommodate the 90th percentile forecast demand at PAL 5 and the challenges would be manageable.

- Is flexible and can provide reasonable levels of service.
- Can be effectively phased.

Furthermore, the ability to switch from a centralized to a decentralized development concepts will exist for years. Such a change could be dictated by changes in circumstances (e.g., advances in technology or modified passenger behavior). Therefore, the Centralized Concept is viable.

## 5.3 Airfield

The capacity of the existing airfield and airspace system was assessed in the facility requirements phase of the Master Plan Update. From that assessment, conclusions and recommendations resulted regarding the crossfield taxiway location and a third parallel runway.

### *5.3.1 Crossfield Taxiway Location*

As traffic increases, a crossfield taxiway system will be needed to facilitate the anticipated increase in aircraft taxiing between the parallel runways and the passenger terminal. The level of aircraft operations that would warrant an improved crossfield taxiway system is not anticipated to occur within the planning period. However, the planned locations and geometry of the crossfield taxiways will influence the potential size of certain facilities (e.g., the P3 parking garage) planned for construction during the planning period. Therefore, a shift in the locations and geometry of the crossfield taxiways from those shown on the existing ALP is recommended. The recommended concept is shown on Figure 5-5.

### *5.3.2 Third Parallel Runway*

The concept for a third parallel runway was conceived during preparation of the 2000 Airport master plan, and it is identified as Runway 10R-28L on the existing ALP. As shown on the ALP, the runway was planned to be located 3,250 feet south of existing Runway 10R-28L (centerline-to-centerline separation), at 11,925 feet long and 200 feet wide.

Although it has now been determined that the third parallel runway will not be needed during the planning period, the planning team evaluated its functionality if the length were reduced to 8,500 feet. This reduced length was hypothesized based on the PAG's sustainability criteria—in particular, the desire to minimize the potential environmental impact of the runway and to maximize land use efficiency.

The revised concept, shown on Figure 5-6, is for a third parallel runway that is 8,500 feet long, 150 feet wide, and located 3,250 feet south of existing Runway 10R-28L (centerline-to-centerline separation).

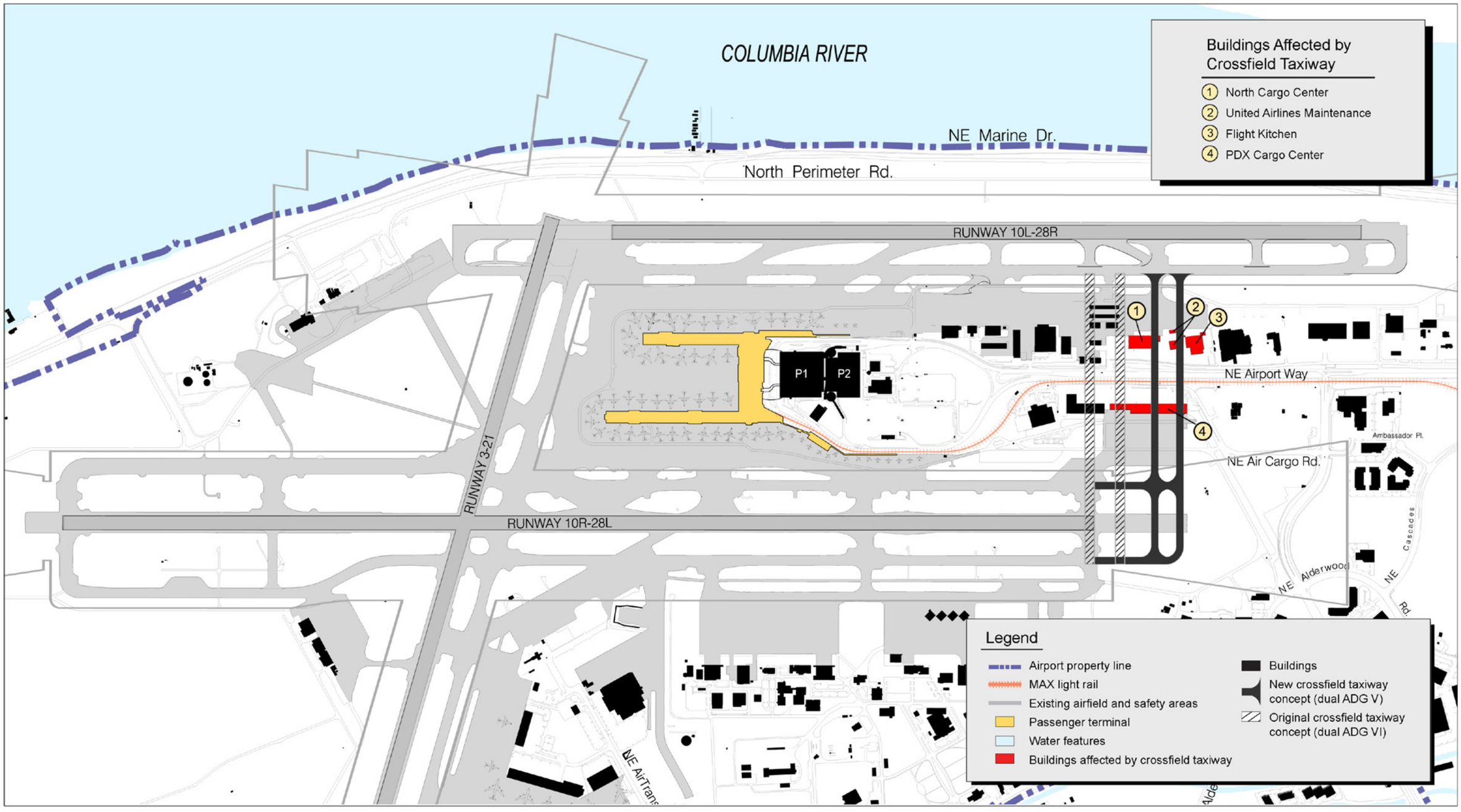



*Figure 5-5*

*Concept for Planned Crossfield Taxiways*

*Master Plan Update*
*Portland International Airport*

*Source: Jacobs Consultancy, November 2009.*

*March 2010*

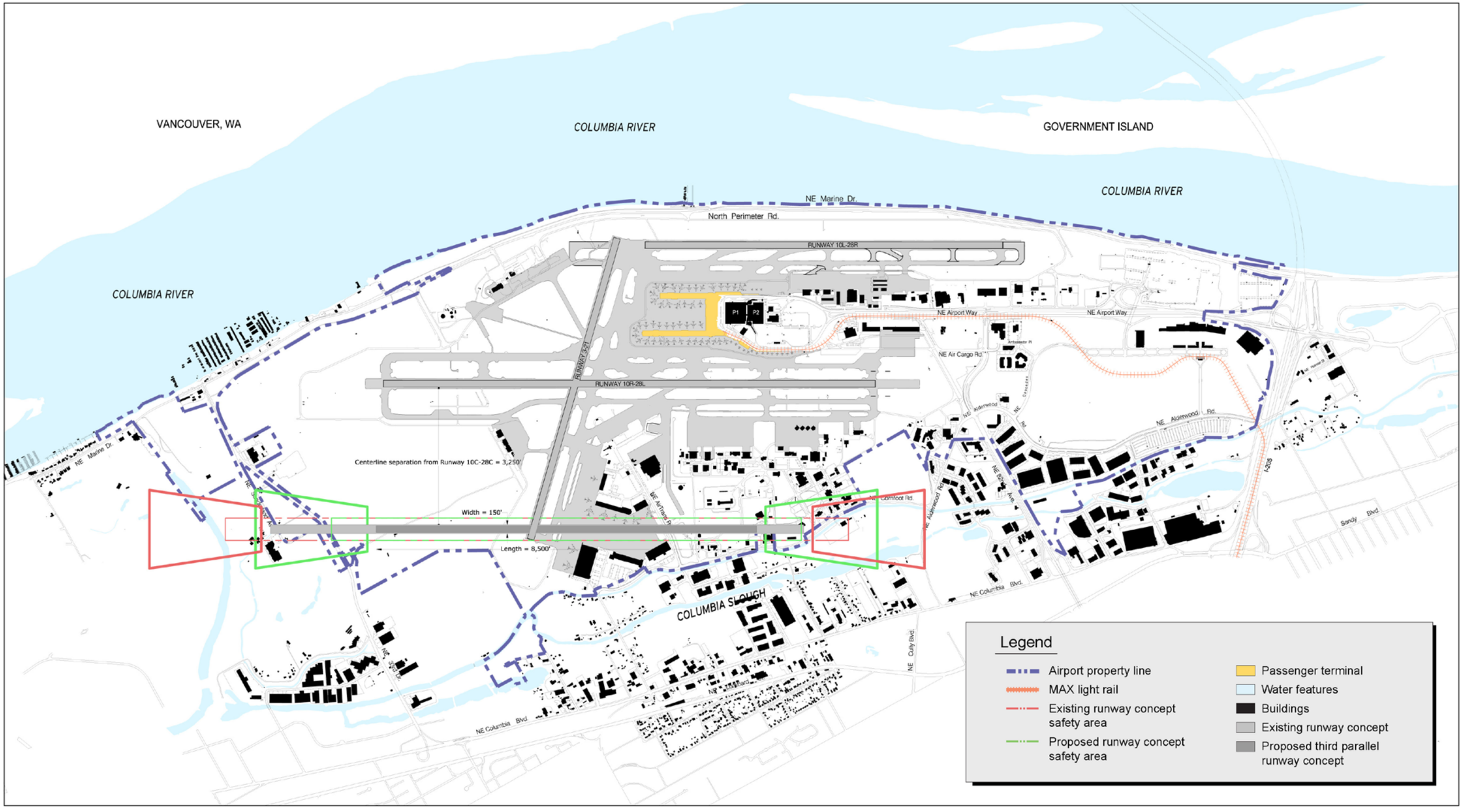



*Figure 5-6*

*Concept for 8,500-foot-long Third Parallel Runway*

*Master Plan Update*
*Portland International Airport*

*Source: Jacobs Consultancy, November 2009.*

*March 2010*

## 5.4 Passenger Terminal

The four primary elements of the long-range plan for passenger terminal facilities are as follows:

- **Passenger terminal concourses**—Multiple facilities within the passenger terminal concourses may need to be modified to meet future requirements, including the holdrooms on Concourse A, the regional airline holdroom on Concourse E, and the FIS facilities on the lower level of Concourse D. However, these projects are either deferrable or, in the case of the FIS facilities, market driven. Alternatives for these facilities will be identified and assessed in follow on studies.

- **Main passenger terminal**—With upgrades and modifications anticipated through PAL 5 (2035), the existing passenger terminal can accommodate the demand associated with the 50th percentile forecasts for PAL 5. Appropriate upgrades and modifications should be assessed in followon studies.

- **Terminal Expansion East**—Considerable planning was completed to develop the TEE concept prior to this Master Plan Update. TEE would provide passenger processing facilities to supplement the existing passenger terminal when it reaches capacity, which is not anticipated within the planning period for this Master Plan Update (through 2035). However, projects will be constructed during the master planning period, the design for which is closely related to the TEE, including the P3 garage. Therefore, prudent planning dictates that the TEE be evaluated and, if appropriate, confirmed to be the best long-range terminal development concept.

- **Remain overnight aircraft parking**—The highest priority project related to meeting terminal requirements is RON aircraft parking.

Accordingly, the following sections summarize (a) the preferred long-range terminal development concept, (b) alternatives for providing additional RON aircraft parking, and (c) the recommended strategy for maintaining terminal effectiveness.

### *5.4.1 Long-range Terminal Development Concept*

Four alternative concepts for developing terminal facilities beyond PAL 5 (2035) were identified, including the TEE concept. Each is consistent with the Centralized Concept and capable of accommodating the 90th percentile forecast passenger demand at PAL 5 (2035). The four alternative long-range terminal development concepts were qualitatively assessed relative to potential cost and the PAG's sustainability criteria. It was concluded that TEE, shown on Figure 5-7, is the preferred long-range terminal development concept.

