Troutdale Airport Master Plan Update

Port of Portland

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October 2004

TROUTDALE AIRPORT
MASTER PLAN UPDATE

TROUTDALE, OREGON

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INTRODUCTION

This airport master plan update is intended to define the needs and direction of future development at Troutdale Airport over the next twenty years and beyond. This project updates the Portland-Troutdale Airport Master Plan Report (Hodges & Shutt, 1990), which has provided the primary airport planning guidance for the airport during the past ten years. Some improvements have been made to landside facilities (primarily additional T-hangar buildings) since the last master plan was completed. As part of the recent national focus on increasing airport security, the airport will be undertaking a major upgrade of its perimeter fencing (6-foot chainlink) and gate system in 2002. However, there have not been significant changes in the airside facilities (runway and taxiways) since the master plan was last updated.

Data from a variety of other sources are used in this evaluation, including:

- Oregon Continuous Aviation System Plan (Volume 1 Inventory and Forecasts, March 1997, The Airport Technology and Planning Group)
- Local documents, drawings and regional socioeconomic data
- FAA Airport Record Forms, Forecast data, Aeronautical charts, instrument approach data, etc.
- Recent master plan documents from other Portland area airports.
- Oregon Aviation Plan (Dye Management Group, 2000).

This chapter documents the inventory of existing airside and landside airport facilities. Airside facilities are generally defined as airfield facilities such as runways and taxiways. Aircraft parking aprons, hangars, and support facilities such as aircraft fuel storage/dispensing facilities are defined as landside facilities.

Although considerable investment in facility and maintenance improvements at Troutdale Airport have occurred since the last master plan was completed, the aviation industry and local/regional economy have experienced considerable upward and downward shifts during this period. As a result, airport activity and the pace of development have fluctuated. This study will evaluate the changes that have occurred in recent years and develop a realistic view of the airport's potential opportunities and needs over the next twenty years.

Troutdale Airport is owned and operated by the Port of Portland. The Port also operates and maintains Portland International Airport, Portland Mulino Airport and Portland-Hillsboro Airport, in addition to its extensive base of marine facilities. Troutdale Airport is categorized as a "High Activity/Business Aviation Airport" in the Oregon Aviation Plan[1] and is included in Oregon's core system of airports, which denotes its significance in Oregon's aviation system. The airport serves a wide range of general and business aviation, and resource related government agency purposes. The most recent air traffic control tower data is from 2002 when the airport had 72,180 operations (takeoffs and landings).

The airport is located within the City of Troutdale in Multnomah County. The airport is located along the south shore of the Columbia River, near the western entrance to the Columbia Gorge Scenic Area. The airport is bounded by the Sandy River (east), U.S. Interstate 84 (south), the Reynolds Aluminum site (north), and a combination of rural, industrial and residential developments (west). The local area is made up of several small communities surrounding Troutdale including Fairview, Gresham and Wood Village. The airport vicinity is depicted in Figure 1-1.

AIRPORT LOCALE

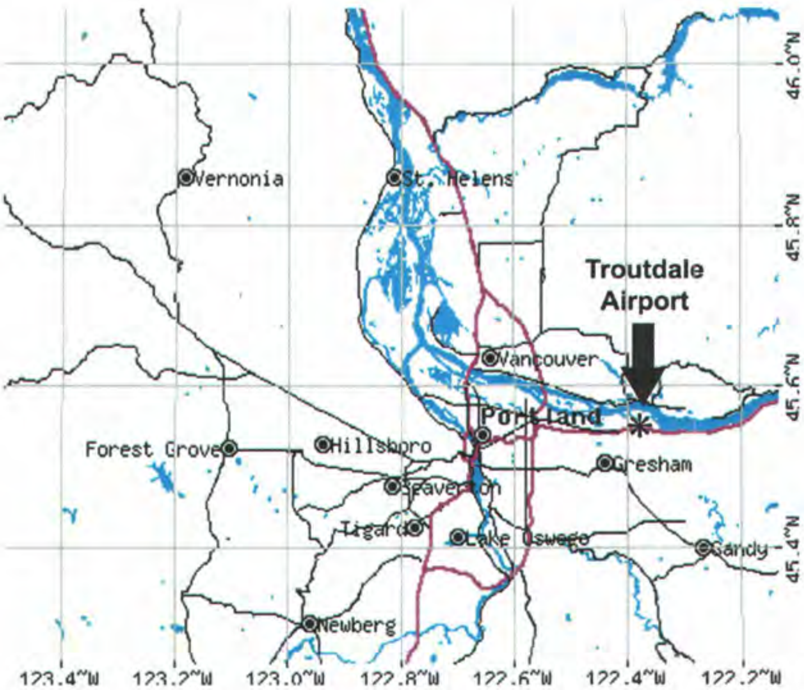
Troutdale is located at the confluence of the Sandy River with the Columbia River, in Multnomah County at the east edge of the Portland-Vancouver metropolitan area. It sits at the gateway to the Columbia Gorge National Recreation Area, which starts on the east side of the Sandy River and continues east up the Columbia River Gorge to Biggs, Oregon. As such, the City of Troutdale sits at the juncture between Oregon's most dense urban area (Portland is 12 miles east), and the Columbia River Gorge National Scenic Area – a gigantic river canyon of 80 miles in length, bordered on its sides with cliffs 3,000 to 4,000 feet high.

Photo 1-1: Troutdale Airport and The Gorge

The City of Troutdale has a land area of approximately 5 square miles and has a population of 13,980 persons (in year 2001). It is located within the greater Portland metropolitan area's "urban growth boundary" which is intended under Oregon land use law to be developed with ever more dense residential and business uses, with the goal of protecting the forest and agricultural lands that are outside of the "urban growth boundary."

[1] Oregon Department of Transportation. Dye Management Group and Century West Engineering.

Figure 1-1: Airport Vicinity Map



In recent years there has been considerable growth and development of businesses in the town center, as well as in the larger community. The City of Troutdale has historically valued having the airport available to the community. The City of Troutdale and the Port of Portland have worked closely to ensure the airport maintains a broad support structure. Troutdale Airport is recognized by community leaders as an important part of the local economy and transportation system. There are no major current conflicts known to exist between the airport and the community. (A copy of a memorandum summarizing a meeting held with City of Troutdale staff is attached to this airport master plan in Appendix A-2.)

The four cities that are tightly grouped in this eastern portion of the Portland urban area share many common interests. The cities of Troutdale, Gresham, Wood Village, and Fairview have formed a "Four Cities" organization which meets regularly to share information and work at accomplishing common goals regarding economic development and transportation. This larger "four cities" area consists of approximately 33 square miles (including Multnomah County lands intended to eventually be within these citys' boundaries) and with a combined population of approximately 116,000 persons.

Interstate I-84 runs east and west through this corridor of "four cities" and provides the primary transportation link to downtown Portland and to Vancouver. Troutdale Airport is located immediately north of I-84, in the north-east quadrant of the "four cities" area. The airport is located approximately three miles from the center of this combined "four cities" area, and is the only publicly owned airport located in the area. Graham Road at the Troutdale Exit from I-84, provides vehicle access to the airport from the east and west. Likewise, to the south of the freeway, Graham Road becomes NE 257th Avenue and provides easy access to the center of Gresham.

Industrial lands to the north, west, and south flank the airport. The open space of the Columbia River and the Columbia Gorge National Scenic Area lies to the east of the airport. The 539 acre Reynolds Aluminum property, located directly to the north of the airport, once was the major employer for Troutdale residents. However, the plant has permanently closed and the site is slated for major new industrial and commercial development. Recently a non-profit group has been formed to specifically look at using the Reynolds site to promote high tech businesses. This group – The Oregon Science and Technology Park (OSTP) – has recently been awarded a grant from the State of Oregon to initiate studies to assess the potential options for site development. A memorandum providing background on those interests, and the potential relationships to the airport are provided in Appendix A-3 to this airport master plan document. Other groups, including the Port of Portland, have studied the Reynolds site as a possible location for a range of industrial uses that could take advantage of the site's proximity to rail, the freeway, and the airport.

CLIMATE

Troutdale Airport sits at the boundary between the Willamette Valley and the Columbia River Gorge. Moderate temperatures and precipitation characterize the Willamette Valley region. High winds bringing cold air and freezing rain represent the extreme winter weather of the Columbia River Gorge. Based on National Climate Data Center recorded climatic data for the period 1971 and 2000, Troutdale averages 44.85 inches of precipitation and 5.7 inches of snowfall annually.[2] The mean maximum temperature is 82.5 degrees Fahrenheit (August), the highest mean maximum temperature is 90.2 degrees Fahrenheit (in 1986), the mean minimum temperature is 33.9 degrees Fahrenheit (January), and the minimum temperature was 22.8 degrees Fahrenheit (in 1979).


Photo 1-2: Aerial View of Airport from East

Based on the wind rose data created during the time period July 1949 through March 1951 (see Airport Layout Plan Drawing 2 in Chapter 8) prevailing winds at Troutdale Airport generally follow an east-west pattern due to the

[2] Western Regional Climate Center

strong east-west influence of the Columbia River Gorge topography. When barometric pressure significantly differs on the east and west sides of the Cascade Mountain range, strong flows are created through the Columbia River Gorge. Based on that wind rose data, it appears that Runway 7-25 provides approximately 99 percent wind coverage for up to 15 miles per hour cross-wind conditions and approximately 98 percent wind coverage for up to 12 miles per hour cross-wind conditions. Winds at the airport are above 15 miles per hour approximately 16 percent of the time. Of these, approximately 75 percent are east winds from the Columbia River Gorge that line up well with the runway heading. All winds greater than 31 miles per hour are from the east and line up with the runway heading.

During very low wind, cool and moist conditions, fog can form in the Portland-Vancouver metropolitan area. However, light winds from the Columbia River Gorge frequently allow Troutdale Airport to remain open for visual use when Portland International Airport, Pearson Airport, Aurora Airport, Hillsboro Airport, and other local airports have gone to "zero ceiling zero visibility" conditions. This condition is depicted in the picture above which was taken in the afternoon of December 7, 2001 during a short flight from Aurora Airport to Troutdale to get aerial photos for this Master Plan study. Low fog is seen forming over Portland International Airport in the top of the picture. Within 30 minutes every airport in the Portland-Vancouver area was completely covered with this fog, with the exception of Troutdale Airport.

SOCIOECONOMIC CONDITIONS

Population

Table 1-1 below summarizes population trends in the Tri-County Area as compiled by Metro. The City of Troutdale and Troutdale Airport are located in Subarea 5, which exhibited an above-average rate of growth in 1998-99.

The projected annual average population growth rates for the Portland-Vancouver Region are as follows:

1999: 1.8%	2000: 1.6%	2001: 1.5%	2002: 1.6%
2003: 1.7%	2004: 2.0%	2005: 1.7%	2006-22: 1.5%

Source: 2000-2030 Regional Forecast (Draft), Metro, March 2002.

By the year 2022 there will be a projected 2.65 million people living in the 5 county region; migration is expected to account for one-half of future population growth in the region. Many people moving into the Portland region (an estimated 300,000 from 1990-2000) are young workers, a trend reflected in employment figures for the area.