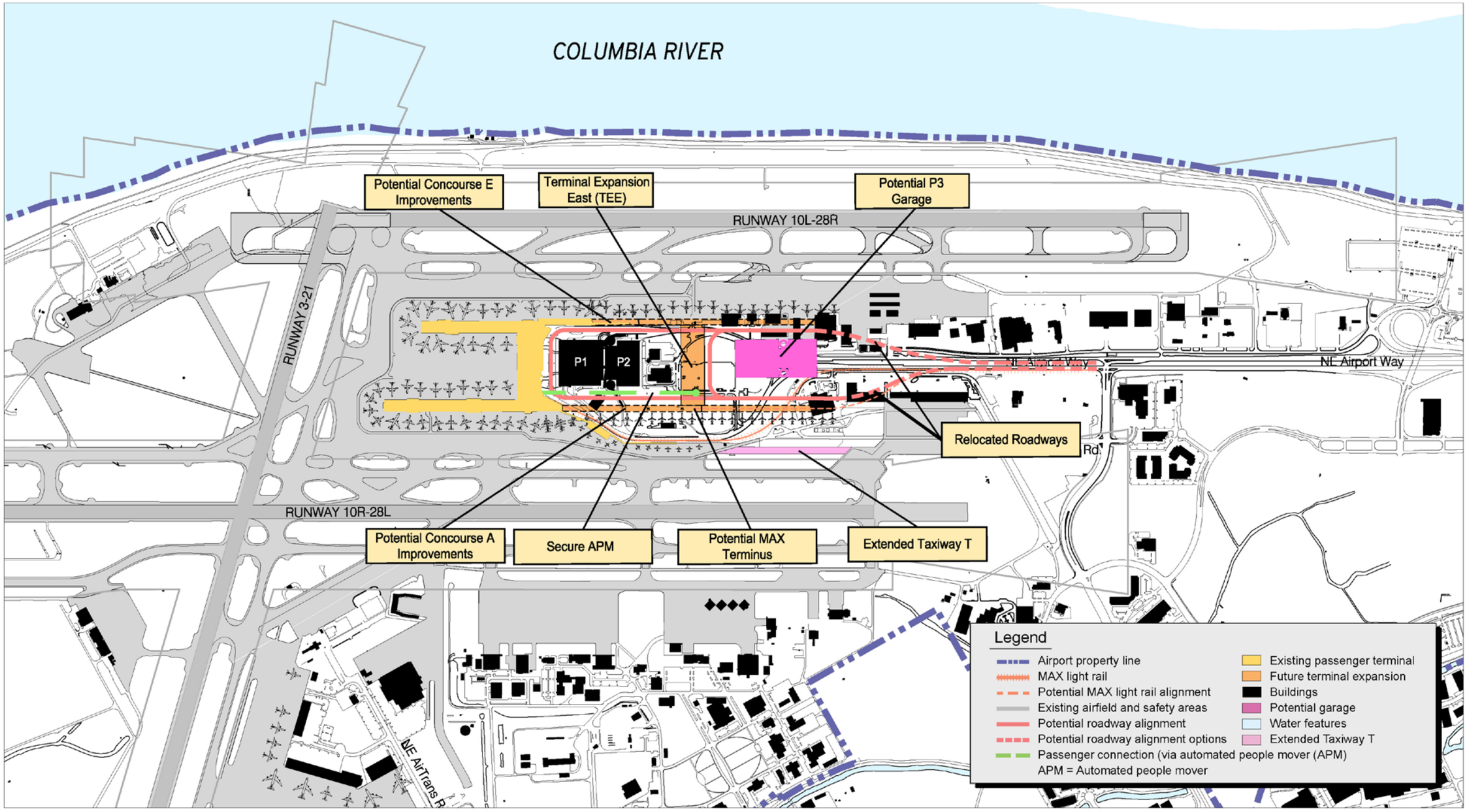



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*Figure 5-7*

*Terminal Expansion East Concept*

*Master Plan Update*
*Portland International Airport*

*Source: Jacobs Consultancy, November 2009*

*March 2010*

### *5.4.2 Remain Overnight Aircraft Parking*

Three RON concepts were identified and evaluated and the following conclusions were reached:

- The best location for RON aircraft parking is to the west of Runway 3-21. However, use of this location for RON parking would require relocating an existing navigation aid (the very-high frequency omnidirectional range station, or VOR) and no appropriate on-Airport site is available.

- Adding RON aircraft parking in the area between the Sheraton Hotel and the Hampton Inn and Taxiway A is the best alternative available in the short term—it is an efficient use of the land, would not affect adjacent functions, and would be relatively inexpensive to implement.

The recommended strategy for providing RON aircraft parking is to continue using the PDX Cargo Center apron for RON aircraft parking and supplement that capacity by constructing additional RON aircraft parking at each PAL:

- PAL 1 (2012) requirements can be met by constructing an aircraft apron north of the Sheraton Hotel and Hampton Inn to accommodate four ADG III (e.g., the B-737-800) aircraft, as shown on Figure 5-8.

- PAL 2 (2017) requirements can be met by implementing phase 2 of the project to be completed at PAL 1 (2012). Phase 2 consists of expanding the phase 1 aircraft apron to the east to accommodate an additional two ADG III aircraft. This expansion is also shown on Figure 5-8.

- PAL 3 (2022) requirements can be met by expanding the phase 1 and phase 2 aircraft apron further to the east.

- PAL 4 (2027) and PAL 5 (2035) requirements should be met by constructing a RON aircraft parking apron to the west of Runway 3-21.

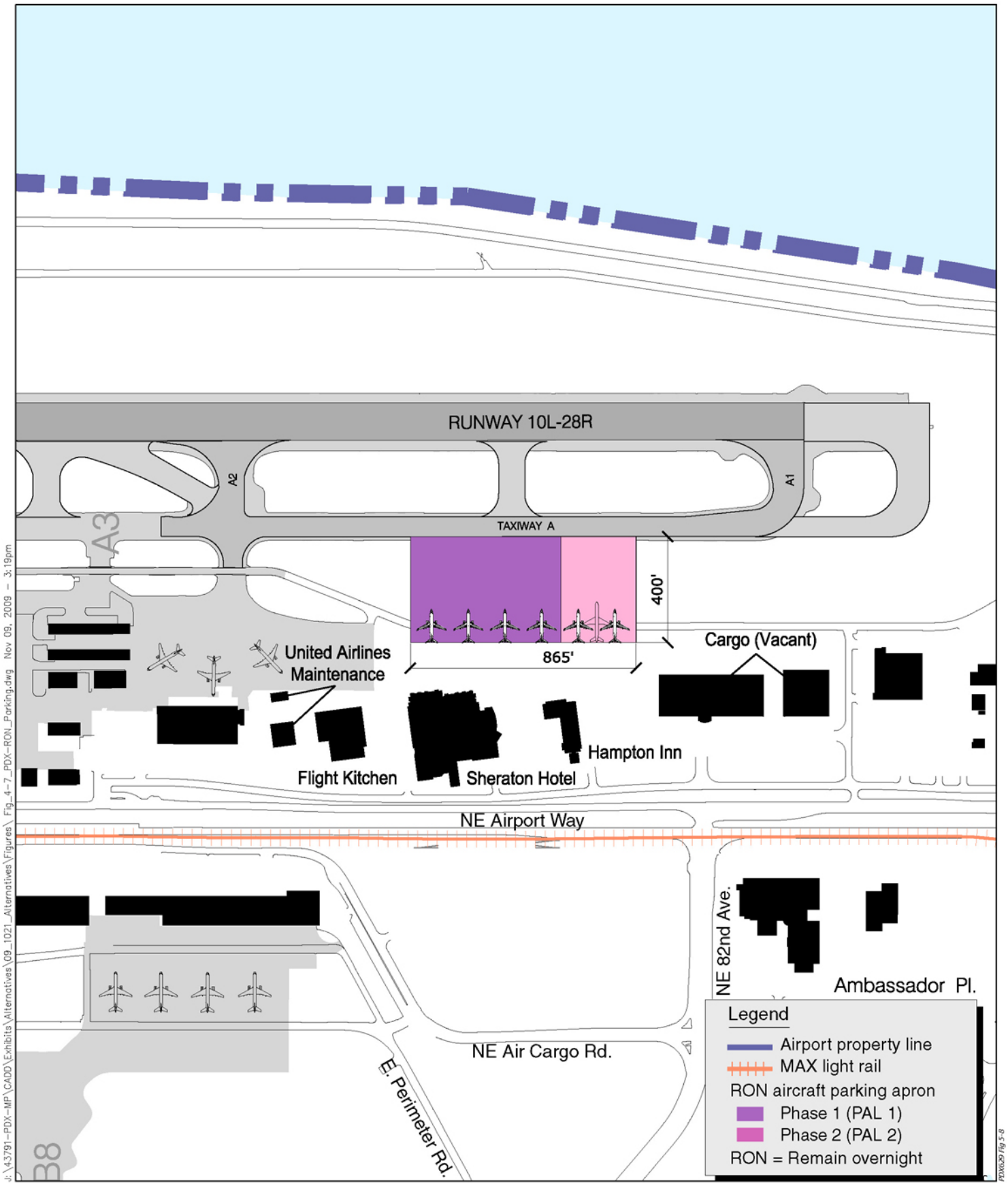


*Figure 5-8*

## *Recommended Concept for PAL 1 and PAL 2 Remain Overnight Aircraft Parking Apron*

*Master Plan Update*
*Portland International Airport*

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0' 500'
Scale: 1" = 500'

*Source: Jacobs Consultancy, November 2009.*

*March 2010*

### *5.4.3* Strategy for Maintaining Terminal Effectiveness

Although no immediate or urgent requirements to modify passenger terminal facilities exist (modest improvements are not necessary until approximately PAL 2), concepts for maintaining their effectiveness will involve investing in opportunities related to six key elements:

- **Ticketing—**The layout of the existing passenger ticket counters is based on outdated procedures and technology (e.g., procedures that assumed most passengers check-in for flights at the ticket counters rather than at home or at common-use kiosks). Although the layout continues to be effective, there may be better alternatives.

- **Ticketing lobby—**The arrangement of the ticketing lobby to accommodate passenger queuing and circulation functions is based on the outdated procedures and technology that resulted in the existing ticket counter concept and layout.

- **Airline ticket office space—**Many of the functions that airline ticket offices, located behind the ticket counters, were originally designed to accommodate have been overtaken by new processes and technology; therefore, the space is underutilized and represents an opportunity for increasing terminal productivity.

- **Concessions—**The concessions program at the Airport is among the best in the United States and should continue to evolve based on the Port's strategy for satisfying changing passenger needs and enhancing revenue. Any future terminal changes should be carefully coordinated with the overall concessions strategy.

- **Passenger security screening—**As noted in *Technical Memorandum No. 3 – Facility Requirements*, as passenger security screening equipment and procedures continue to evolve, it is likely that the layout of the space and equipment dedicated to passenger security screening will change. Moreover, a more effective layout may exist.

- **Mezzanine office space—**With the completion of the Port's new headquarters, atop the P2 parking garage, much of the Port's office space on the mezzanine of the passenger terminal will be vacant. This represents a potential revenue opportunity.

It is possible to significantly enhance the terminal's future effectiveness and improve level of service through a comprehensive remodeling program. Therefore, it is recommended that a passenger terminal master plan be completed to develop a comprehensive strategy and plan to reconfigure level 1 and the mezzanine. A

comprehensive plan and strategy would avoid a piecemeal approach to improvements and ensure: (1) preserving future development options, (2) the most effective use of terminal resources, (3) the most efficient possible passenger processing and the best possible passenger experience, and (4) the maximum possible concessions revenues. This recommended follow-on study is further described in Section 9 of this Summary Report.

## 5.5 Ground Transportation and Parking

Alternatives for providing or improving parking and rental car facilities, enplaning and deplaning curbside roadways, and terminal area roadways and intersections are discussed in this section.

### *5.5.1 Parking*

An analysis was completed to identify and evaluate alternative locations for future parking at the Airport. The primary assumptions used in the analysis were:

- A mix of parking products (i.e., short-term, long-term, and economy) will continue to be offered.
- The long-term and economy lots will remain in their existing locations.
- The size of the long-term lot will contract and expand through the PALs as the facilities in the core development area are developed and modified.
- Structured parking (i.e., garages) can be provided at the potential P3 location (between the future TEE and crossfield taxiways) and the potential P4 location (at the southwest corner of the intersection of NE Airport Way and NE 82nd Avenue). The garages could accommodate both public parking and rental cars.
- In determining the area available for construction of the P3 garage, it was assumed that the crossfield taxiways will be constructed to the east of the locations shown on the existing ALP.
- Total public parking requirements can be met at each PAL by allocating parking demand among the facilities.

The alternatives for providing structured parking at the P3 and P4 sites are shown on Figure 5-9, which illustrates the garages at full buildout and shows the spatial relationship of these garages to the TEE. The next increment of parking required, which will drive the construction of another garage in either the P3 or the P4 location will occur at PAL 2 (2017). Therefore, the Port must decide in the relative near term where to locate the next garage.

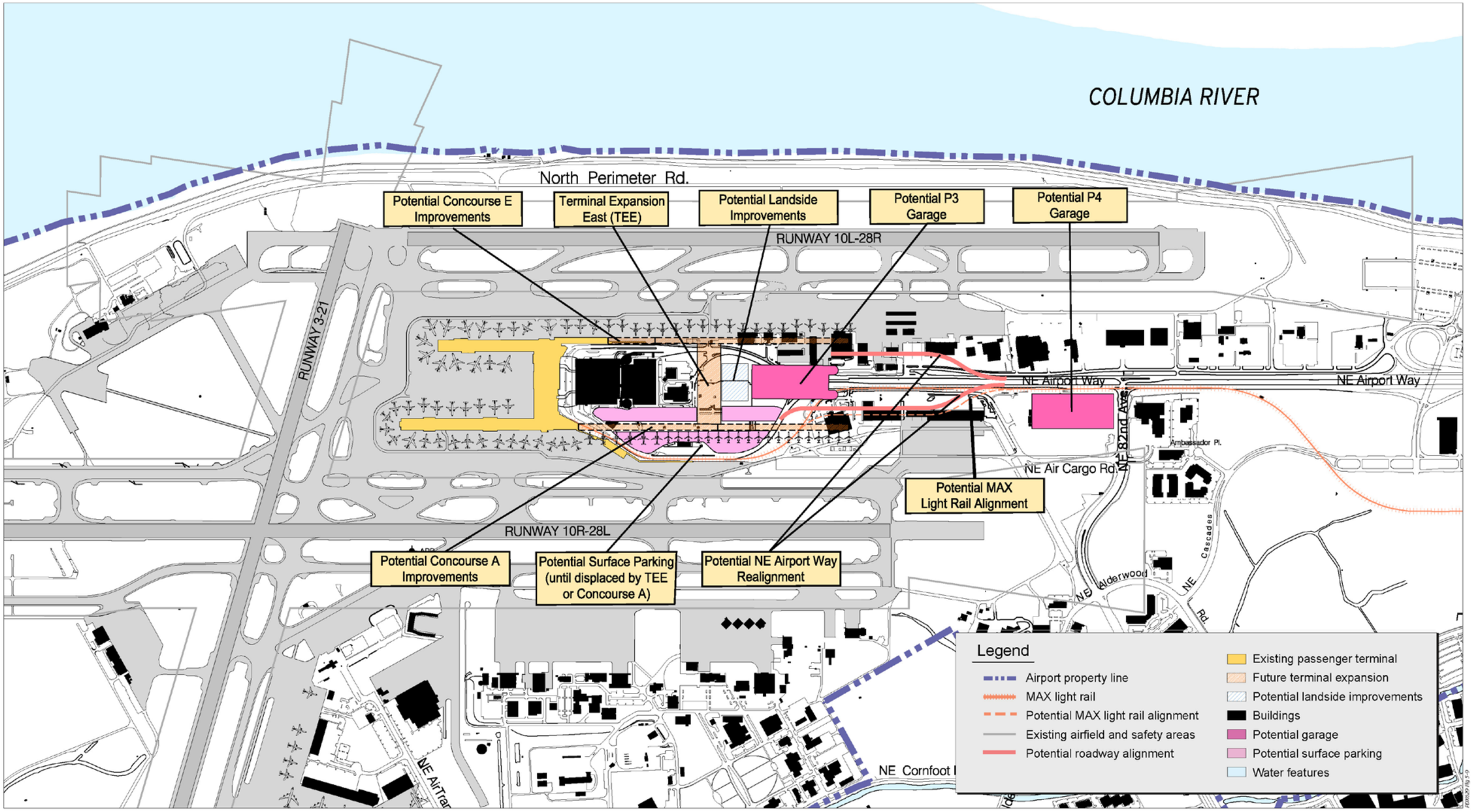


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*Figure 5-9*

*Locations of the P3 and P4 Parking Garages and Other Potential Long-term Development*

*Master Plan Update*
*Portland International Airport*

*Source: Jacobs Consultancy, November 2009*

*March 2010*

Each alternative location has strengths and weaknesses. For example, a strength of the potential P3 location is its proximity to the passenger terminal, and a weakness is that its construction in that location would trigger the relocation of several adjacent facilities, as illustrated on Figure 5-3. These strengths and weaknesses are summarized in Table 5-1 in terms of the applicable planning criteria. Unless future studies indicate that postponing the relocation of adjacent facilities outweighs the benefits related to preserving future flexibility, minimizing environmental impact, and maximizing land use and operational efficiency, the next parking garage should be constructed on the potential P3 site shown on Figure 5-9.

As described in *Technical Memorandum No. 3 – Facility Requirements*, additional employee parking will not be required until PALs 4 and 5. These requirements can be met by expanding the employee parking facility located between NE Alderwood and NE Cornfoot roads.

### *5.5.2 Rental Cars*

Five alternative concepts for locating a future consolidated rental car facility at the Airport were considered:

- Concept 1—the P1 and P2 garages (status quo)
- Concept 2—the P3 garage
- Concept 3—the P4 garage
- Concept 4—a garage located in the existing rental car storage area, west of the intersection of NE Mount Hood Avenue and NE Airport Way
- Concept 5—a garage located east of NE 82nd Avenue and north of NE Alderwood Road, in the Portland International Center

An adjacent at-grade service center is assumed in each concept. In Concepts 1, 2, and 3, a garage that provides a mix of rental car and public parking spaces is assumed. In Concepts 4 and 5, a garage that accommodates rental cars only is assumed.

Given that the consolidated rental car facility would not be needed until PAL 4 (2027), a decision regarding the preferred location for the facility is not needed for the purposes of this Master Plan Update. Furthermore, pending a decision regarding the location of the next public parking garage, which will not be made until a future study is completed, such a decision would be premature. The major factors affecting the decision are discussed in *Technical Memorandum No. 4 – Alternatives*.

### *5.5.3 Enplaning and Deplaning Curbside Roadways*

The enplaning curbside roadway, as currently configured, is expected to be adequate until PAL 4, when an additional lane will be required; a second additional lane will be required at PAL 5. The deplaning curbside roadway is expected to be adequate until PAL 3, when an additional lane will be required; this additional lane would be expected to satisfy the deplaning curbside roadway requirements through PAL 5 (2035).

The enplaning curbside roadway and unloading area requirements may be satisfied by reducing the outer roadway area reserved for noncurbside functions and encouraging drivers to use the outer roadway for passenger unloading.

Two alternatives were identified for satisfying the requirements for deplaning curbside roadways and loading areas—one involves reconfiguring the commercial vehicle area; the other involves new construction. The recommended alternative for satisfying deplaning curbside roadways and loading area requirements involves reconfiguring the commercial vehicle area (located on the lower level between the public roadways and the P1 garage) to provide supplemental deplaning roadway and curbside loading capacity. The alternative would be implemented in two phases, as described and illustrated in *Technical Memorandum No. 4 – Alternatives*.

Reconfiguring the commercial vehicle area is the preferred alternative based on sustainability criteria—its relative costs are lower than the costs for new construction, the reuse of existing facilities is emphasized, and changes to operational procedures are favored over new construction.

### *5.5.4 Terminal Area Roadways and Intersections*

The locations of the terminal area roadways and intersections analyzed and their requirements through PAL 5 are summarized in Section 4.4. The physical alternatives for meeting these requirements and the preferred solutions will be determined in detailed engineering and design studies that will be completed prior to the projects being implemented.

## 5.6 Air Cargo

The PDX Cargo Center, the North Cargo Center, and the Northeast Cargo Complex provide a capacity of approximately 236,000 square feet of processing and warehousing space. This capacity far exceeds the requirement for belly-cargo facilities, even at PAL 5 (2035), when the total requirement is estimated to be 93,000 square feet.

The AirTrans Cargo Center is well designed with excellent landside access for trucking cargo to and from the Airport and excellent airside access for aircraft. Therefore, the AirTrans Cargo Center should continue to be the Airport's primary all-cargo processing

area. The alternatives and recommended strategy for developing all-cargo facilities are as follows:

- The land available in the AirTrans Cargo Center to the north of the Horizon Air Maintenance Center and west of the ground runup enclosure should be developed as necessary to satisfy the all-cargo requirements at the Airport through PAL 1 (2012). A followon study is needed to define the remaining development area, the development potential, and the site layout.

- Following the full buildout of the remaining undeveloped area of the AirTrans Cargo Center, a decision will be needed regarding the best use of the area occupied by the Boeing aircraft maintenance hangar. It is assumed that the all-cargo facilities requirements for PAL 2 (2017) will be met either by converting the aircraft maintenance hangar for use as a cargo warehouse or demolishing it and constructing a new warehouse. Whether the aircraft maintenance hangar should be converted or replaced should be the subject of a followon study. The aircraft ramp associated with the aircraft maintenance hangar is in excellent condition and should be reused.

- When the AirTrans Cargo Center is fully developed, which is expected at PAL 2 (2017), two alternatives will be available for locating subsequent development—the Southwest Quadrant or some portion of the existing military area, should it become available. The military area is preferred because it has the same strengths as the AirTrans Cargo Center, the potential environmental impact would be minimized, land resources would be used efficiently, and operational efficiency would be maximized.

- The military area is under long-term lease; therefore, for planning purposes, it was assumed that all-cargo development at PALs 3 through 5 will occur in the Southwest Quadrant.

## 5.7 General Aviation

Three alternative concepts for accommodating general aviation facilities were identified and assessed: supplement the existing 30-acre general aviation area with a contiguous 13-acre parcel to the east, supplement the existing 30-acre general aviation area with a separate 20-acre area to the east, or prepare a new 50-acre site located adjacent to the fuel farm and capable of accommodating existing and potential general aviation activity.

# 6. LONG-RANGE DEVELOPMENT PLAN AND STRATEGY

The long-range development plan for Portland International Airport is a pragmatic plan that builds on the Airport's success as one of the best planned and managed airports in the United States. Development over the past 15 years has included numerous projects that contributed to this success, including terminal expansions north and south, new roadways, the roadway canopy, an aircraft engine runup facility, award winning concessions, and a new parking garage.

Continued Airport development will be required. However, the long-range development plan is moderated as a result of lower than anticipated forecast demand since the 2000 master plan was prepared and the Airport's superior existing facilities, the application of sustainability principles, and the notion that future changes will increase the use of existing facilities and the efficiency of operations. Moreover, the major features of the Airport (e.g., access via NE Airport Way and NE 82nd Avenue, a single passenger terminal, and a three-runway airfield) will remain relatively unchanged.

## 6.1 Proposed Projects

The locations of airfield, passenger terminal, ground transportation and parking, cargo, and general aviation projects included in the recommended long-range development plan are shown on Figure 6-1. Although a third parallel runway, crossfield taxiways, and new terminal are not needed within the planning horizon (i.e., through 2035), the ability to construct these facilities is protected in the plan if they are needed and approved through both NEPA and City of Portland land use processes.

Projects will be implemented based on planning activity levels. Five PALs, as identified in Table 4-1 along with their corresponding forecast years and levels of activity, were considered. If activity does not materialize as quickly as anticipated, the projects remain valid although the timing of their implementation may change.

The recommended long-range development plan is summarized in the following sections by both Airport functional area and by PAL.

### *6.1.1 Development Plan and Strategy by Airport Functional Area*

The recommended long-range development plan and strategy are summarized below according to projects within the various functional areas of the Airport.

**Airfield**. The plan and strategy for airfield development are to:

- Reserve the area required for a third parallel runway, should it be needed and approved.


## AIRFIELD

1. Reserve the area required for a third **parallel runway to ensure flexibility** if it is ever needed and approved.
2. **Reserve the area required for crossfield** connector taxiways, awaiting their need and approval. (see smaller graphic)

## PASSENGER TERMINAL

3. Reserve the area required for Terminal Expansion East, which will be needed for activity beyond PAL 5. (see smaller graphic)
4. Continuously modify passenger security screening areas as required by the Transportation Security Administration.
5. Increase gate productivity by constructing an additional aircraft parking area north of NE Airport Way for aircraft that remain at the Airport overnight (PALs 1 through 3).
6. Further increase gate productivity by constructing an additional aircraft parking area west of Runway 3-21 for aircraft that remain at the Airport overnight (PALs 4 and 5).