Table 1-1: Census Tract Data

year	1990	1998	% change	1999	% change
county subareas					
Multnomah County					
1	9,528	10,360	8.732%	10,911	5.319%
2	311,438	325,936	4.655%	326,689	0.231%
3	84,570	95,427	12.838%	95,729	0.316%
4	79,674	89,303	12.085%	90,386	1.213%
5	92,361	113,870	23.288%	116,065	1.928%
20	6,316	7,104	12.476%	7,069	-0.493%
total	583,887	642,000	9.953%	646,850	0.755%
Clackamas County					
6	65,801	72,311	9.893%	72,805	0.683%
7	23,994	33,574	39.927%	34,724	3.425%
8	53,866	61,268	13.742%	61,534	0.434%
9	26,214	31,603	20.558%	32,090	1.541%
10	26,459	34,648	30.950%	35,180	1.535%
19	82,516	90,295	9.427%	90,517	0.246%
total	278,850	323,700	16.084%	326,850	0.973%
Washington County					
11	19,154	28,608	49.358%	28,806	0.692%
12	40,069	52,650	31.398%	52,991	0.648%
13	82,364	89,055	8.124%	89,495	0.494%
14	83,296	118,089	41.770%	121,560	2.939%
15	39,062	52,748	35.037%	54,753	3.801%
16	23,309	26,903	15.419%	27,101	0.736%
18	24,300	29,647	22.004%	30,043	1.336%
total	311,554	397,700	27.650%	404,750	1.773%
Clark County					
total	238,053	328,000	37.784%	337,000	2.744%

Source: 1999 Census Tract Estimates, Metro, January 2000.

Economy

As a result of the current economic recession in the United States, many sectors are experiencing employment declines; particularly manufacturing jobs in transportation equipment, machinery, metals, and food processing. Analysts are predicting a turnaround in the regional economy starting in 2003. Transportation is expected to remain at a steady rate of growth of an average 1.5% through the year 2020 (see table next page).

EMPLOYMENT FORECAST *(population in brackets)*
2000: 1,208,900 (*1,874,450*)
2005: 1,320,600 (*2,049,200*)
2010: 1,483,800 (*2,233,900*)
2015: 1,631,700 (*2,394,600*)
2020: 1,795,400 (*2,571,100*)
2025: 1,979,200 (*2,768,200*)
Source: 2000-2030 Regional Forecast (Draft), Metro, March 2002.

PER CAPITA INCOME
2000: $28,400
2005: $27,900
2010: $28,800
2015: $30,400
2020: $33,000
2025: $35,500
Source: 2000-2030 Regional Forecast (Draft), Metro, March 2002.

The regional per capita income is expected to increase from $28,400 in 2000 to $33, 000 in 2020, an average increase of about 0.8% per year.

Table 1-2: BASELINE REGIONAL EMPLOYMENT FORECAST:

		1996	1997	1998	1999	2000	2005	2010	2015	2020
total non-farm employment	1000's of people	869.3	906.9	922.9	936.1	958.0	1043.4	1168.6	1273.0	1387.6
	rate	4.7%	4.3%	1.8%	1.4%	2.3%	3.4%	2.3%	1.7%	1.7%
total manufacturing	1000's of people	139.2	145.0	147.0	143.3	145.5	154.7	165.9	168.9	172.8
	rate	16.2%	21.9%	20.5%	13.1%	7.8%	6.3%	7.3%	1.8%	2.3%
total non-manufacturing	1000's of people	730.1	761.9	776.0	792.7	812.5	888.8	1002.7	1104.2	1214.9
	rate	5.0%	4.4%	1.8%	2.2%	2.5%	3.4%	2.4%	1.9%	1.9%
food processing	1000's of people	10.0	9.8	9.7	9.1	8.9	8.5	8.2	7.7	7.2
	rate	-0.8%	-1.7%	-1.7%	-6.3%	-1.5%	0.3%	-0.8%	-1.2%	-1.3%
textiles & apparel	1000's of people	4.5	4.4	4.3	3.8	3.4	4.0	3.6	3.1	2.6
	rate	-7.0%	-3.1%	-3.0%	-10.9%	-10.7%	1.4%	-2.0%	-3.1%	-3.2%
lumber & wood products	1000's of people	7.7	8.1	7.9	7.5	7.6	7.4	6.8	5.9	5.0
	rate	-1.2%	4.8%	-2.9%	-4.6%	1.5%	0.4%	-1.6%	-2.8%	-3.1%
paper & allied products	1000's of people	6.5	6.3	6.3	6.1	6.7	6.8	6.6	6.2	5.9
	rate	-8.1%	-3.7%	0.9%	-2.9%	9.6%	0.8%	-0.5%	-1.2%	-1.2%
printing and publishing	1000's of people	9.9	10.1	10.4	10.9	11.1	12.2	13.1	13.5	13.7
	rate	-3.0%	2.2%	3.0%	4.6%	1.8%	2.0%	1.4%	0.5%	0.3%
metals	1000's of people	19.0	19.8	20.6	20.1	19.9	20.2	20.5	19.8	19.4
	rate	2.3%	3.8%	4.2%	-2.3%	-1.0%	2.6%	0.3%	-0.6%	-0.4%
nonelectrical machinery	1000's of people	19.9	20.9	19.8	17.8	17.0	17.6	20.2	20.9	21.9
	rate	6.4%	4.8%	-5.0%	-10.4%	-4.5%	4.2%	2.7%	0.7%	0.9%
electrical machinery & instruments	1000's of people	34.2	37.1	39.0	38.5	41.7	50.4	56.4	59.3	62.3
	rate	11.6%	8.5%	5.0%	-1.3%	8.4%	5.9%	2.3%	1.0%	1.0%
durable goods (other)	1000's of people	8.1	8.3	8.2	8.4	8.5	9.4	10.3	11.1	11.9
	rate	-1.2%	3.3%	-1.7%	2.2%	1.1%	2.7%	1.9%	1.5%	1.4%
nondurable goods (other)	1000's of people	8.8	9.0	8.5	8.0	8.0	7.8	9.0	10.1	11.3
	rate	9.4%	2.2%	-5.5%	-6.3%	-0.6%	4.1%	2.7%	2.3%	2.4%
transport., comm. & utilities	1000's of people	49.4	51.7	53.1	54.2	55.4	58.4	64.9	69.9	75.2
	rate	3.4%	4.8%	2.5%	2.2%	2.2%	2.9%	2.1%	1.5%	1.5%
wholesale trade	1000's of people	63.6	67.9	68.9	67.4	67.2	73.3	81.6	87.9	94.4
	rate	2.9%	6.8%	1.4%	-2.1%	-0.3%	3.9%	2.2%	1.5%	1.4%
retail trade	1000's of people	153.1	157.6	160.1	164.9	168.1	184.8	207.0	225.6	245.3
	rate	4.1%	2.9%	1.6%	3.0%	2.0%	4.0%	2.3%	1.7%	1.7%
finance, insurance, real estate	1000's of people	63.0	66.3	66.7	66.2	64.5	68.4	74.2	80.1	85.3
	rate	5.4%	5.2%	0.5%	-0.7%	-2.6%	3.4%	1.6%	1.5%	1.3%
services (non-health)	1000's of people	180.3	190.7	196.4	203.5	214.2	244.5	284.8	326.3	373.5
	rate	6.1%	5.8%	3.0%	3.6%	5.2%	3.9%	3.1%	2.8%	2.7%
health services	1000's of people	57.7	60.2	61.3	62.2	62.1	71.2	82.3	93.5	105.2
	rate	2.8%	4.4%	1.7%	1.5%	-0.1%	3.0%	3.0%	2.6%	2.4%
government (state & local)	1000's of people	93.9	95.1	97.9	103.2	108.5	111.2	121.0	129.7	139.5
	rate	3.7%	1.3%	2.9%	5.4%	5.2%	1.9%	1.7%	1.4%	1.5%
government (federal civilian)	1000's of people	17.5	17.8	17.9	17.6	18.5	17.9	19.3	19.4	20.3
	rate	-0.7%	1.7%	0.6%	-1.7%	5.5%	-0.2%	1.5%	0.2%	0.9%

Source: 2000-2030 Regional Forecast (Draft), Metro, March 2002.

HISTORY

Troutdale History

The area at the confluence of the Sandy and Columbia Rivers was "discovered" in the autumn of 1792 by Lt. Broughton and his men. The Crew was traveling aboard a British vessel under command of Captain George Vancouver who was aboard another vessel. They were ascending the Columbia River, when they reached a point just east of the mouth of the Sandy River. This point, immediately across the Sandy River from Troutdale, was named Broughton's Bluff, many years later. Mount Hood was named by Broughton while he was on this location at that time

Before Lewis and Clark, the lands along Columbia River were inhabited by Native Americans of the Chinookan language group. Those inhabiting the area on either side of the Columbia River, from Wapato Island (Sauvie Island) to the Quicksand River (Sandy River) were of a sub-language group Multnomah (*malnumax* meaning 'those towards the water' or 'those closer to the Columbia River')[3]. At the time of Lewis and Clark's visit in 1806, this area was known as Wapato Valley and may have been one of the most densely populated areas in the Americas north of what is now Mexico[4].

Lewis and Clark arrived at this area in IFR conditions on November 3rd Sunday 1805. Clark wrote: "*The fog so thick this morning that we could not see a man 50 steps off, this fog detained us until 10 oclock at which time we set out . . . . at 3 miles I arrived at the entrance of a river which appeared to scatter over a sand bar, the bottom of which I could see quite across and did not appear to be 4 inches deep in any part; I attempted to wade this stream and to my astonishment found the bottom a quick sand, and impassable - I called to the canoes to put to shore, I got into the canoe and landed below the mouth, & Captain Lewis and myself walked up this river about 1 1/2 miles to examine this river which we found to be a very considerable stream discharging its waters through 2 channels which forms an Island of about 3 miles in length on the river and 1 1/2 miles wide, composed of course sand which is thrown out of this quick sand river compressing the waters of the Columbia and throwing the whole current of its waters against its Northern banks, within a channel of 1/2 a mile wide. . . . . The QuickSand River appears to pass through the low country at the foot of those high range of mountains in a southerly direction, - The large creeks which fall into the Columbia on the stard. Side rise in the same range of mountain which we suppose to be Mt. Hood is S. 85E about 47 miles distant from the mouth of quick sand river. . . . .below Quicksand River the country is low rich and thickly timbered on each side of the river, the islands open and some ponds, the river wide and emence numbers of fowls flying in every*

[3] *Handbook of American Indians*, Volume 7 Northwest Coast, ed. Wayne Suttles, 1990, p545.

[4] *Naked Against the Rain*, Rick Rubin, 1999, p. 8.

direction such as swan, geese, brants, cranes, storks, white guls, comerants and plevers, also great numbers of sea otter in the river . . . ."[5]

It is interesting that Clark does not describe any structures or residents at this location. This indicates that Troutdale and the airport site were probably not used for village or major camp sites at that time by Native Americans.