## GROUND TRANSPORTATION AND PARKING

7. Increase capacity at selected roadway intersections (PALs 1 through 5).
8. Increase the productivity of rental car operations by providing low-cost, at-grade service facilities (PALs 1 through 3).
9. Provide additional on-Airport roadway lanes (PALs 1 through 4).
10. Construct a grade-separated interchange at the intersection of NE Airport Way and NE 82nd Avenue (PAL 2).
11. Provide additional structured parking (PALs 2 through 5).
12. Reorganize the commercial vehicle area to increase the capacity of the deplaning curbside and roadway (PAL 3).
13. Develop a consolidated rental car facility (PAL 4).

## AVIATION SUPPORT

14. Provide additional fuel system capacity (PALs 1 through 5).

## AIR CARGO

15. Improve undeveloped parcels or redevelop existing facilities within AirTrans Cargo Center (PALs 1 through 3).
16. Provide additional cargo facilities in the Southwest Quadrant or in other nearby locations that may be available (PALs 4 and 5).

## GENERAL AVIATION

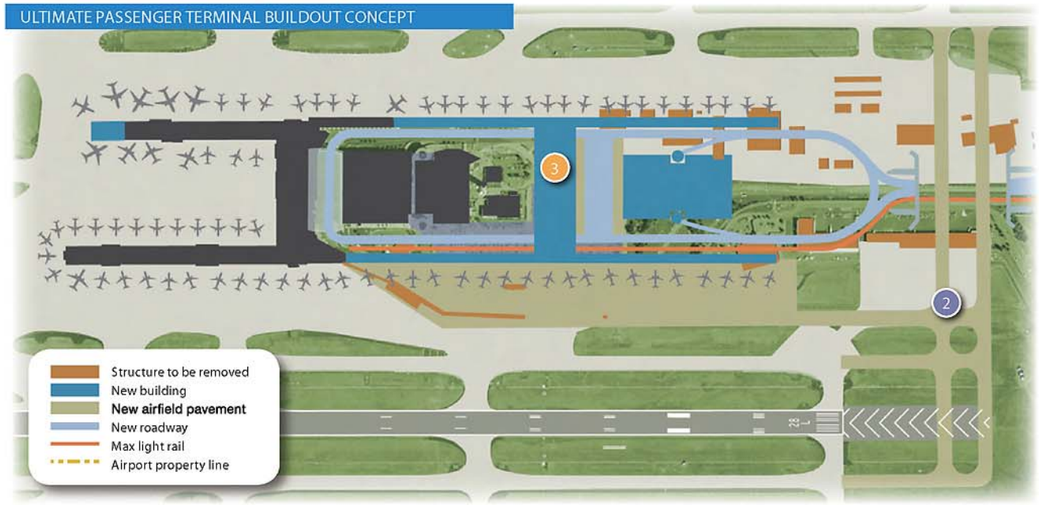
17. Preserve land for interim general aviation expansion.
18. Preserve land to ultimately accommodate all general aviation facilities.

### RELATIONSHIP BETWEEN PALS AND AVIATION DEMAND FORECASTS

| | 2007 Actual | 2012 PAL 1 | 2017 PAL 2 | 2022 PAL 3 | 2027 PAL 4 | 2035 PAL 5 |
|---|---|---|---|---|---|---|
| Passengers (a) | 14.7 | 15 | 18 | 20.6 | 23.7 | 26.8 |
| Cargo (b) | 280 | 322 | 414 | 496 | 594 | 732 |
| Aircraft operations (c) | 265 | 258 | 292 | 318 | 347 | 378 |

(a) millions (b) thousands of metric tons (c) thousands
PAL = Planning activity level

## ULTIMATE PASSENGER TERMINAL BUILDOUT CONCEPT

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MAP NOT TO SCALE

*Figure 6-1*

*Long-Range Development Plan*

*Master Plan Update*
*Portland International Airport*

*March 2010*

*Sources: Jacobs Consultancy, November 2009.*

- Reserve the area required for crossfield connector taxiways, which ultimately will be required to minimize aircraft emissions, fuel consumption, and taxiing times between the terminal gates and the parallel runways.

**Passenger Terminal.** The plan and strategy for passenger terminal facilities development are to:

- Reserve the area required to accommodate Terminal Expansion East. In recommending the Centralized Concept for development, the PAG anticipates that this terminal expansion will be required beyond PAL 5 (2035).

- Continuously modify passenger security screening areas within the terminal, as dictated by the TSA.

- Increase terminal gate productivity by constructing an additional aircraft parking area north of NE Airport Way to accommodate aircraft that remain at the Airport overnight (PALs 1 through 3).

- Further increase terminal gate productivity by constructing additional area to the west of Runway 3-21 to accommodate aircraft that remain at the Airport overnight (PALs 4 and 5).

Although no immediate or urgent requirement exists for major modifications to the main passenger terminal, concepts for maintaining its effectiveness will involve investing in opportunities related to six key functional elements:

- **Ticketing**—The layout of the existing passenger ticket counters is based on outdated procedures and technology (e.g., procedures in which it was assumed that most passengers check in for flights at the ticket counters rather than at home or at common-use self-serve kiosks). Although the layout continues to be effective, there may be better alternatives.

- **Ticketing lobby**—The arrangement of the ticketing lobby accommodating passenger queuing and circulation functions is based on the outdated procedures and technology that resulted in the existing ticket counter concept and layout.

- **Airline ticket office space**—The functions that airline ticket offices, located behind the ticket counters, were originally designed to accommodate have been replaced by new processes and technology; therefore, the space is underused and represents an opportunity to increase terminal productivity.

- **Concessions**—The concessions program at the Airport is among the best in the United States and should continue to evolve based on the Port's strategies for satisfying changing passenger needs and enhancing revenue. Any future

terminal changes should be carefully coordinated with the overall concessions strategy.

- **Passenger security screening**—As passenger security screening equipment and procedures continue to evolve, it is likely that the layout of the space and equipment dedicated to this function will change. Moreover, a more effective layout may exist.

- **Mezzanine office space**—With completion of the Port's new headquarters, much of the Port's office space on the mezzanine of the passenger terminal will be vacant. This vacant space represents a potential revenue opportunity.

It is possible to significantly enhance the terminal's effectiveness and improve level of service through a comprehensive terminal remodeling program. Therefore, it is recommended that a passenger terminal master plan be completed to develop a comprehensive strategy and plan to reconfigure the upper level and the mezzanine. A comprehensive plan and strategy would avoid a piecemeal approach to improvements and ensure (a) the preservation of future development options, (b) the most effective use of terminal resources, (c) the most efficient possible passenger processing and the best possible passenger experience, and (d) the maximum possible concession revenues.

**Ground Transportation and Parking.** The plan and strategy for ground transportation and parking facilities development are to:

- Provide additional capacity at selected roadway intersections (PALs 1 through 5).

- Increase the productivity of existing rental car facilities by providing low-cost at-grade service facilities (PALs 1 through 3).

- Provide additional lanes to the on-Airport roadway system (PALs 1 through 4).

- Construct a grade-separated interchange at the intersection of NE Airport Way and NE 82nd Avenue (PAL 2, 2017).

- Provide additional structured parking (PALs 2 through 5).

- Reorganize the commercial vehicle area to increase capacity of the deplaning curbside and roadway (PAL 3, 2022).

- Provide a consolidated rental car facility (PAL 4, 2027).

**Cargo.** The recommended plan and strategy for developing all-cargo facilities are as follows:

- Improve undeveloped parcels or redevelop existing facilities within the AirTrans Cargo Center (PALs 1 through 3).

- Provide additional cargo facilities in the Southwest Quadrant or other nearby locations that may be available (PAL 4, 2027 and PAL 5, 2035).

During the planning period, it is expected that some of the belly-cargo facilities will be demolished to make way for other development. Accordingly, the recommended plan and strategy for belly-cargo facilities are as follows:

- Initiate specific cargo studies to confirm if the:

  - Realignment of NE Airport Way to construct the P3 parking garage can avoid demolition of the west building in the PDX Cargo Center—if so, the PDX Cargo Center (east and west buildings) would remain viable until the crossfield taxiways are constructed.

  - Grade-separated interchange at NE 82nd Avenue requires demolition of all or part of the Northeast Cargo Complex.

  - Best use of the properties north of NE Airport Way includes retention of the North Cargo Center (also confirm the duration of its retention).

- Pending the results of future studies, do not invest further in the PDX Cargo Center (west building), the North Cargo Center, or the Northeast Cargo Complex.

- Encourage the consolidation of belly-cargo facilities within the PDX Cargo Center over time. The PDX Cargo Center (east and west buildings) appears adequate for accommodating all belly-cargo requirements until construction of the crossfield taxiways results in demolition of the east building.

- If the U.S. Postal Service were to vacate its facility, reserve the space to allow the partial replacement of the PDX Cargo Center's east building when the crossfield taxiways are constructed.

**General Aviation.** The future development of general aviation facilities depends on market-driven conditions. The recommended plan and strategy for general aviation facilities are as follows:

- In the short term, maintain general aviation facilities in their current locations.

- Limit spending on new general aviation facilities pending completion of a future study to determine the timing and effect of adjacent projects (e.g., the P3 garage).

- Preserve land to expand general aviation facilities adjacent to the existing general aviation area.

- Preserve land to accommodate the ultimate relocation of all general aviation facilities.

**Support.** Provide additional fuel system capacity as required.

### *6.1.2 Development Plan by Planning Activity Level*

The recommended long-range development plan is summarized below according to planning activity levels.

**PAL 1 (2012).** The most significant PAL 1 project is the RON aircraft parking ramp, located immediately north of NE Airport Way and the hotel properties. This project will result in increased productivity of the aircraft gates at the terminal.

Supplemental at-grade rental car service facilities, which include fueling positions, car wash bays, and car storage, will be provided east of the existing rental car service facilities. The existing and new rental car service facilities will be connected by a bridge that passes over the ramp leading to the rental car facilities inside the P1 garage.

Projects to improve roadway and intersection performance will be implemented on the terminal exit roadway (a lane addition), the intersection of NE AirTrans Road and NE Cornfoot Road (a signalized intersection), and the intersection of NE Airport Way and I-205 (the addition of space to accommodate queues of eastbound traffic turning north).

Multiple sites have been identified for a second general aviation fixed base operation, if one is required. For illustrative purposes, the site northeast of the intersection of NE Airport Way and NE 82nd Avenue is shown on Figure 6-1. For this project, the Port's costs would be limited to those associated with providing site access, power, and aircraft ramp. Development costs would be borne by a third-party developer or operator.

Undeveloped parcels in the northern portion of the AirTrans Cargo Center would be improved for development as appropriate for all-cargo use by a developer or operator.

Minor projects related to security screening are expected to be implemented within the passenger terminal. As the TSA changes its equipment and procedures associated with passenger security screening, the space associated with the equipment and

passenger processing activities will be rearranged accordingly. These projects are expected to continue throughout the planning period.

**PAL 2 (2017).** Significant projects required to accommodate PAL 2 include the construction of a third public parking garage (providing approximately 2,060 spaces) and a grade-separated interchange at the intersection of NE Airport Way and NE 82nd Avenue. Although the location of the garage will be decided subsequent to completion of the Master Plan Update, it is likely to be immediately east of the CUP and FAA Airport traffic control tower. This site is referred to as the P3 site; the alternate site is referred to as the P4 site.

The RON aircraft parking ramp and supplemental rental car service facilities added to accommodate PAL 1 activity would be expanded and minor projects related to passenger security screening, as described above, would be completed. The existing aircraft fuel storage facilities would be expanded, at no cost to the Port.

All-cargo warehouse and ramp requirements would be accommodated by either reusing or redeveloping the aircraft maintenance hangar located in the southwest corner of the AirTrans Cargo Center.

**PAL 3 (2022).** The public parking garage, RON aircraft parking ramp, and supplemental rental car service facilities constructed at PAL 1 and expanded at PAL 2 would be further expanded at PAL 3.

The existing commercial vehicle area, located between the lower level public roadways and the P1 garage, would be reconfigured to provide supplemental deplaning curbside and roadway capacity.

Additional minor projects related to passenger security screening, as described previously, would be completed and the existing aircraft fuel storage facilities would be further expanded, at no cost to the Port.

Roadway projects would include the addition of a westbound lane to NE Airport Way and the addition of queuing space for traffic traveling northbound on NE Alderwood Road and turning left on NE Cornfoot Road.

When all-cargo activity reaches the level forecast at PAL 3, the AirTrans Cargo Center will be at capacity, and additional all-cargo facilities would be developed in the Southwest Quadrant, unless suitable surplus military facilities are available.

**PAL 4 (2027).** The public parking garage, constructed for PAL 2 and expanded for PAL 3, would be expanded, as would the at-grade employee parking facilities. In addition, a consolidated rental car facility would be constructed at one of five potential locations—the P1 and P2 garages, the P3 site, the P4 site, the rental car storage area

north of NE Airport Way, or a site east of NE 82nd Avenue and north of NE Alderwood Road. For illustrative purposes, the location shown on Figure 6-1 is east of NE 82nd Avenue and north of NE Alderwood Road. With construction of the consolidated rental car facility, the rental car facilities located in the P1 and P2 parking garages would be converted to public parking spaces.

With relocation of the rental cars from the P1 parking garage, space within the commercial vehicle area, which would have been reconfigured at PAL 3, would be rearranged. Taxicabs and other commercial vehicles would be relocated to the P1 parking garage space vacated by the rental cars and the space vacated by the taxicabs and commercial vehicles would accommodate rental car shuttle vehicles. The customer service center vacated by the rental car companies would be converted to a waiting area and service center for commercial vehicle customers.

Roadway projects would include lane additions to NE Airport Way, the P1 parking garage entrance and exit, the terminal exit roadway, the return-to-terminal road, and the deplaning level departure roadway.

Additional RON aircraft parking would be provided to the west of Runway 3-21.

Additional minor projects related to passenger security screening, as described previously, would be completed and the existing aircraft fuel storage facilities would be expanded, at no cost to the Port.

Additional all-cargo development would occur in the Southwest Quadrant, unless suitable surplus military facilities are available.

**PAL 5 (2035)**. Additional structured public parking would be provided by expanding the P3 parking garage and the at-grade employee parking facilities would be expanded again.

The RON aircraft parking ramp constructed at PAL 4 would be expanded to provide additional capacity. Additional minor projects related to passenger security screening, as described previously, would be completed and the aircraft fuel storage facilities would be expanded, at no cost to the Port.

At the intersection of NE 82nd Avenue and NE Alderwood Road, queuing space would be added for eastbound traffic turning right on NE 82nd Avenue.

All-cargo development would continue in the Southwest Quadrant, unless suitable surplus military facilities are available.

## 6.2 Development Costs

Construction of the projects included in the recommended long-range development plan is estimated to cost approximately $1.2 billion, in 2008 dollars. The distribution of estimated costs by functional element and by PAL is shown in Tables 6-1 and 6-2, respectively.

Table 6-1

**TOTAL ESTIMATED COSTS OF PROPOSED PROJECTS THROUGH PAL 5 (2035)**
**BY FUNCTIONAL ELEMENT**
(in millions of 2008 dollars)

| Functional element | Estimated cost | Distribution |
|---|---|---|
| Passenger terminal | $ 43.6 | 3.8% |
| Parking and curbsides | 646.3 | 55.7 |
| Rental car facilities | 221.6 | 19.1 |
| Roadways | 7.9 | 0.7 |
| Key intersections | 124.1 | 10.7 |
| Cargo | 113.8 | 9.8 |
| General aviation | 2.1 | 0.2 |
| Total | $1,159.4 | 100.0% |

Source: Jacobs Consultancy, February 2010.

Table 6-2

**TOTAL ESTIMATED COSTS OF PROPOSED PROJECTS THROUGH PAL 5 (2035)**
**BY PLANNING ACTIVITY LEVEL**
(in millions of 2008 dollars)

| PAL | Estimated cost | Distribution |
|---|---|---|
| 1 (2012) | $ 34.7 | 3.0% |
| 2 (2017) | 247.4 | 21.3 |
| 3 (2022) | 215.9 | 18.6 |
| 4 (2027) | 438.0 | 37.8 |
| 5 (2035) | 223.4 | 19.3 |
| Total | $1,159.4 | 100.0% |

Source: Jacobs Consultancy, February 2010.

## 6.3 Financial Feasibility Analysis

This section summarizes the objectives, approach, and conclusions of the analysis conducted to demonstrate the financial feasibility of the long-range development plan. The analysis was completed by Port financial staff using the Port's financial models.

### *6.3.1 Objectives*

The objectives of the financial analysis were to demonstrate that:

- Airport debt will remain within practical levels.
- Bond covenants related to debt service and reserve funds can be met.
- The Airport enterprise can generate acceptable levels of net income.
- Sufficient financing capacity exists for Airport-related capital expenditures in addition to those included in the long-range development plan.
- Airline rates and charges at the Airport will remain competitive.
- Passenger rates and charges at the Airport will remain competitive.

### *6.3.2 Approach*

In the analysis, Port financial staff assumed the conservative and proven strategies of (a) using "pay-as-you-go" funding to reduce borrowing, (b) issuing Airport revenue bonds to bridge funding gaps, and (c) using Airport revenues to pay bond debt service.

The approach to the financial analysis involved the following steps:

- The estimated costs for the projects identified in Section 6.1 were combined with the estimated costs for all other projects in the Airport's existing capital improvement program.
- Operating and maintenance expenses were estimated based on a review of historical trends, anticipated inflationary increases, costs related to the growth in aviation demand, and changes that could result from proposed capital improvement projects.
- The Airport's total funding requirements were estimated annually through 2035 (the timing of projects as described in Subsection 6.1.2 was assumed), and compared with funds available from "pay-as-you-go" funding sources. The "pay-as-you-go" funding sources considered include:
  - FAA Airport Improvement Program grants

  - Passenger facility charge revenues
  - TSA grants
  - State, local, and other funding
  - Airport discretionary cash flow from operations

- Funding gaps (i.e., amounts by which the Airport's total funding requirement will exceed the amount available through "pay-as-you-go" funding sources) were identified.
- The ability to bridge the funding gaps using bond proceeds was verified by testing the ability of the Airport enterprise to meet the customary financial requirements associated with bond issuances. Such requirements include debt service coverage and the maintenance of debt service reserve funds.

### *6.3.3 Conclusions*

The conclusions from the financial analysis were that the objectives outlined in Section 6.3.1 can be met—it is feasible to fund the long-range development plan.

As stated previously, a fundamental assumption underlying the long-range plan is that projects will be implemented based on demand. If demand does not materialize as quickly as anticipated, the projects remain valid although the timing of their implementation may change.

# 7. NOISE EXPOSURE ANALYSIS

This section describes the noise exposure analysis completed to inform the long-term land use planning process for the Airport.

## 7.1 Background and Purpose

The purposes of the analysis were to (a) assess the potential noise exposure in areas surrounding the Airport through PAL 5 (2035), and (b) compare the noise exposure in the potentially affected areas with that in areas in which the City of Portland has restricted the development of noncompatible uses (i.e., residential development).

The FAA, the U.S. EPA, and the Oregon Department of Environmental Quality have determined that residential land uses are not compatible with noise exposure above a threshold defined as day-night average sound level (DNL) 65 (expressed in A-weighted decibels, or dBA). DNL is a noise metric developed by the U.S. EPA and used in most FAA-sponsored noise analyses. To help enforce its restrictions on noncompatible development around the Airport, the City has developed a boundary—referred to as the X-Overlay—that identifies where restrictions apply. The X-Overlay is based on the DNL 65 noise exposure contour from an aircraft noise analysis completed for the Port in 1990.

## 7.2 Approach

The noise analysis consisted of three primary elements: (a) use of the FAA's Integrated Noise Model (INM) to determine noise exposure, (b) definition of scenarios representing various levels of aviation demand, facilities, and procedures expected to be in use at the Airport at PAL 5, and (c) development of INM inputs based on those defined scenarios. In addition to the DNL contours, contours for two supplemental metrics, time-above and number of-events-above, were produced for this analysis.

### *7.2.1 Integrated Noise Model*

Noise exposure areas are typically defined as areas in which aircraft noise equals or exceeds defined levels; the boundaries of those areas are referred to as noise contours. The INM is used to produce DNL noise contours centered around the Airport's runways. DNL is designed to represent the cumulative noise level in an area for a 24-hour period during any given year. The INM computes DNLs by summing the noise produced by all aircraft events during a 24-hour period, adding an extra 10 decibel weighting penalty to reflect the significance of nighttime noise—from aircraft operations occurring between 10:00 p.m. and 7:00 a.m.

In the calculation of DNL in the INM, a considerable number of variables are taken into account. Variables having the greatest effect on noise exposure are numbers of annual aircraft operations, the aircraft fleet mix serving the Airport, airfield geometry, time of

operation, and expected flight paths. To estimate noise exposure for different combinations of activity (annual operations/time of operation), facilities (airfield geometry), and procedures (flight paths) at Portland International Airport, four scenarios were defined, as described in the following subsection.

### *7.2.2 Noise Analysis Scenarios*

The highest number of annual aircraft operations identified in *Technical Memorandum 2 – Aviation Demand Forecasts* is forecast to occur at PAL 5. Therefore, the four scenarios were all developed for PAL 5 at two levels of forecast demand: the 50th and 90th percentiles. The forecasts were also based on future flight schedules, which were used to determine time of operation.

Scenario 1 represents future Airport conditions at PAL 5, assuming the 50th percentile forecast level of activity. Scenario 2 represents future Airport conditions at PAL 5, at the 90th percentile forecast level of activity. Scenario 3 represents the same activity assumptions as Scenario 2, but incorporates modified jet aircraft departure flight paths, reflecting dual-stream operations.

Currently, the flight paths of jets departing from the Airport merge over the Columbia River, focusing noise exposure over the water. Changing to a dual-stream mode of operation, where jets would not converge into a single stream over the river, is a capacity-enhancing measure expected to be implemented if the 90th percentile of PAL 5 forecast demand occurs.

Scenario 4 represents another capacity-enhancing measure likely to be implemented when the 90th percentile of PAL 5 forecast demand is reached—the addition of a third parallel runway south of existing Runway 10R-28L. With the third parallel runway, aircraft would arrive and depart in three independent streams—referred to as "triple stream" operations. Additional information pertaining to each scenario is presented in Table 7-1.

### *7.2.3 Integrated Noise Model Inputs*

The variables for this noise analysis were derived from the INM databases for the 2017 Noise Exposure Map (NEM) developed as part of the *Federal Aviation Regulations (FAR) Part 150 Noise Exposure Map Update* for the Airport. The number of annual aircraft operations, aircraft fleet mix, time of operation, airfield geometry, and expected flight paths (flight tracks) have the greatest effect on the size and shape of the areas affected by aircraft noise. INM inputs for the four scenarios are provided in Appendix C of *Technical Memorandum No. 4 – Alternatives*.

Table 7-1

**NOISE EXPOSURE ANALYSIS SCENARIOS**

| | Scenario 1 | Scenario 2 | Scenario 3 | Scenario 4 |
|---|---|---|---|---|
| Annual aircraft operations | 377,820 | 567,140 | 567,140 | 567,140 |
| Annual average day operations *(a)* | 1,035 | 1,553 | 1,553 | 1,553 |
| Departure restrictions | Yes | Yes | No | No |
| Airfield | Existing | Existing | Existing | Addition of third parallel runway |

*(a)* Numbers may vary slightly from the forecasts because of rounding.

Source: Jacobs Consultancy, *Technical Memorandum No. 2 – Aviation Demand Forecasts*, September 2008.