The earliest settlers came in 1850 and 1851[6]. Early donation land claims were filed by John Douglass, D.F. Buxton, Benjamin Hall, Stott and Hicklin. Family records credit David F. Buxton as Troutdale's true founder. He filed a donation land claim in 1853 in the center of present day City of Troutdale. Buxton developed the town's first primitive water system, which was in use until the 1960's. He died in Troutdale in 1910.

However, it was Captain John Harlow, a former sea captain from Maine and successful Portland businessman, who conceived a successful plan for the town. In 1872 he purchased part of Buxton's land claim to build his country home. Because he raised trout in ponds on his farm, he called his farm "Troutdale." He convinced the railroad to build a depot at the site of his farm so he could ship his produce. On November 20th in 1882, Troutdale had a rail line; an important step in becoming a bonafide town.

After Harlow's death in 1883, Celestia, his widow, began platting a town with blocks and streets. Much of the city was built in 1890 and 1891. The first edition of Troutdale's newspaper announced the opening of Aaron Fox's new store, a restaurant, and included ads for a hardware store, surgeon, notary public and blacksmith. The town's major industry was the American Dressed Meat Company, later sold to become Portland's Swift and Company. Other industries that rose were a lumber mill, a hotel and a distillery. The distillery burned in what was reported as a "bright blue flame" in the 1890's.

Aaron Fox was instrumental in incorporating the City in 1907 and became its first mayor. It had become a town of saloons, and incorporation arose from the necessity to exercise some controls over them. Huge licensing fees precluded the need for city taxes. In 1907, a disastrous fire swept through the city burning many of the 1890's buildings. A church built on a hillside two blocks from the business district was one of the few 1890's buildings that survived. Some homes also survived. In 1914, one year after women got the vote in Oregon, Clara Latourell Larsson become mayor of Troutdale and one of Oregon's earliest women mayors.

The Columbia River Highway was built and ran through Troutdale in 1916. Enterprising residents opened businesses, restaurants, tea rooms, hot dog stands and dance pavilions to feed and entertain the travelers. In 1925, a second fire mostly destroyed the business district. This fire is believed to have resulted from an

[5] *Moulton's Lewis and Clark's Journals,* (Clark) November 3rd, Sunday, 1805

[6] This history of the City of Troutdale comes largely from the City of Troutdale Citizen's Handbook.

explosion of a still in the garage of John Larsson, the former mayor's husband. The Tiller Hotel and Helming's Saloon, both built after the first 1907 fire, are two of the pre-1925 buildings left in the business district today.

John Harlow's original house was torn down in the 1920's. The only original building remaining was the home of his son, Fred built in 1900 on the original farm site. That building is now the Harlow House Museum of the Troutdale Historical Society. The original rail depot burned in 1907 and was replaced by a new building at its present site in 1979.

In the 1920's, Troutdale claimed the title of the "Celery Capital of the World" as a result of prize winning celery grown here. But farmers also grew wonderful produce and gladiola bulbs... grown in the area's fertile, sandy soil and shipped all over the nation by rail. The Troutdale City Hall was completed in 1923. The original wood dance floor is now covered by city offices. The dances were an important part of Troutdale's social life for years.

Construction of an aluminum plant was a boon to the economy in the mid 1940's, but eventually its emissions ended the gladiola industry and damaged other crops. Completion of Interstate 84 in the 1950's pulled traffic off the Columbia River Highway and away from Troutdale. The City remained fairly quiet during the 1950's.

Suddenly in the 1960's, Portland suburbanites discovered Troutdale and the City built its first subdivision and made plans for a new sewage treatment plant. Under the guidance of Mayor Glenn Otto, who later became a state senator and statewide leader, the city boundaries expanded from 320 to more than 2000 acres.

Airport History

The Troutdale Airport site has been in continuous aviation use for nearly eighty years. The following provides a chronology summarizing development at Troutdale Airport:

- 1924 First airport activity on site - grass field on private farm.
- 1920's Landing strip converted to gravel. Airport maintained by the Civil Aeronautics Administration.
- 1930 U.S. government uses Troutdale airport as a landing strip for U.S. mail carriers.
- 1936 United Airlines establishes a radio center to communicate with their aircraft.
- 1942 Port of Portland purchases 263 acres, including airfield, from three property owners at a total cost of $52,300.
- 1942 Paved runway, 4,640 feet long and 150 feet wide constructed with north parallel taxiway and small apron area.
- 1946-48 Several hangars, a wooden control tower, and a cafe built along north side of field. U.S.

Forest Service hangar and office established in SW corner of airport.

- 1950's Airport serves as alternate landing site for airlines serving Portland.
- 1960 First T-hangars constructed on south side of airport.
- 1960 Approach zone property acquired with FAA funding.
- 1961 New air traffic control tower constructed.
- 1976 U.S. Forest Service relocates to temporary facilities in NE corner of airport.
- 1978 Terminal area apron and partial parallel taxiway constructed on south side of field. Project funded by FAA.
- 1979 New perimeter road (Graham Road) constructed north of airport.
- 1981 Terminal building and automobile parking lot built.
- 1983 Runway extended to 5,400 feet and south parallel taxiway completed. Sundial Road relocated to accommodate runway extension. Project is FAA funded.
- 1986 New U.S. Forest Service base constructed.

AIRPORT ENVIRONMENT

Troutdale Airport is located approximately one half mile north of the city center, just on the other side of Interstate 84 (I-84). As noted earlier, the airport is located in an area devoted to industrial and commercial development along the I-84 corridor. The airport is surrounded on three sides by industrial development and the freeway, and on the fourth side is the open space of the Columbia River Gorge to the east.

Photo 1-3: Aerial View of Airport from West

The Sandy River is the major drainage feature in the area, flowing from the glaciers of Mt. Hood west to Troutdale and then into the Columbia River. Most of the Sandy River above the Stark Street Bridge (approximately 2 miles upstream from the City of Troutdale) is within a "Wild and Scenic" area designated by the State of Oregon, the U.S. Bureau of Land Management, and the U.S. Forest Service.

The airport property, however, is largely drained to local smaller creeks that drain directly to the Columbia River. On the south side of the runway water drains to Arata Creek, which flows north around the west end of the runway into Salmon Creek. On the north side of the runway water drains to Salmon Creek, which flows west into Blue Lake, and thence into the Columbia River. A large portion of the storm water runoff from the City of Troutdale drains through the airport property. All of the storm water runoff is managed by the Sandy Drainage District. A dike exists between the Columbia River and these airport and adjacent industrial lands. Thus, during high water periods water is pumped from these creeks up into the Columbia River.

The airport property is considered a "back-up" area by the Drainage District where in extreme rain conditions water is intended to back up rather than run directly into the Sandy River[7]. The potential impact of such a "back-up" impacting the usability of the runways and taxiways will be further considered in Chapter 5 Airport Development. It will be important to coordinate how the Drainage District's use of the property interfaces with the airport needs for dry buildings and usable runways, taxiways, aprons, and vehicular access.

During storm periods both the Port and the Drainage District are aware that oil appears in the drainage ditches. It is believed that this is coming from old truck stop tanks on the south side of the freeway, and from the freeway itself. Drainage district representatives note that they are aware of only one non-functioning aspect to the airport drainage system. This is at the NNW corner of the airport where a 12 inch diameter pipe often is not adequate and creates an area of flooding.

Due to the relatively flat topography, portions of the airport property are wetlands. The Port of Portland has created an inventory of natural resource features on the property (see Appendix E-6 Natural Resources Assessment Management Plan). Control tower staff note that these wetlands are an attractor to birds, which has resulted in at least three bird strikes during the past six years. One pilot attending the Joint Planning Conference testified that he experienced hitting 5 seagulls during one take-off eight years ago[8]. The drainage district staff note that beaver and nutria have been observed moving further and further up the waterways and ditches around the airport. Coyotes are regularly seen around the airport, but there have been no reports of problems related to aircraft operations.

The Frontage Road loop between the two I-84 exits/interchanges located at the north and south ends of the airport, and surrounding developments create a generally urbanized setting for the airport. No significantly incompatible land uses or activities appear to exist in the vicinity of the airport. However, preventing future incompatible land uses and obstructions in the areas around the airport will be critical to protecting the long-term viability of this site.

[7] For discussion of drainage issues see Appendix A-4, *Joint Planning Conference Meeting Minutes*, 2/28/02.

[8] For discussion of wildlife issues see Appendix A-4, *Joint Planning Conference Meeting Minutes*, 2/28/02.

AIRFIELD FACILITIES

The airport currently accommodates locally based single and light twin-engine aircraft. In addition to local aircraft, the airport accommodates itinerant general aviation and business aviation. Existing conditions at the airport are depicted on **Figure 1-2** – Existing Airport Property and Facilities and **Figure 1-3** Existing Airport Property and Facilities with Aerial Photo. **Table 1-3** summarizes airport data.

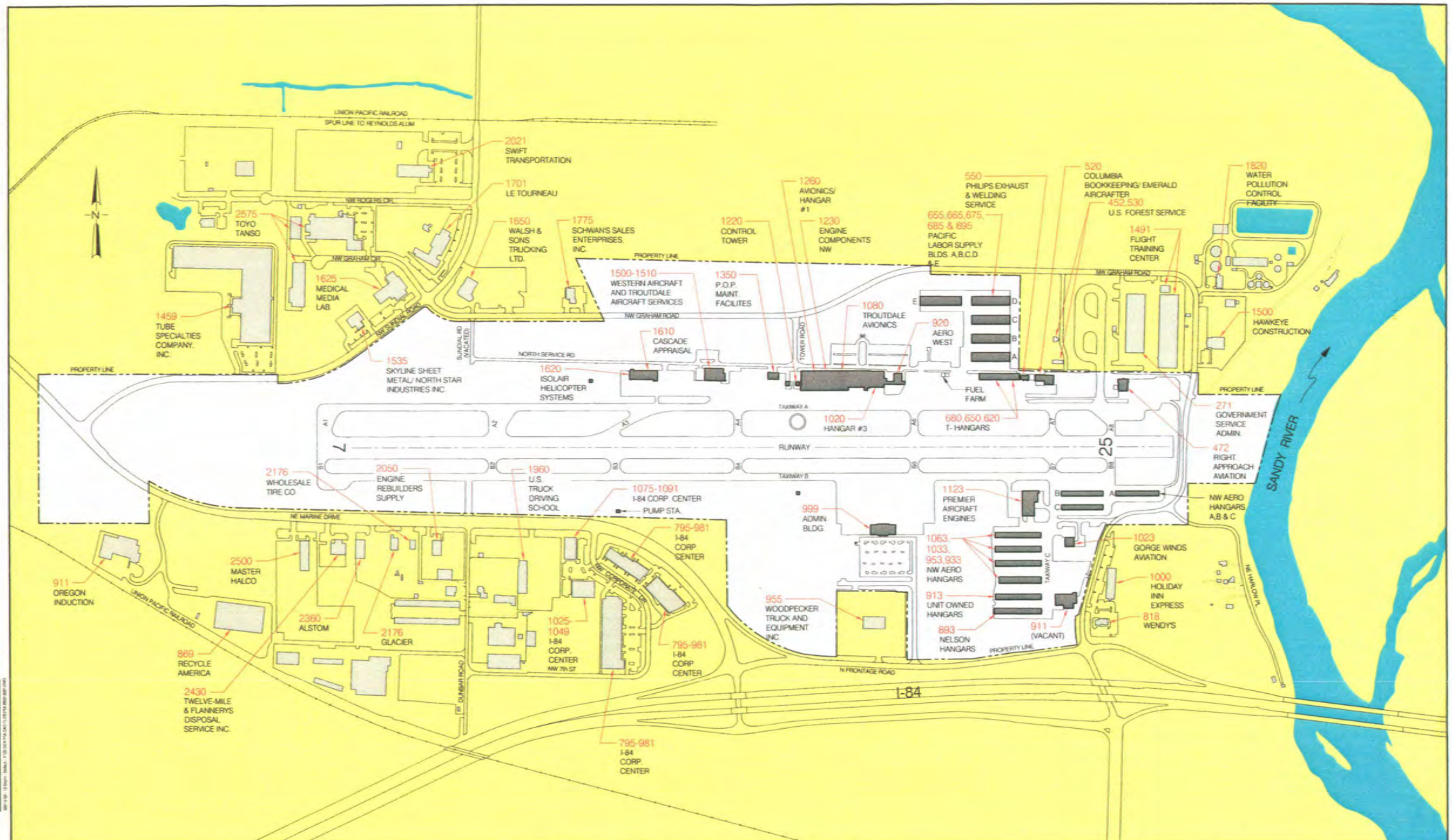
Table 1-3: Airport Data

Airport Name/Designation	Troutdale Airport (TTD)
Airport Owner	Port of Portland
Date Established	1920's (In Port Ownership Since 1942)
Airport Category	National Plan of Integrated Airport Systems (NPIAS): General Aviation FAA Airport Reference Code: B-II (1990 Airport Master Plan) Oregon Aviation Plan: Category 2 (High Activity/Business General Aviation Airport)
Airport Acreage	284 Acres
Airport Coordinates	N 45°32.96' W 122° 24.08'
Airport Elevation	39 feet Mean Sea Level (MSL)
Airport Traffic Pattern Configuration/Altitude	Left Traffic - 1,000 feet above ground level
Air Traffic Control Tower	Open 15 hours per day (7:00AM to 10PM - local time)

RUNWAY AND TAXIWAYS

Troutdale Airport has one paved, lighted runway (7/25), which is oriented on a 070-250 degree magnetic alignment. The runway is 5,399 by 150 feet and has nonprecision instrument runway markings. A 400-foot blast pad (paved overrun) is located beyond the east end of Runway 25. The runway is designed to accommodate large aircraft (19,000 pound single wheel, 25,000 pound dual wheel land gear), although it accommodates DC6/7 fire tanker aircraft weighing between 104,000 and 143,000 pounds during the fire season with 5 to 50 operations per year.

The runway is served by dual parallel taxiways on the north (Alpha) and south (Bravo) sides. The dual parallel taxiways are 50 feet wide, each with seven exit taxiways. Taxiway Alpha 3 is a high speed exit taxiway located approximately 1,800 feet down the runway from the end of Runway 7; all other exits are 90-degree taxiways.



NO	DATE	BY	REVISIONS	CKD	APPVD	NO	DATE	BY

PORT OF PORTLAND
PORTLAND, OREGON

DESIGNED BY B. SHELDEN
DRAWN BY B. CURRIER
CHECKED BY D. ADKINS
DATE JAN 2002
SCALE 1" = 300

PORTLAND TROUTDALE AIRPORT

HOUSE NUMBERING PLAN
ADDRESS PLAN

FIGURE 1-2

PAGE 1-15

SUBMITTED BY

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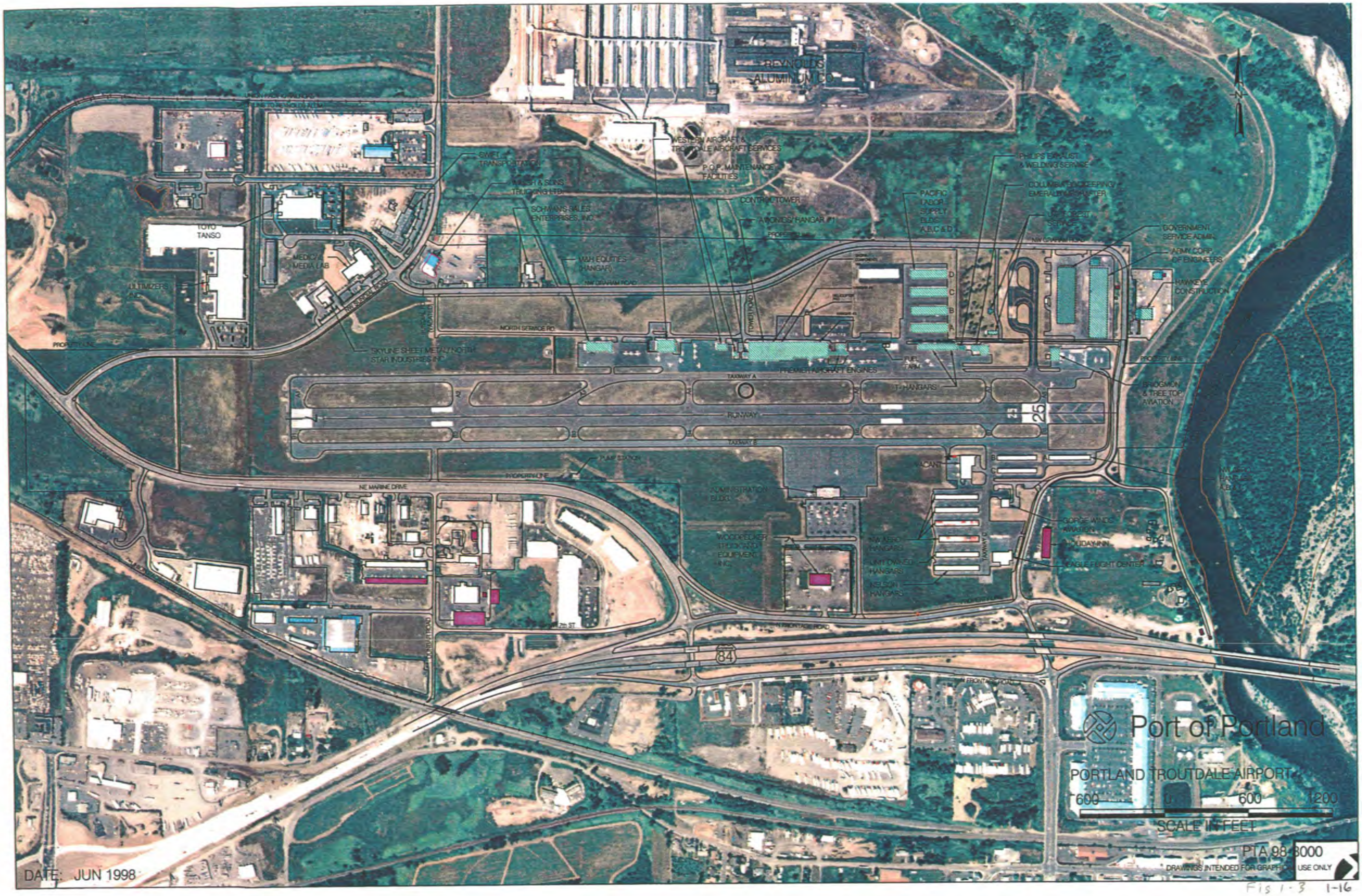


REYNOLDS ALUMINUM CO.
WESTERN AIRCRAFT & TROUTDALE AIRCRAFT SERVICES
P.O.P. MAINTENANCE FACILITIES
CONTROL TOWER
TOYO TANSO
ULTIMIZERS INC.
MEDIC/A MEDIA LAB
SKYLINE SHEET METAL/NORTH STAR INDUSTRIES INC.
SCHWAN'S SALES ENTERPRISES, INC.
M/H EQUITIES (HANGAR)
PACIFIC LABOR SUPPLY BLDG. A,B,C & D
PHILIPS EXHAUST & WELDING SERVICE
GOVERNMENT SERVICE ADMIN.
ARMY CORP OF ENGINEERS
HAWKEYE CONSTRUCTION
NORTH SERVICE RD.
FUEL FARM
PREMIER AIRCRAFT ENGINES
T-HANGARS
TAXIWAY A
RUNWAY
TAXIWAY B
25
PUMP STATION
PROPERTY LINE
NE MARINE DRIVE
VACANT
ADMINISTRATION BLDG.
WOODPECKER TRUCK AND EQUIPMENT INC.
NELSON HANGARS
GORGE WINDS AVIATION
HOLIDAY INN
EAGLE FLIGHT CENTER
84
Port of Portland
PORTLAND TROUTDALE AIRPORT
600 0 600 1200
SCALE IN FEET
PTA 98-3000
DRAWINGS INTENDED FOR GRAPHIC USE ONLY
DATE: JUN 1998

Fig 1-3 1-16

Aircraft hold lines are located approximately 160 feet (south side of runway) and 200 feet (north side of runway) from runway centerline. Aircraft holding areas are located adjacent to the A8 taxiway at the end of Runway 25 and the A1 and B1 taxiways at the end of Runway 7.

Other taxiways provide access to landside development and numerous taxilanes serve the airport's hangar developments. **Table 1-4** and **Table 1-5** summarize existing runway and taxiway facilities.

Table 1-4: Runway Data

Dimensions	5,399 x 150 feet; 400-foot paved overrun at Runway 25 end.
Effective Gradient	0.2%
Surface	Asphalt Concrete (AC)
Weight Bearing Capacity (WBC)	19,000 pounds – Single Wheel (SW); 25,000 pounds –Dual Wheel (DW) Landing Gear. Western 1,000 feet of runway is 30,000 pound SW.
Marking	Non Precision (threshold marker, runway numbers, fixed distance markers, centerline stripe)
Lighting	Medium Intensity Runway Edge Lighting (MIRL); Threshold Lights; Runway End Identifier Lights (REIL) and Visual Approach Slope Indicators (VASI) (Rwy 7 & 25); Lighted Runway/Taxiway Holding and Location Signs
Wind Coverage	97.9 percent (All Weather). Data: 7/49-3/53

Source: Port of Portland airport drawings and documents; FAA/NOS Airport Facility Directory

Table 1-5: Taxiway Data

Taxiway	Description	Key Dimensions	Lighting/Marking
Taxiway A Exit Taxiways A1, A2, A3, A4, A6, A7, A8	North Parallel Taxiway 7 Exit Taxiways (1 high speed; 6 90-degree exits)	50 feet wide 275-foot runway separation	Medium Intensity Taxiway Edge Lighting (MITL)
Taxiway B Exit Taxiways B1, B2, B3, B4, B6, B7, B8	South Parallel Taxiway 7 Exit Taxiways (all 90-degree exits)	50 feet wide 200-foot runway separation	Medium Intensity Taxiway Edge Lighting (MITL)
Taxiway C **(South Hangar Taxiway)**	Southeast Hangar Area Access Taxiway	50 feet wide	None
Forest Service Taxiway	Air Tanker Taxiway to Operations Areas (Off Airport)	60 feet wide	None
North T-Hangar Taxiway	T-Hangar Access Taxiway	50 feet wide	None

Source: Port of Portland airport drawings and documents; FAA/NOS Airport Facility Directory

The 1990 Airport Layout Plan includes an all-weather wind rose based on local observations from 1949 to 1953. The wind rose indicates that Runway 7-25 has all-weather wind coverage of 97.9 percent at 12 miles per hour. A low visibility wind rose (ceiling 1,000 feet and/or visibility 3 miles, but more than 200 feet and ½ mile) estimates wind coverage at 96.6 percent at 12 miles per hour. Although wind coverage based on 15 miles per hour is not estimated, it appears coverage would exceed 98 percent. Local pilots and air traffic controllers indicate that the winds follow a seasonal pattern with easterly winds from the Columbia River Gorge common during the winter and westerly winds during the summer.