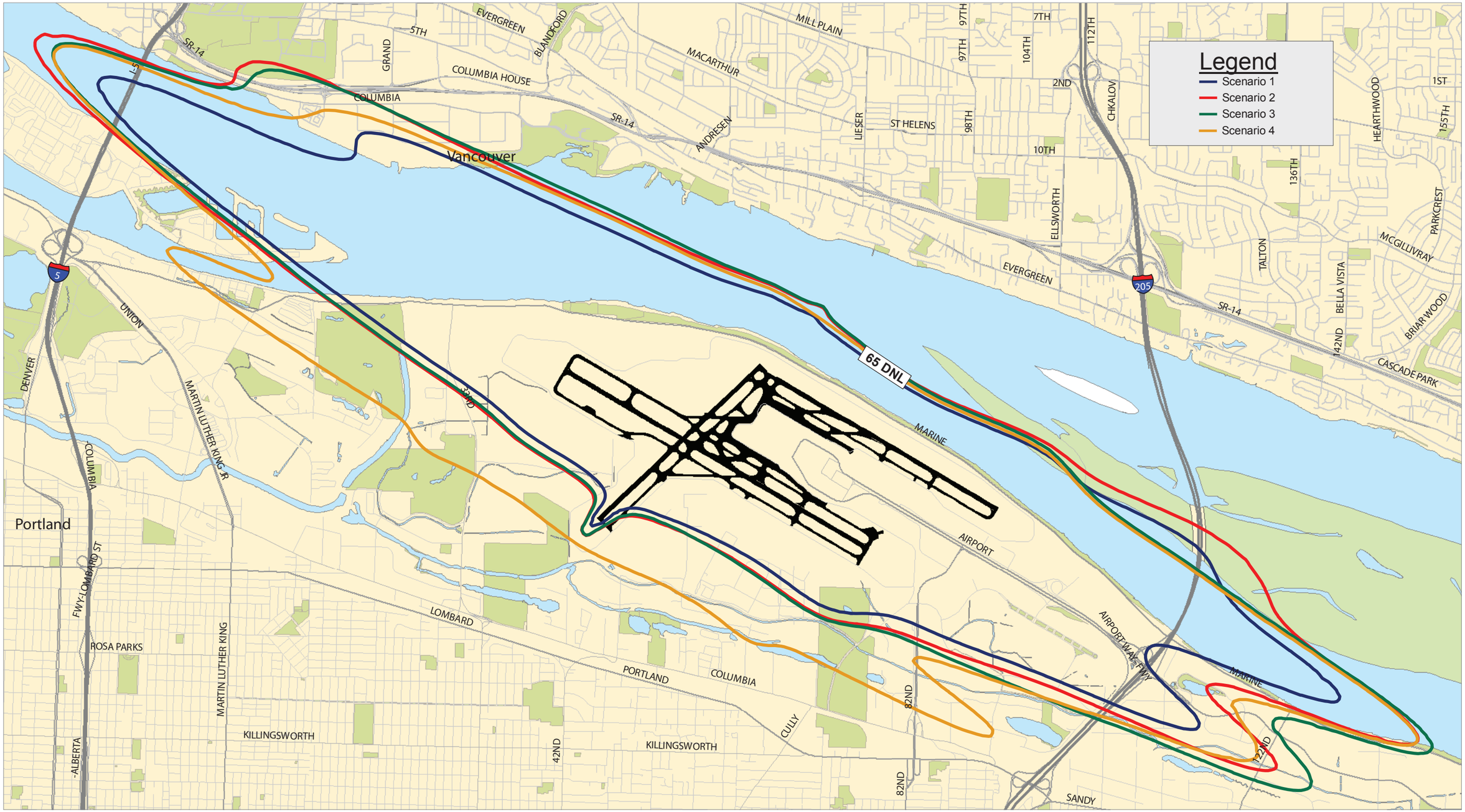
## 7.3 Results

DNL noise exposure contours for each scenario were compared to determine which scenario(s) would produce the greatest amount of future noise exposure. Figure 7-1 presents a comparison of each scenario's DNL 65 contour. As presented on Figure 7-1, it was determined that Scenarios 3 and 4 would produce the greatest amount of future noise exposure.

The contours produced for Scenarios 3 and 4 were then compared to the X-Overlay to determine the amount of future noise exposure not encompassed within the existing overlay boundary. Figures 7-2 and 7-3, respectively, present comparisons of Scenarios 3 and 4 with the X-Overlay.

The DNL 65 contour for Scenario 3 encompasses about 6,300 acres. Approximately 1,000 acres within the DNL 65 contour for Scenario 3 are not encompassed by the X-Overlay. The majority of this area, approximately 900 acres, consists of the Columbia River. The remaining area is located southeast of Airport property.

The DNL 65 contour for Scenario 4 encompasses about 7,000 acres. Approximately 1,200 acres within the DNL 65 contour for Scenario 4 are not encompassed by the X-Overlay. About half of this area, approximately 600 acres, consists of the Columbia River. The remaining 600 acres are located south of Airport property.




AIRPORT FUTURES
CHARTING A COURSE FOR PDX

0' 3,000'
Scale: 1" = 3,000'

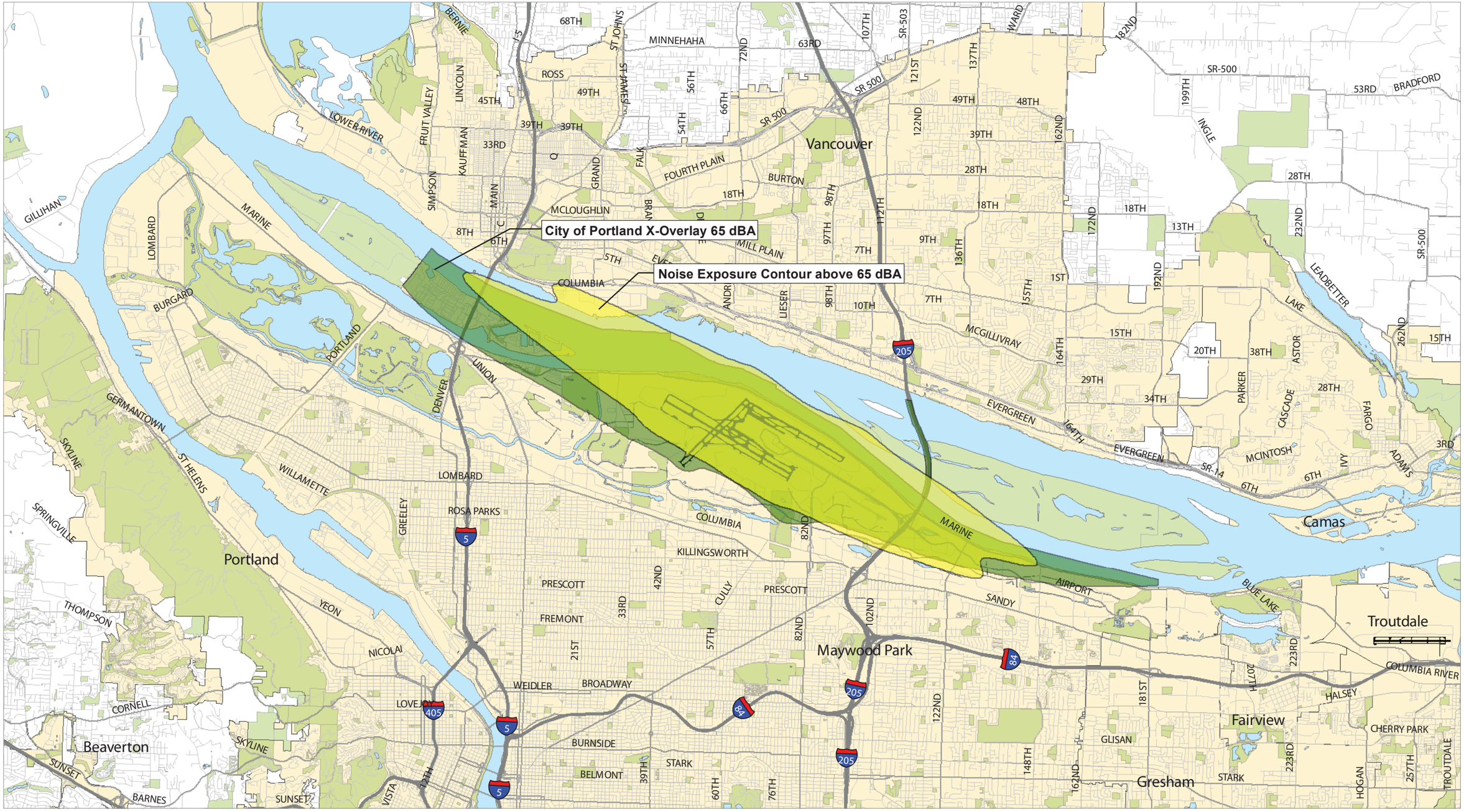
*Figure 7-1*

*Comparison of DNL 65 Contours for Scenarios 1 through 4*

*Master Plan Update*
*Portland International Airport*

*March 2010*

*Sources: Jacobs Consultancy - Noise Exposure Contours, June 2009; Port of Portland - Basemap, June 2009.*




AIRPORT FUTURES
CHARTING A COURSE FOR PDX

0' 7000'
Scale: 1" = 7000'

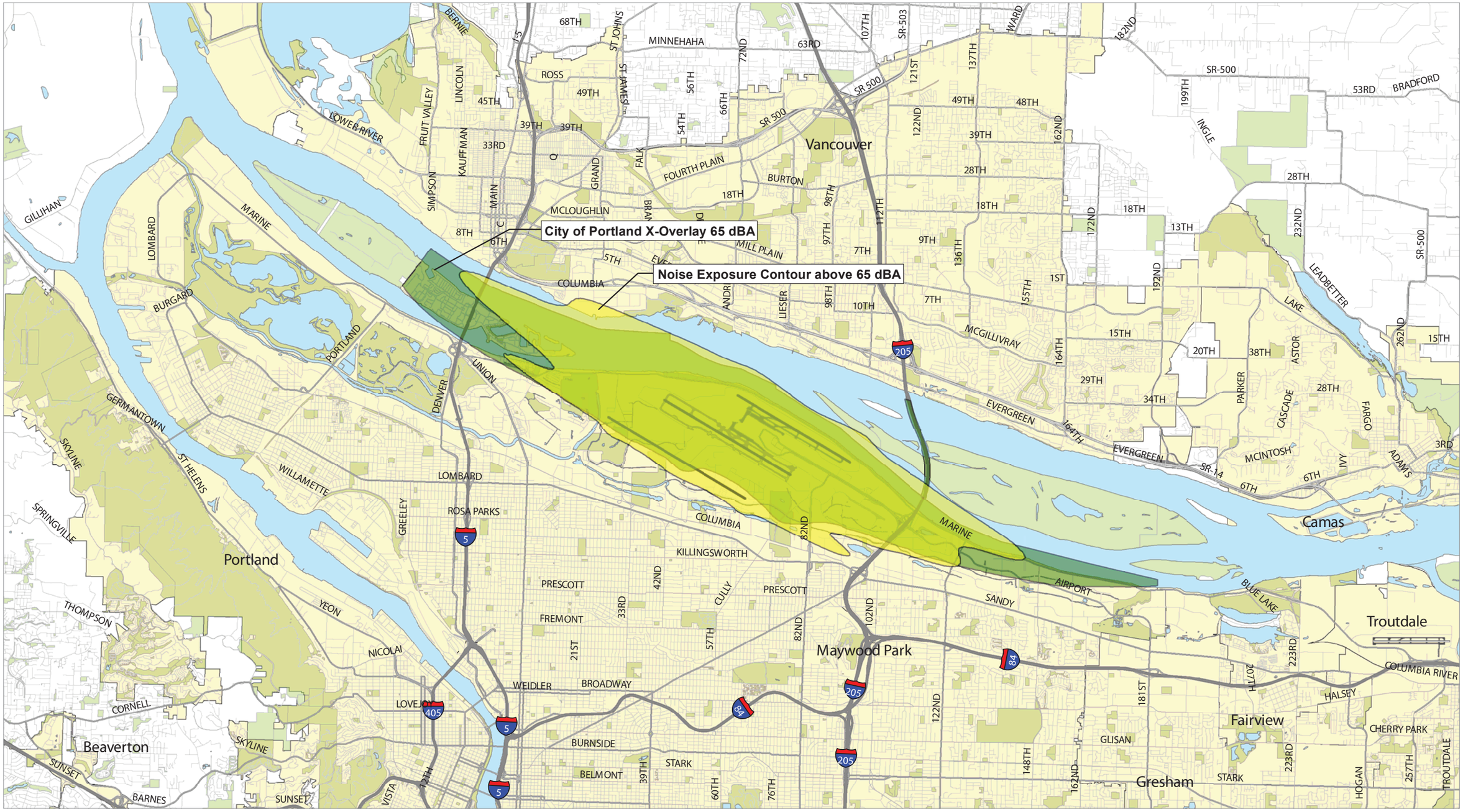
*Figure 7-2*

*Comparison of Scenario 3 DNL 65 Contour with X-Overlay*

*Master Plan Update*
*Portland International Airport*

*Sources: Jacobs Consultancy - Noise Exposure Contours, June 2009; City of Portland - X-Overlay, June 2009; Port of Portland - Basemap, June 2009.*

*March 2010*




AIRPORT FUTURES
CHARTING A COURSE FOR PDX

0' 7000'
Scale: 1" = 7000'

*Figure 7-3*

*Comparison of Scenario 4 DNL 65 Contour with X-Overlay*

*Master Plan Update*
*Portland International Airport*

*Sources: Jacobs Consultancy - Noise Exposure Contours, June 2009; City of Portland - X-Overlay, June 2009; Port of Portland - Basemap, June 2009.*

*March 2010*

# 8. LAND USE PLAN

This section summarizes the land use plan prepared by the City of Portland during Airport Futures.

## 8.1 Overview

The principles guiding Airport Futures and the primary outcomes of the land use plan are summarized in Table 8-1.

Table 8-1

**PRIMARY OUTCOMES OF THE LAND USE PLAN**

| Guiding Principle | Outcome |
|---|---|
| Allow the City to address the complex issues associated with the Airport and their potential impacts | Recognizing the potential impacts of growth (e.g., impacts to natural resources, traffic, and noise), the land use plan provides for the mitigation of impacts and assurances to the community that significant new Airport development (e.g., a third parallel runway or decentralized terminal configuration) will involve a significant planning process and Portland City Council approval. |
| Give the community greater opportunity to influence Airport planning and development | Recognizing that planning is a continuous process, the land use plan provides an ongoing and highly collaborative public involvement process to address future issues associated with operating an airport in an urban area. |
| Provide the Port with flexibility to respond to changing circumstances | Recognizing the importance of PDX to the bi-state regional economy, the land use plan provides the Port with certainty that PDX will continue to operate as an allowed use in its current location and the flexibility of configuring PDX facilities to be responsive to future needs. |

The land use plan will be implemented through Comprehensive Plan Goals and Policies (also referred to as the Comprehensive Plan) amendments, zoning code amendments, and intergovernmental agreements between the City and the Port. These amendments and agreements and the analyses that influenced them—the key components of and inputs to the land use plan—are summarized below.

- **Comprehensive Plan Amendments.** Amendments were adopted to address issues identified during Airport Futures and strengthen the importance of partnerships, investments, and regulations to achieve the City's goals and objectives. The Comprehensive Plan map was amended to change the designation of two areas from employment lands to industrial lands.

- **PDX Plan District and Other Zoning Code Amendments.** The new PDX Plan District (Plan District) was developed to implement the land use plan. The PDX Plan District and other zoning code amendments change the Airport to an allowed used in an industrial zone, prohibit a third parallel runway and decentralized terminal, and specify reviews based on the potential impacts of development proposals to the community. The zoning map was amended to change the designation of two areas from employment lands to industrial lands.

- **Aircraft Landing Overlay Zone Amendments.** This overlay zone, which provides safer operating conditions for aircraft in the vicinity of the Airport by limiting the height of structures and construction equipment, was amended to more clearly define height restrictions to building permit applicants, improve coordination with the FAA, and apply to a larger area. The overlay zone was applied to East Portland and East Hayden Island, which were annexed after the overlay zone was originally applied.

- **Airport Noise Impact Overlay Zone Amendments.** This overlay is intended to reduce the effect of aircraft noise on development in the Airport vicinity by limiting residential densities and requiring noise insulation, noise disclosure statements, and noise easements. The current overlay will be retained. The area that requires noise disclosure statements for new development was expanded to partially address the impact of noise outside the 65 DNL noise contours. Additionally, a noise working group was created to provide leadership in addressing noise outside the 65 DNL noise contours.

- **Environmental Program (Natural Resources) Amendments.** The City amended its Environmental Program to comply with Metro Titles 3 and 13, Statewide Planning Goal 5, the Clean Water Act, and the Endangered Species Act. The amended program identifies mitigation required for future impacts to natural resources, allows for the conversion of habitats to address wildlife hazards, and outlines a program to help achieve the PAG's goal of contributing to the overall enhancement of the Columbia Slough watershed.

- **Transportation Impact Analysis.** This analysis identified transportation mitigation projects based on Airport growth, created a City review process for all future transportation impact analyses, tested numerous strategies to increase transit ridership, and addressed community concerns regarding cut-through traffic.

- **Economic Development Inventory.** An economic development inventory identified the current economic benefits of the Airport, market potential, site and infrastructure needs, and current and strategic opportunities.

The following sections present additional information related to the Comprehensive Plan amendments and the PDX Plan District and other zoning code amendments.

## 8.2 Comprehensive Plan Amendments

The Comprehensive Plan, as amended during Airport Futures, is the framework and policy foundation for the land use plan as well the zoning code amendments and inter-governmental agreements that will implement the land use plan. The following amendments to Comprehensive Plan goals 1, 5, 8, and 11 were adopted to implement the recommendations of the PAG:

- **Goal 1 – Metropolitan Coordination**—Amendments to Goal 1 include collaborating with the Port to work toward assuring that PDX becomes the "most sustainable airport in the world."

- **Goal 5 – Economic Development**—Amendments to Goal 5 include adopting the Master Plan Update by reference and adding language to highlight the economic importance of PDX to the region.

- **Goal 8 – Environment**—Amendments to Goal 8 include referencing the environmental regulations of the new Portland International Airport Plan District, modifying language related to land beneath the 68 DNL and 65 DNL noise contours, and adding disclosure language related to land beneath the 55 DNL noise contour.

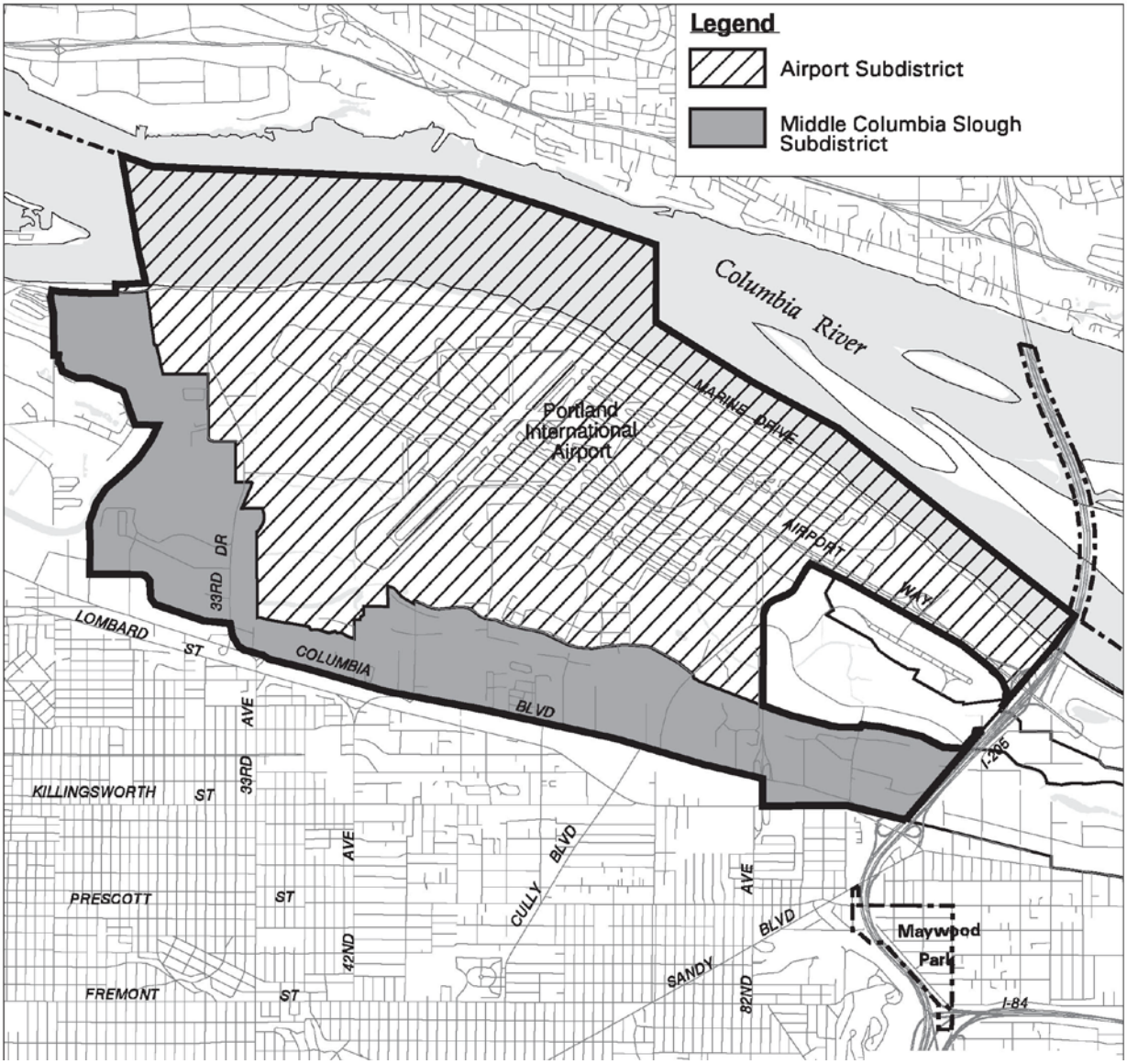
- **Goal 11 – Public Facilities**—Amendments to Goal 11 include changes similar to those for Goals 1 and 5, as well as specific references to the proposed zoning code amendments, references to the Airport facilities map and sustainability goals, and language regarding flexibility for the Port in Airport operations, management, and development over time.

## 8.3 PDX Plan District and Other Zoning Code Amendments

A plan district is an entire area that has special characteristics and is regulated by a special set of zoning regulations and development standards. The new PDX Plan District, shown on Figure 8-1, is one of the regulatory tools created to implement the land use plan by addressing the social, economic, and environmental aspects of growth and development at Portland International Airport.

Figure 8-1

**PORTLAND INTERNATIONAL AIRPORT PLAN DISTRICT BOUNDARIES**




Source: City of Portland.

The Airport is a unique land use within the City and requires tailored regulations to address wildlife hazards and impacts to transportation and natural resources. The PDX Plan District provides flexibility for the Port of Portland—the owner of PDX—to address a constantly changing aviation industry, while addressing the broader community impacts of operating an airport in an urban environment.

The following are highlights of the PDX Plan District and other zoning code amendments.

- Airport and customary Airport uses are allowed by right within the Airport Subdistrict
- Hotel uses are allowed by right on industrially zoned land within the Airport Subdistrict
- Development inside the security fence is not regulated (e.g., taxiways, lighting equipment, etc.), except for a third parallel runway which is prohibited
- A decentralized terminal is prohibited
- Review of transportation impacts will be based on passenger levels, rather than a rigid timeline
- Review of new development/uses in the Southwest Quadrant of the Airport will be based on the adequacy of public services
- New landscaping standards and an Airport specific plant list that address wildlife hazards
- Pedestrian standards for retail and office development
- Requirement for notices to be mailed to neighborhood associations, coalitions, and the PDX Community Advisory Committee (PDX CAC) when major new development is proposed
- Airport specific Type III Land Use Review posting notice requirements to better inform the community about development projects
- Archaeological resource protection provisions required by State law
- Requirement that all road crossings of the Columbia Slough be by bridge
- Requirement that pavement within environmental zone transition areas be removed and revegetated as part of major development/redevelopment
- Exemption from City environmental regulations for usual and customary drainage district activities
- Exemption from City environmental regulations for usual and customary wildlife hazard management practices

- Special development standards for development near natural resources, including habitat conversion

The Planning Advisory Group reviewed the facility requirements from the Master Plan Update and City review procedures to determine the type and level of review that is appropriate for development at PDX. The Land Use/Transportation subcommittee then met with the Public Involvement subcommittee to discuss possible triggers for review. The following ideas resulted from the discussion:

- Minor development and programmatic development (maintenance and repair) should not be reviewed by the City or the PDX CAC.

- The PDX CAC will review the Port's capital improvement list annually to identify any programmatic development that would benefit from input from the committee

- The City should review projects if there are potential impacts beyond the boundary of PDX

- The Port will inform the PDX CAC of upcoming projects

- Major projects, such as the 3rd parallel runway, will require a new legislative process similar to Airport Futures.

# 9. FUTURE STUDIES

Fourteen future studies necessary to finalize key development decisions were identified during the master planning process. The objectives of the future studies are summarized below and their timing is summarized in Table 9-1.

## 9.1 Passenger Terminal Master Plan

Although no urgent requirements to modify Airport passenger terminal facilities exist, it is possible to significantly enhance the passenger terminal's future effectiveness through a comprehensive terminal master plan.

The objective of a passenger terminal master plan would be to evaluate the terminal in its entirety and develop a comprehensive strategy and plan to reconfigure Level 1 and the mezzanine, thus avoiding a piecemeal approach to improvements and ensuring (a) the most effective possible passenger processing, (b) the best possible passenger experience, and (c) the maximum possible concession revenues.

This objective meets the sustainability criteria to preserve future development options and maximize operational efficiency while minimizing the environmental impacts associated with building new facilities. Also, it would result in an effective phasing plan for terminal development.