AIRCRAFT PARKING APRON

Troutdale Airport has several apron areas used for local and transient aircraft parking. The airport currently has 161 light aircraft tiedowns available for use. Approximately two-thirds of the tiedowns are located on the south side of the runway, where a single large apron adjacent to the South Terminal Building has 45 positions. The remaining tiedowns on the south side of the runway are located on the large transient aircraft apron, adjacent to the terminal building, near at the southeast corner of the airport between Gorge Winds and Eagle Air. The condition of the aircraft parking aprons range from very good to poor depending on the surface (pavement condition, cracking, vegetation growth, etc.) and the condition of the tiedown apparatus (chains, ropes, cables). The U.S. Forest Service (USFS) tanker base, located off airport property has its own designated apron areas for aircraft parking for its fleet of air tankers. **Table 1-6** summarizes existing apron facilities at the airport.

Table 1-6: Aircraft Apron Data

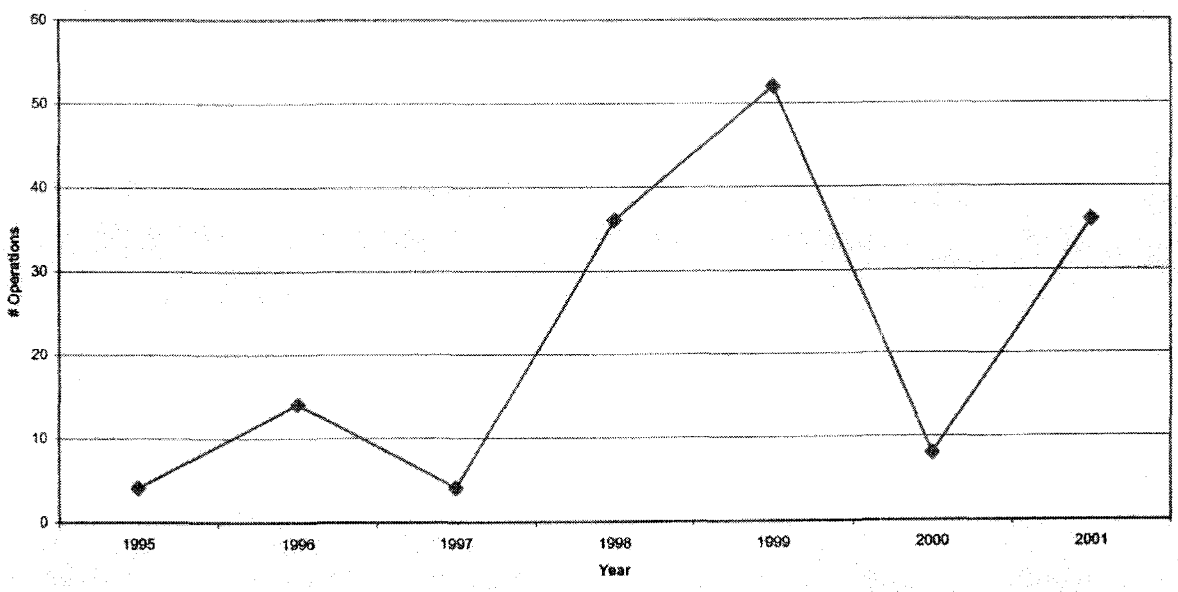
Apron	Existing Use/Configuration	Aircraft Tiedowns
South Transient Apron	Aircraft Parking	45 Tiedowns
South Apron – East Section (North of Eagle Flight)	Aircraft Fueling & Loading	None
South Apron – East Section (South of Gorge Winds)	Aircraft Parking & Fueling	12 Tiedowns
South Apron (former Premier Aircraft)	Aircraft Parking (Maintenance Related)	None
North Apron - East Section (Right Approach Aviation)	Aircraft Parking	21 Tiedowns
North Apron –Center Section	Aircraft Parking (Premier FBO to Emerald Aircraft)	37 Tiedowns
North Apron – West-Central Section	Aircraft Parking (West of Port Maintenance Bldg.)	16 Tiedowns
North Apron – 2 West Sections	Aircraft Parking & Maintenance	30 Tiedowns
	Sum Total Tiedowns on Public Airport	161
USFS Tanker Apron (Off Airport)	Aircraft Parking, Loading and Fueling	2-3 Large Aircraft Hardstand Positions

Source: Port of Portland Data; visual inspection (5/02).

US FOREST SERVICE TANKER BASE (OFF AIRPORT)

The U.S. Forest Service Troutdale Tanker Base is located near the northeast corner of the airport. The tanker base is located off airport property with large aircraft access provided by a single taxiway that connects to Taxiway A, near the east end of Runway 25 (from Taxiway A8). The facility is designed to accommodate simultaneous ground operations in support of two large aircraft. The taxiway has two separate loops that lead to two concrete hardstands for aircraft loading. The facility is designed to accommodate a variety of fixed wing and rotor aircraft, including large aircraft such as Douglas DC-6/7 four-engine piston aircraft which have been converted into air tankers. The forest service maintains facilities, equipment, and storage tanks for water and fire retardant slurry. Vehicle access to the USFS facilities is provided by a single gated access road extending from NE Graham Road. Flight activity at the tanker base fluctuates widely depending on the level of fire activity in the region, but is generally less than 100 operations per year. **Figure 1-4** shows the tanker operations for the past seven years.

Figure 1-4: Forest Service Tanker Operations at Troutdale Airport



Air traffic controllers at the airport indicate that the taxiing of fire tanker aircraft is generally limited to Taxiway Bravo (south parallel) due to wingtip clearance requirements. Taxiway Alpha, although having greater separation from the runway, is bordered by parked aircraft and hangars. When taxiing west to east, aircraft will travel on Taxiway Bravo and cross the runway on Taxiway B8 and A8 to reach the USFS taxiway.

AIRFIELD PAVEMENT CONDITION

The Port of Portland participates in a program of pavement evaluation and maintenance for Oregon's general aviation airports. This evaluation provides standardized pavement condition ratings, pavement features and current conditions. Data from the Port's pavement maintenance program was reviewed and general observations were made by the consultant during a recent site inventory.

The airfield pavements at Troutdale are generally in good condition or better due to the Port's ongoing investment in pavement maintenance. The runway and main taxiways are in fair to excellent condition. Other taxiways and hangar taxilanes range from poor to excellent depending on the age of the taxiway. Aircraft parking aprons are generally in good condition or better, although some the north apron areas (west sections) are in poor condition. **Table 1-7** summarizes airfield pavement conditions for Troutdale Airport based on data provided by the Port.

Table 1-7: Summary of Airfield Pavement Condition

Pavement	Section Design	Pavement Strength (pounds)	Condition
Runway 7/25	2" AC; 8" Base Course 3" AC; 6" Base Course (west extension)	19,000 # SW 30,000 # SW	Very Good to Excellent
Taxiway A (north parallel)	2" AC; 8" Base Course 3" AC; 6" Base Course (west extension and high speed exit A3; and east end holding area)	19,000 # SW 30,000 # SW	Very Good to Excellent
Taxiway B (south parallel)	2" AC; 8" Base Course 3" AC; 6" Base Course (west half & AC holding area; and far eastern section)	19,000 # SW 30,000 # SW	Fair
Taxiway C (SE Hangar Area)	3" AC; 12" In-Place Soil-Cement Treated Base	30,000 # SW	Good
Forest Service Taxiway	Data Not Available from Port	--	--
North T-Hangar Taxiway/Taxilanes	2" AC; 8" Base Course	12,500 # SW	Good
Terminal Area Apron	2" AC; 6" Base Course	19,000 # SW	Fair
North Apron – West Section	3" AC; 12" Base Course	30,000 # SW	Poor to Very Good

North Apron – Center Section	1.5" to 3" AC (varies by section); 6" to 12" Base Course (varies by section)	12,500 to 30,000 # SW	Fair to Good
North Apron – East Section (Right Approach Aviation)	Section Data Not Available	--	Good to Excellent
South Apron – Gorge Winds FBO	3" AC 12" Base Course	30,000 # SW	Fair to Good
South Apron – Eagle Flight FBO	1.5" AC 6" Base Course	16,000 # SW	Good to Very Good
South Apron (Former Premier FBO)	1.5" AC 6" Base Course	16,000 # SW	Fair to Poor
South T-Hangar Taxilanes	1.5" AC 6" Base Course	16,000 # SW	Fair to Poor

1. Port of Portland Data

LANDSIDE FACILITIES

AIRPORT BUILDINGS

Troutdale Airport has a wide variety of buildings that support aviation and related activities. The airport is home to several aircraft-related maintenance businesses that provide specialized services to aircraft from throughout the area. The south side of the airfield includes the Port South Terminal Building, three SASO buildings, and nine rows of T-hangars. The north side of the airfield includes several conventional hangars used primarily for commercial aviation activities (aircraft airframe, power plant, avionics maintenance, etc.), five rows of T-hangars, the control tower and Port maintenance buildings. Existing airport buildings are summarized in **Table 1-8.**

Table 1-8: Airport Buildings

Port Address	Building		Existing Use
	South Side of Runway		
999	Airport Terminal Building	65x170 2 story; 1981	Restrooms, Office
1123	Vacant	100x170 hangar	Aircraft Storage/Maintenance/Office (vacant)
911	FBO Business	60x120 hangar + office; 1986	Aircraft Storage/Maintenance/Office