## 9.2 Terminal Expansion East Project Definition Study

TEE will provide supplemental passenger processing facilities when the existing passenger terminal reaches capacity. Although the facilities are not expected to reach capacity within the planning horizon considered in the Master Plan Update (through 2035), TEE is within the Airport's core development area and would affect or be affected by other facilities that must be modified or constructed in the relatively near term. The ultimate success of TEE depends on the extent to which the operation of these dependent facilities is effectively integrated through thoughtful planning and design.

The objective of a TEE project definition study would be to complete a sufficient amount of preliminary TEE and related facilities design to understand and document the (a) concept of TEE and major related facilities operation (e.g., how origin, destination, and transfer passengers and baggage would be processed and how ground transportation functions would operate), (b) program and vertical and horizontal dimensional requirements for TEE and major related facilities, and (c) likely construction sequence for facilities related to TEE and the timing of and effects on existing facilities.

Table 9-1

**TIMING OF RECOMMENDED FUTURE STUDIES**
**BASED ON 50TH PERCENTILE FORECASTS**

| | | Complete within 2 years | Initiate within 2 years | Initiate within 4 years | Other |
|---|---|---|---|---|---|
| 1. | Passenger Terminal Master Plan | | X | | |
| 2. | Terminal Expansion East Project Definition | | X | | |
| 3. | North Side Properties Redevelopment Study | | X | | |
| 4. | P4 Parking Garage Project Definition | | X | | |
| 5. | All-Cargo Development Study | | | | X *(a)* |
| 6. | Gate Management and Operations Study | | | | X *(b)* |
| 7. | Concourse A Improvements Study | | | | X *(c)* |
| 8. | Concourse E Regional Airline Holdroom Improvements | | | | X *(d)* |
| 9. | Aircraft Rescue and Fire Fighting Facilities Siting Study | | | | X *(e)* |
| 10. | NE 82nd Avenue Grade-Separated Interchange Project Definition | X *(f)* | | | |
| 11. | High-Speed Rail Study | | | | X *(g)* |
| 12. | Remain Overnight Aircraft Parking Ramp Design Study | | X | | |
| 13. | Commercial Vehicle Roadway Redevelopment Study | | | | X *(h)* |
| 14. | Enplaning Roadway Study | | X | | |

Note: Timing indicated is relative to completion of the 2010 Master Plan Update, assuming increases in passengers, cargo, and aircraft operations in accordance with the 50th percentile forecasts. The need for all future studies will be monitored and their timing adjusted consistent with demand.

*(a)* Consistent with activity and before further development within the AirTrans Cargo Center.
*(b)* When improvements would be beneficial and the study is justified.
*(c)* When justified by activity and input from Horizon Air.
*(d)* When justified by holdroom use and input from United Airlines and SkyWest Airlines.
*(e)* When FAA requirements cannot be met with existing facilities.
*(f)* Should be completed before or in conjunction with the North Side Properties Redevelopment Study and the P4 Parking Garage Project Definition (studies 3 and 4 above).
*(g)* Consistent with the region's high-speed rail plans.
*(h)* Consistent with activity and the need to accommodate PAL 3 requirements.

Source: Jacobs Consultancy, March 2010.

## 9.3 North Side Properties Redevelopment Study

The north side properties are located north of NE Airport Way, between Concourse E and Mt. Hood Avenue. Some of the properties are fully occupied (e.g., those used by general aviation), some are underutilized (e.g., the North Cargo Center), and at least one is vacant (the Delta Cargo facilities). All are subject to future relocation or redevelopment as required for higher and better use of the land (e.g., the extension of Concourse E to the east).

The objectives of the redevelopment study would be to define:

a. How the land envelope for the north side properties will be affected by adjacent short- and long-term development, such as TEE and the P3 parking garage, the crossfield connector taxiways, and the grade-separated interchange at NE Airport Way and NE 82nd Avenue.

b. Appropriate land uses, both interim and permanent, for the north side properties.

c. Investments or facilities modifications that could permit maximum use of these valuable north side properties.

d. The plan for additional RON aircraft parking positions to be constructed at PAL 1 (2012).

## 9.4 P4 Parking Garage Project Definition Study

The P4 parking garage site is located immediately northwest of the intersection of NE Airport Way and NE 82nd Avenue. Both the P3 site and the P4 site have been identified as potential locations for the next increment of on-Airport structured parking. In addition, it is believed that either site could accommodate the future consolidated rental car facility.

The objectives of a P4 parking garage project definition study would be to:

a. Determine the utility of the P4 site as a construction staging and laydown area and recommend whether this utility is sufficient to justify delaying development of the site until after the P3 site is developed.

b. Prepare a drawing illustrating the area available for development considering completion of the grade-separated interchange at NE Airport Way and NE 82nd Avenue.

c. Determine the size and layout of the garage if it were to accommodate public parking only or both public parking and a consolidated rental car facility.

d. Evaluate the differences if rental car hold and staging facilities are at grade and outside the garage vs. inside the garage.

e. Identify the number of public parking spaces available for the two optional configurations defined in objective 3, above.

f. Develop a P4 site access/egress plan that provides clear public access while not compromising the operations of NE Airport Way, NE 82nd Avenue, and the light rail system.

## 9.5 All-Cargo Development Study

At PAL 2 (2017), when all-cargo activity reaches 384,000 short tons per year, an additional 129,000 square feet of warehouse space will be required. The AirTrans Cargo Center is the preferred location for development of future all-cargo facilities; however, its capacity is limited.

The objectives of the all-cargo development study would be to:

a. Determine if the existing aircraft maintenance hangar should be converted for use as a cargo warehouse, demolished and replaced with a new cargo warehouse, or retained as is.

b. Identify the site or sites remaining within the AirTrans Cargo Center for all-cargo development.

c. Identify sites within the AirTrans Cargo Center that could be redeveloped to permit more efficient use of the area.

d. Prepare plans illustrating the incremental all-cargo development potential of the sites remaining in the AirTrans Cargo Center and the actions required to complete development. Account for the potential effects of governing criteria, such as those in FAR Part 77, *Objects Affecting Navigable Airspace*.

e. Identify the potential for all-cargo development or redevelopment of some portion of the property currently leased by the military, should that property become available. Account for the potential effects of governing criteria, such as those in FAR Part 77.

f. Prepare plans illustrating the potential for phased all-cargo development in the Southwest Quadrant of the Airport.

## 9.6 Gate Management and Operations Study

The Port's long-term strategy is to increase gate use from approximately four daily turns (a turn is the arrival and departure of a single aircraft) per gate to approximately six daily turns. This strategy, which is based on the assumption that common-use gate practices will be implemented, when combined with the somewhat limited area available for ground service equipment staging and storage, may increase the difficulty of managing and operating aircraft gates.

The objectives of the gate management and operations study would be to:

a. Document the amount of ground service equipment associated with airline passenger aircraft currently at the Airport by owner/operator, where that equipment is stored and staged, how it is managed, and current management issues.

b. Assess how and why these management issues may be exacerbated in the future by increased gate utilization through increased common use.

c. Identify alternatives to facilitate the management and operation of the gates with respect to staging and storing ground service equipment.

This study would emphasize the Port's commitment to sustainability by maximizing operational efficiency.

## 9.7 Concourse A Improvements Study

Holdroom space on Concourse A is currently deficient and will become further deficient in the future as larger capacity aircraft (e.g., the Bombardier Q-400) enter service. This deficiency is partially mitigated by adjacent concession spaces that provide passengers with additional seating area. Although Concourse A will ultimately be demolished and reconstructed to permit the extension of Taxiway T, interim improvements may be justified.

The objectives of the Concourse A improvements study would be to identify (a) alternatives for increasing passenger comfort and convenience in Concourse A, and (b) the timing of the improvements to ensure minimal inconvenience to customers and the tenant.

## 9.8 Concourse E Regional Airline Holdroom Improvements Study

The lower level holdroom on Concourse E that serves commuter aircraft at Gates E6 through E13 is currently deficient and will remain so in the future. To the extent that the number of commuter aircraft served from this holdroom increases, or the size of the aircraft increases, the level of service will deteriorate.

The objectives of the Concourse E regional airline holdroom improvements study are to identify (a) alternatives for increasing passenger comfort and convenience in the holdroom to a level equivalent to that provided in other holdrooms, and (b) the timing of the improvements to ensure minimal inconvenience to passengers and SkyWest Airlines.

## 9.9 Aircraft Rescue and Fire Fighting Facilities Siting Study

The FAA's requirements for ARFF facilities may change in the future. If it is not possible to meet the new requirements with the Airport's existing ARFF facilities, a new facilities siting study would be needed.

The objective of the ARFF facilities siting study would be to identify and evaluate alternatives for meeting the new requirements and recommend the preferred alternative.

## 9.10 NE 82nd Avenue Grade-separated Interchange Project Definition Study

It is anticipated that the intersection of NE 82nd Avenue with NE Airport Way will become capacity-constrained by PAL 2 (2017). According to prior Port access studies, the solution is a grade-separated interchange to provide for unimpeded travel eastbound and westbound on NE Airport Way while northbound and southbound traffic on NE 82nd Avenue would use the signalized interchange ramps.

The objectives of the grade-separated interchange project definition study would be to identify the (a) the preferred design concept for the interchange, (b) extent of Airport property required to accommodate the concept, and (c) effects on existing facilities and land parcels, as well as the timing of those effects.

## 9.11 High-Speed Rail Study

The effective integration of the Airport with the region's future high-speed rail service requires additional study.

The objectives of the high-speed rail study would be to:

a. Confirm the region's expectations and plans for high-speed rail service and facilities.

b. Define the range of policy and facilities issues that must be resolved to integrate air transportation at the Airport with high-speed rail transportation.

c. Identify a range of potential Airport-related policy and facilities alternatives.

d. Prepare a preliminary long-range plan for integrating air and high-speed rail transportation.

## 9.12 Remain Overnight Aircraft Parking Ramp Design Study

To meet the Port's objective to achieve higher gate utilization, thereby avoiding the expansion of passenger concourses to add aircraft gates, 23 additional RON positions will be required by PAL 5 (2035). The requirements also include four additional RON positions by PAL 1 (2012) and two additional RON positions by PAL 2 (2017).

The objectives of the RON aircraft parking ramp design study would be to:

a. Confirm the preferred location for supplemental RON aircraft parking.

b. Complete the design for the aircraft ramp(s) required through PAL 2 (i.e., ramp(s) to accommodate up to six RON aircraft).

c. Recommend how the project should be phased.

d. Determine the maximum number of RON aircraft parking positions that should be constructed in the immediate terminal area before proceeding with development to the west of Runway 3-21.

e. Prepare a concept plan showing how RON aircraft parking positions can be developed to the west of Runway 3-21 to meet the Airport's needs through PAL 5 (2035).

## 9.13 Commercial Vehicle Roadway Redevelopment Study

By PAL 3 (2022), the deplaning curbside loading area will be deficient. By PAL 4 (2027), the deplaning curbside loading area deficiency will increase and another deplaning roadway lane will be needed. The preferred alternative for correcting both the loading area and roadway lane deficiencies involves reconfiguring the existing commercial vehicle service area in a two-phase process. In phase 1, which will occur at PAL 3, the existing commercial vehicle area would be reconfigured for use by automobiles associated with deplaning passenger activity. This reconfiguration would enable both PAL 3 and PAL 4 needs to be met. Phase 2, which will occur at PAL 4, would involve relocating some of the commercial vehicles into the P1 garage (in the space to be vacated when the rental car service center is relocated to the consolidated rental car facility) and restriping the commercial vehicle area to accommodate rental car shuttle buses to and from the consolidated rental car facility.

The objectives of the study would be to develop detailed plans showing (1) how the space to be vacated by the rental cars will be used by commercial vehicles, and (2) how the space vacated by the commercial vehicles will be used for supplemental deplaning curbside and roadway lanes.

## 9.14 Enplaning Roadway Study

It has been identified that the enplaning level departure and approach roadways would be deficient by PAL 1 (2012) and PAL 3 (2022), respectively. Because these roadways are elevated and adjacent to Concourses A and E, the feasibility of widening them to permit additional departure and approach lanes requires further study.

The objectives of the study would be to:

1. Determine the feasibility of widening the enplaning level departure and approach roadways to permit the addition of one departure lane and one approach lane.

2. Identify other alternatives for resolving the deficiency, including operating at a lower level of service.

3. Evaluate the alternatives using modeling to quantify the operational merits of each alternative.

4. Recommend the preferred alternative, considering factors such as construction difficulty and phasing, potential customer inconvenience, level of service, and estimated cost.