1023	FBO Business	60x60 hangar	Aircraft Storage/Maintenance/Office
893, 913, 933, 953, 1033, 1063	South T-Hangar Development (6 hangars in one row)	10, 10, 8, 10,10,10 bays	Aircraft Storage
NW Aero Hangars A B C	Southeast T-Hangar Development (3 hangars)	10 bays each; 1960	Aircraft Storage
--	Waste Water Pump Station		Sewerage Agency Facility
	North Side of Runway		
--	Airport FAA Electrical Building	Small block building west end of airport	Airfield Electrical System Control for VASI & ASOS
1620	FBO Business	60x160 hangar, 30x70 office	Aircraft Maintenance/Office
1500-1510	FBO Business	70x110 hangar, 20x70 office	Aircraft Maintenance/Office
1350	Airport Maintenance Buildings (2)	50x70, 25x30	Equipment Storage & Maintenance/ Office/Fueling
1220	Air Traffic Control Tower & Airport Electrical Vault	102' high; 1962	Control Tower / Airfield systems electrical
1260,1080	SASO Business	130x260 hangar	Aircraft Maintenance/Office
1230	SASO Business	110x210 hangar	Aircraft Maintenance/Office
1020	FBO Business	90x105 hangar	Aircraft Maintenance
920	FBO Business	55x75 offices 2 floors	Offices/Classrooms/Restrooms
655, 665, 675, 685, 695	North T-Hangar Development (5 rows, 10 bays)		Aircraft Storage
680,650,620	Port T-Hangars	42x270 dirt floor	Aircraft Storage
550	FBO Business	25x50	Aircraft Maintenance
520	FBO Business	60x65 and 40x55	Aircraft Storage/Aircraft Maintenance
472	FBO Business	60x60 hangar + office	Aircraft Storage/Maintenance/Office

AIRPORT SUPPORT FACILITIES

AIRCRAFT FUEL

Aviation gasoline (AVGAS) and jet fuel are available at Troutdale Airport. The airport has two primary fuel storage areas. The main storage facility is located on the north side of the runway, east of Premier Aircraft Engines FBO facility (two aboveground fuel tanks). A second fuel storage area is located between Gorge Winds Aviation and Eagle Flight Center with a single underground tank. The airport's fixed base operators (FBO) provide fueling service with mobile trucks and fixed point fueling. Existing aviation fuel storage facilities are listed in **Table 1-9**.

Table 1-9: Aviation Fuel Storage

Fuel Type	Capacity	Tank
AVGAS (100LL)	10,000 gallons	North side of runway. Aboveground Tank.
Jet Fuel (Jet A)	12,000 gallons	North side of runway. Aboveground Tank.
AVGAS (100LL)	12,000 gallons	South side of runway @ Eagle. Underground Tank.
Fuel Trucks	Varies	Mobile Fueling for AVGAS and Jet Fuel.

AIRPORT LIGHTING

The airport lighting at Troutdale Airport accommodates day-night operations in visual flight rules (VFR) and instrument flight rules (IFR) conditions. The airfield is equipped with a rotating beacon mounted on the air traffic control tower, lighted wind socks, and lighted pilot guidance signs. Most aircraft parking, fueling, and hangar areas on the airport have overhead flood lighting.

The runway and parallel taxiways are equipped with medium intensity edge lighting (MIRL/MITL). The runway-taxiway lighting system is radio-activated on the common traffic advisory frequency (CTAF) when the control tower is closed. Both ends of Runway 7/25 have threshold lighting, visual approach slope indicators (VASI) and runway end identifier lights (REIL). The airfield lights generally appear to be in good condition. **Table 1-10** summarizes existing airport lighting at Troutdale Airport.

Table 1-10: Airport Lighting

Component	Type	Condition
Runway Lighting	Medium Intensity Runway Edge Lighting (MIRL)	Good
Taxiway Lighting	Medium Intensity Taxiway Edge Lighting (MITL) on Taxiways A and B.	Good

Lighted Airfield Signage	Lumacurve Airfield Guidance Signs	Good
Visual Guidance Indicators	Visual Approach Slope Indicators (VASI) (4-Box) Runways 7 and 25	Good
Runway Approach Lights	Runway End Identifier Lights (REIL) Runways 7 and 25	Good
Airport Lighting	Airport Rotating Beacon; Lighted Wind Cones	Good

AIRSPACE AND NAVIGATIONAL AIDS

Troutdale Airport operates under both visual flight rules (VFR) and instrument flight rules (IFR). The airspace above the airport is Class D, when the air traffic control tower (ACTC) is in operation and Class G during the hours when the tower is not in operation. Troutdale Airport is located beneath the eastern edge of the Portland International Airport Class C airspace, with a ceiling of 4,000 feet and a floor of 2,000 feet mean sea level (MSL). Aircraft operating in the standard left traffic patterns at Troutdale remain below the PDX airspace. The airspace in the vicinity of the airport is depicted in **Figure 1-5**.

Figure 1-5: Seattle Sectional Chart for PDX

The airport has an air traffic control tower (ACTC) that operates from 7:00 AM to 10:00 PM (local time). The ACTC frequency is also used as the common traffic advisory frequency (CTAF) when the tower is closed. Other radio communications are available for ground control, the airport's automated surface observation (ASOS) weather system, and the Unicom, which is monitored by local fixed base operators (FBO).

Troutdale has one published nondirectional beacon (NDB) non-precision instrument approach (see **Figure 1-6** below). The approach utilizes the Laker NDB, which is located 2.6 nautical miles west of the airport. The NDB approach is authorized as a circle-to-land procedure and requires terminal area radar coverage. The inbound course (057 degrees) is offset from the runway alignment by approximately 13 degrees. The missed approach procedure directs aircraft in a left turn to the northwest to the Battle Ground (BTG) VOR. The NDB approach also has a global positioning system (GPS) overlay. Troutdale also has two published standard terminal arrival routes (STAR) and one standard instrument departure (SID). **Table 1-11** summarizes existing navigational aids and related items.

Table 1-11: Navigational Aids and Related Items

Type	Facilities
Electronic Navigational Aids	None on site. Nearest Locations: Portland VOR/DME (8 nm NW) 111.8 MHz PDX – Runway 28L ILS (2 nm W) 110.5 MHz PDX – Runway 28R ILS (2 nm W) 111.3 MHz Battle Ground VORTAC (14.4 nm NW) 116.6 MHz Laker NDB (2.6 nm W) 332 LHz
Instrument Approaches	NDB or GPS-B. Minimum Descent Altitude (MDA) 1,020' MSL (816' AGL). Visibility requirements: 1-2 ¾ miles (Aircraft Categories A-D)
Weather Observation	Automated Surface Observation Surface (135.625 MHz)
Communication	Air Traffic Control Tower 120.9 MHz Ground Control 121.8 MHz Common Traffic Advisory Frequency (CTAF)(120.9 MHz) Portland Approach/Departure Control 118.1/124.35 MHz

INSTRUMENT APPROACH ISSUES[9]

The Airport is presently served with a NDB or GPS-A approach procedure (see **Figure 1-6**) with relatively high minimums (1021-1½ for approach category B aircraft, a classification that encompasses most general aviation aircraft including some business jets and that used in the balance of this report). Because the course alignment to the Runway 7 threshold exceeds 15°, the procedure is a circling approach. The procedure is based on a NDB that is colocated with the outer marker (Laker LOM) serving the Category I ILS approach to Runway 28R at Portland International Airport.

The Airport is located approximately eight nautical miles from Portland International Airport, within its designated Class C airspace, and their extended runway centerlines intersect. This, coupled with the shared use of the Laker LOM, serves to restrict the instrument flight rule capacity of the Troutdale Airport. Appropriate altitude separation is provided between aircraft directed by FAA air traffic control to use this LOM; however, although aircraft are handled on a first-come, first-serve basis at each airport, those destined for Portland International Airport are assigned a higher priority. Accordingly, aircraft are cleared for the instrument approach procedure to the Troutdale Airport when there is a sufficient gap in the arrival stream to Portland International Airport. As traffic levels increase at each airport, the potential for higher periods of delay to Troutdale Airport arrivals can be expected. This outcome is independent of the availability of new or

[9] This instrument approach analysis was prepared by QED Aviation Consultants, specialists in this kind of analysis.

additional approach procedures at the Airport, as the interaction is the result of the proximity and runway alignments at each facility.

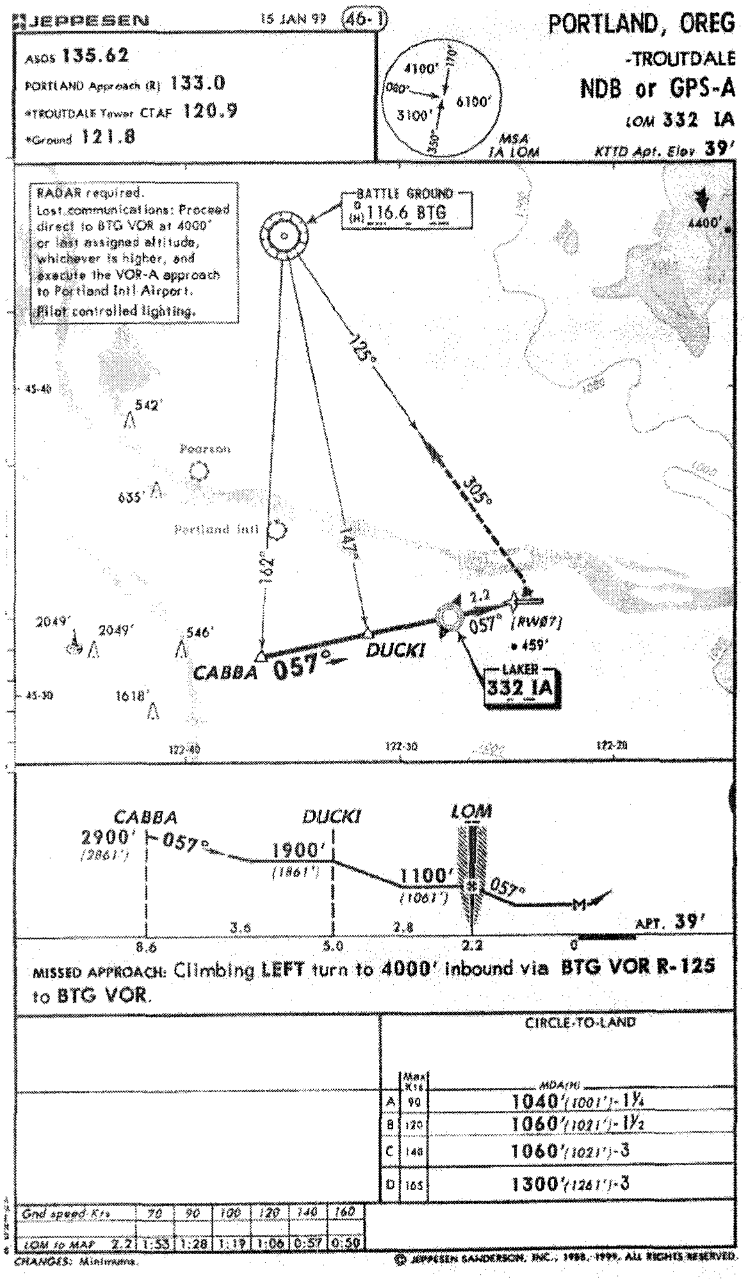


Figure 1-6: Troutdale NDB Approach Chart
(out of date sample – not to be used for navigation purposes)

Pilots operating at Troutdale Airport have requested a new instrument approach that can yield lower operating minimums. This capability would make the Airport more attractive to corporate aircraft that require a higher level of Airport reliability for use.

In the past, instrument approach procedures were dependent on the use of ground-based terminal navigational aids. Their location could affect the resultant approach course and minimums, as in the case of utilizing an off-airport VOR. The availability of satellite-based technology through the use of global positioning system (GPS) has enabled the design of approaches that enhance the potential for straight-in procedures. The accuracy of the GPS signal also permits for a more narrow area of evaluation for possible obstacles that affect the determination of the achievable approach minimums.

GPS signals, when augmented, can provide a precision approach capability. The wide area augmentation system (WAAS) is expected to be approved for full operational capability by the FAA in the year 2006. Local area augmentation systems (LAAS) for public use may be available sooner and could be employed to develop precision approach procedures to all runways at airports in proximity to each other. The establishment of a LAAS at Portland International Airport could generate such results for Troutdale Airport; however, this system is not to the best of the writer's knowledge programmed at the facility. Without WAAS, GPS can be used to establish nonprecision approaches. The FAA is in the process of updating existing instrument approaches nationwide to GPS in order to provide aircraft operators with a higher level of flight accuracy and to minimize the federal investment in the maintenance of ground-based terminal navigational aids. These new approach procedures use the RNAV (area navigation) acronym and minimums are described as GLS, LNAV/VNAV, LNAV and circling. GLS (global navigation satellite system landing system) denotes a precision approach. LNAV/VNAV (lateral and vertical navigation) is another form of a precision approach but designed to less stringent requirements. LNAV (lateral navigation) is used to identify a nonprecision approach.

RNAV approaches with GLS, LNAV/VNAV and LNAV minimums can be established at the Troutdale Airport that can yield lower approach minimums than presently available. A cursory review of an RNAV 7 with LNAV minimums can yield 796-1¼ for approach category B aircraft provided that the missed approach point is positioned 1 nautical mile west of the Runway 7 threshold and an immediate turn to the north (left) to the Battleground VOR is implemented. This placement and missed approach procedure is necessary to minimize the impact of Broughton Bluff. The controlling obstacle in the final approach segment is a tank located at 45°32'13"N and 122°31'17"W at an elevation of 405' MSL with an accuracy code of 1D. Use of a step down fix, a nonstandard application of the instrument approach procedure design guidance, could yield lower minimums, but this is beyond the scope of this assignment. An RNAV 25 approach with LNAV minimums would require the maximum offset alignment of 15° to the north to minimize the impact of the Bluff on approach minimums. However, the resulting minimums could be expected to be 885-1¼ for approach category B aircraft because the Bluff cannot be totally eliminated from consideration in the procedure design.

Due to the high level of accuracy and the relatively more narrow obstacle clearance surface requirements associated with the use of GLS minimums, precision approaches to Runway 7 or Runway 25 can yield the lowest minimums that can be authorized for such a procedure (200-½ if equipped with a MALSR and 200-¾ without the benefit of the MALSR). It is recommended that these be pursued.

Although these RNAV procedures with LNAV or GLS minimums provide improved course guidance to either runway end at Troutdale Airport, their use is very dependent on the arrival stream to Portland International Airport. The airspace interaction requires more detailed review, as does the RNAV procedure potential evaluations indicated above.

The FAA has also established facility standards at airports to complement achievable approach minimums. Therefore, there is a need to balance the approach procedure capability with the improvements required to meet the associated approach minimums. The application of present value, life-cycle benefit/cost analyses can be useful in making decisions in this regard.

There exists the potential to achieve lower approach minimums to either or both runway ends at Troutdale Airport. The level of approach capability may be influenced by the ability of the Airport to meet associated design standards and these should be considered as part of the on-going master planning effort. Airspace interaction with Portland International Airport will limit capacity gains and coordination with the FAA Air Traffic Division needs to be initiated early in the procedure design process.

SURFACE ACCESS AND VEHICLE PARKING

Vehicle access to Troutdale Airport is provided from U.S. Interstate 84 (I-84) and NE Marine Drive. The north and east sections of the airport perimeter is served by NW Graham Road. The west and southwestern sections of the airport perimeter are served by NW Sundial Road and NE Marine Drive. These roadways provide two-way access to the airport's primary development areas. The southeast section of the airport perimeter is served by North Frontage Road (for I-84), which is a one-way (west) roadway that connects NE Marine Drive and Graham Road.

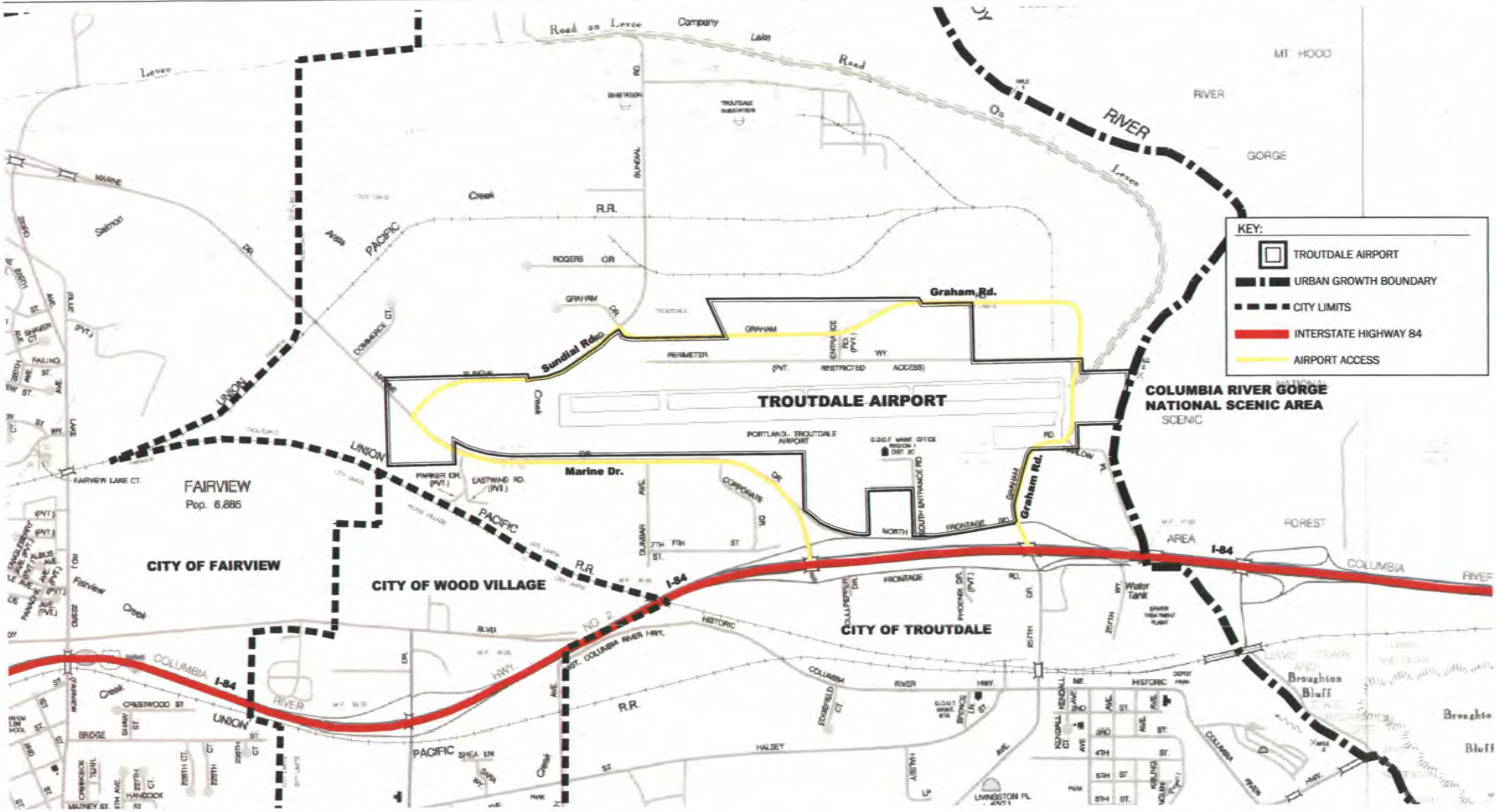
Vehicle access from the airport to I-84 is limited to the west interchange that extends from NE Marine Drive (for west-bound traffic). The I-84 South Frontage Road is one-way (east) that connects to NE Marine Drive (under the freeway) and is used for east-bound traffic. The existing surface access in the vicinity of the airport is depicted in **Figure 1-7**.

UTILITIES

Local utility providers include Telequest (telephone), Northwest Natural Gas (natural gas), Portland General Electric (electricity), and the City of Troutdale (water and sewer). The airport is located within the Multnomah Drainage District No. 1. The airport has extensive storm water drainage system and the Port maintains a Storm Water Pollution Control Plan for the airport. The landside areas of the airport are served with fire hydrants for fire protection. The existing airport utilities are depicted in **Figure 1-8a through 1-8d** (Port Utility Maps). The airport has an electrical building located near the runway that houses controls for airfield lighting and the airport beacon.

FENCING

The airport has a combination of wire and chain link fencing around the airfield. The airport fencing was fully upgraded during 2002, with 6-foot height chain link, topped with barbed wire, and new electronically controlled vehicle access gates.



0 50' 100' 200' SCALE:1"=100'	N	ARON FAEGRE AND ASSOCIATES with Century West Engineering source: ODOT Oregon Transportation Base Map	sheet title: TRANSPORTATION MAP figure: PAGE 1-29 FIGURE 1 - 7

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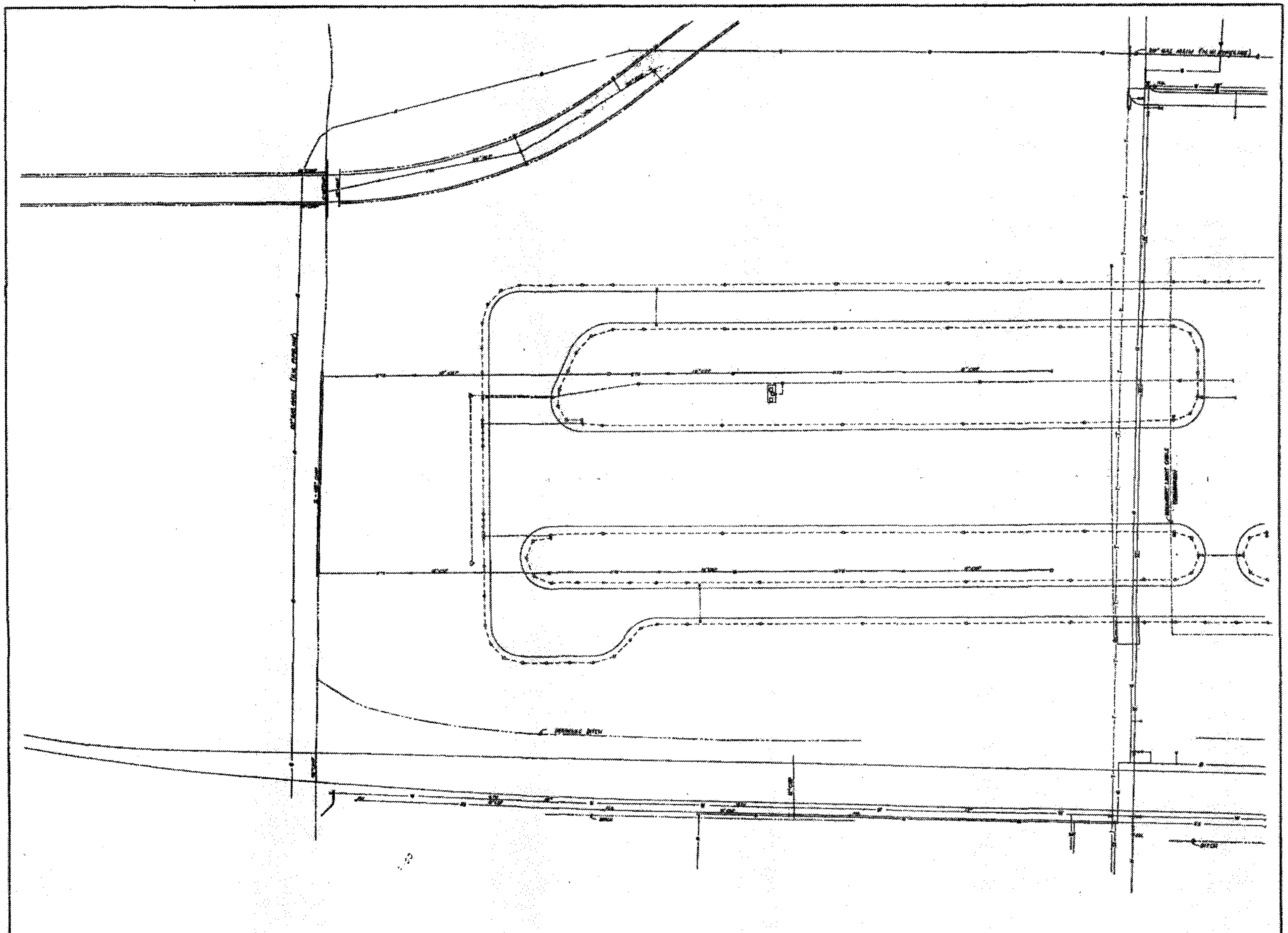

REFERENCE DRAWINGS

TA 45-501	PTA 75-11	
TA 60-5	PTA 81-100	
TA 60-501	PTA 81-10	
PTA 76-7	PTA 82-5	
PTA 78-7	PTA 82-7	

THE PORT OF PORTLAND

PORTLAND TROUTDALE AIRPORT

MASTER UTILITIES

PTA 83-23 1/4 82

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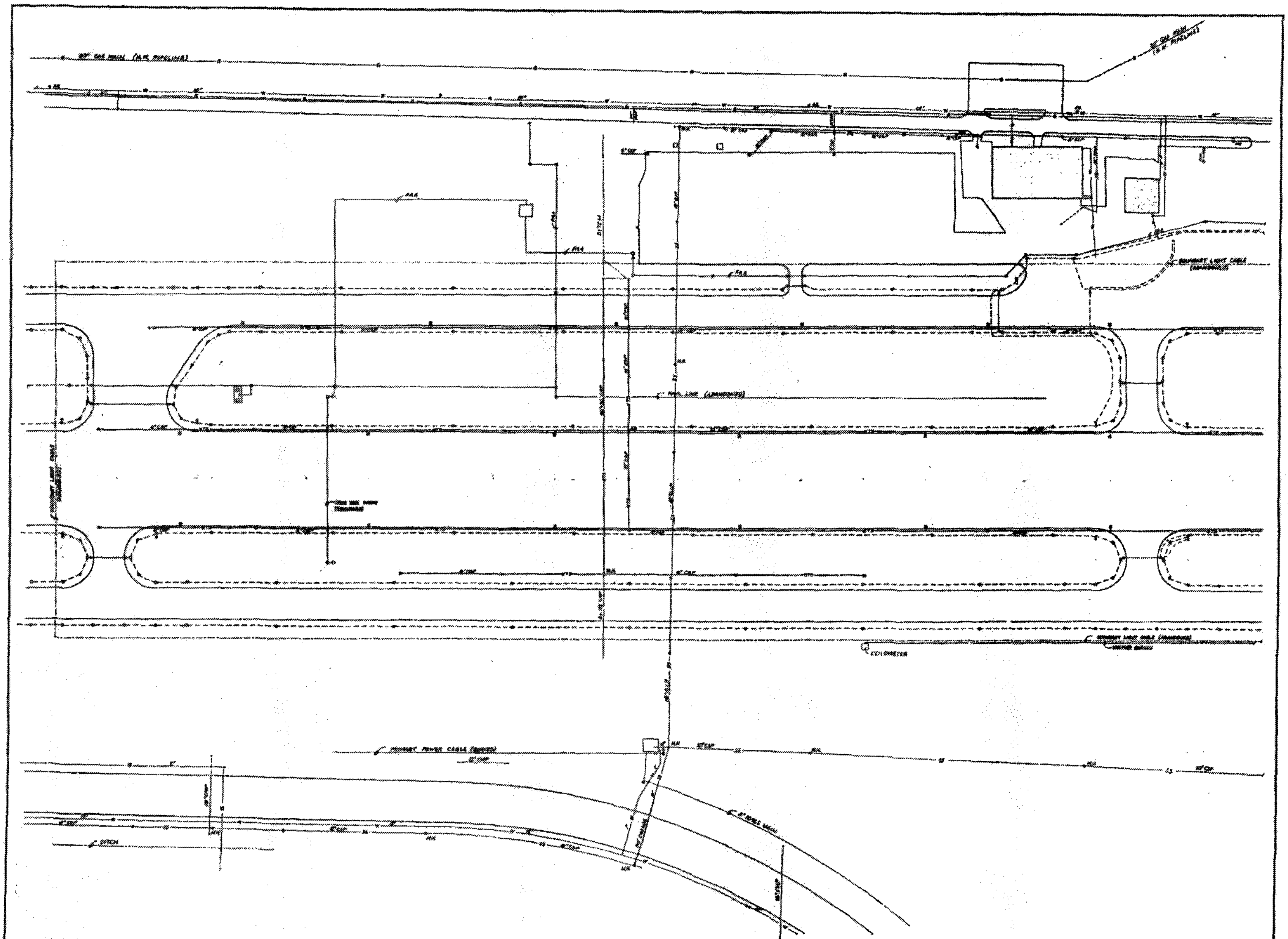
Fig 1-7a
1-30



REFERENCE DRAWINGS

TA 42-301	PTA 76-7	PTA 83-10
TA 60-5, 60-6, 60-8	PTA 78-7	PTA 84-5
TA 50-501	PTA 79-4	N.W. NAT. GAS PLAT
TA 75-1000	PTA 79-11	MAPS 15 BB MAPS
TA 75-2	PTA 81-1000	

THE PORT OF PORTLAND

PORTLAND TROUTDALE AIRPORT

MASTER UTILITIES

PTA 83-23 2/4 C2

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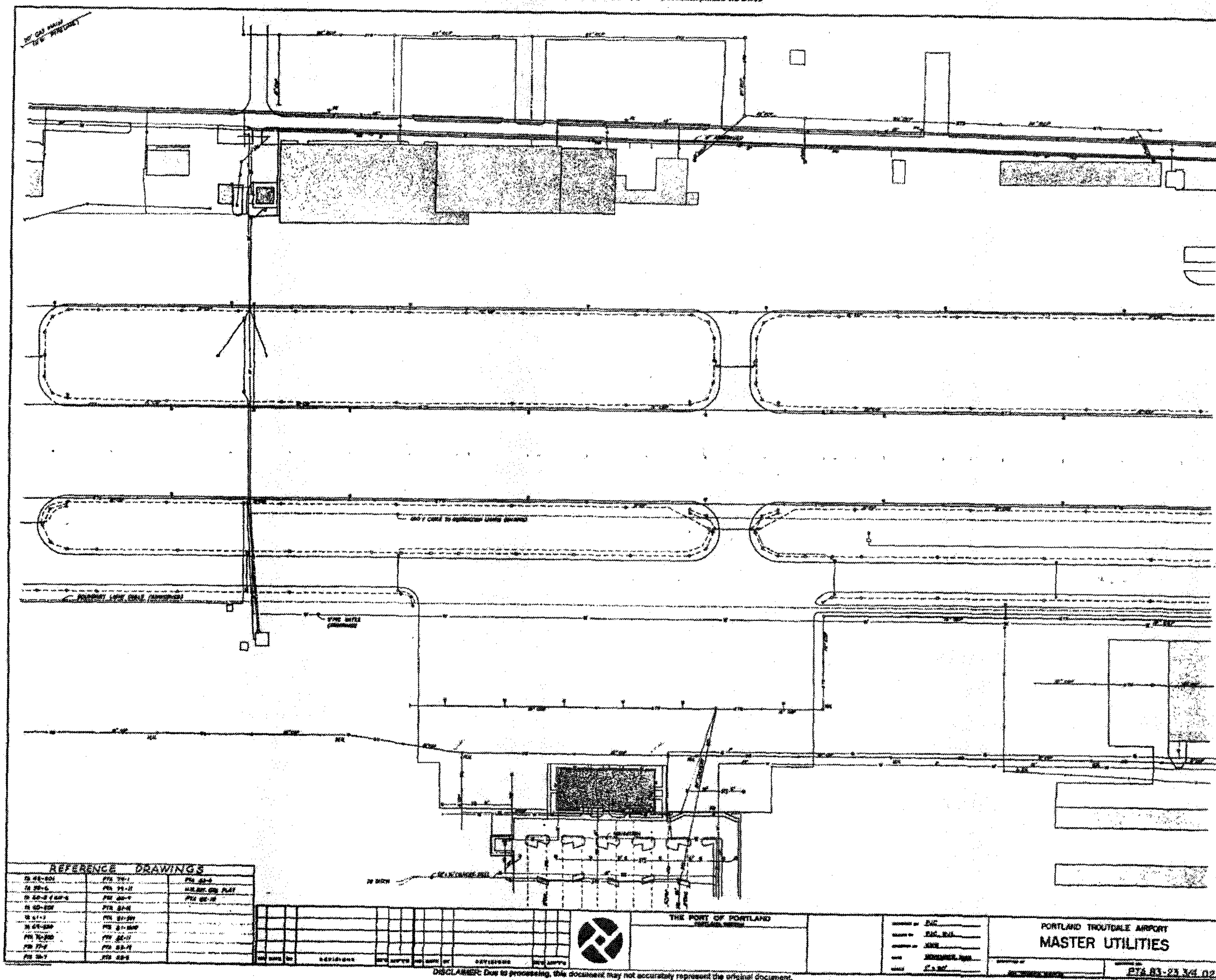

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MICROFILMED

Fig. 1-7c
1-32

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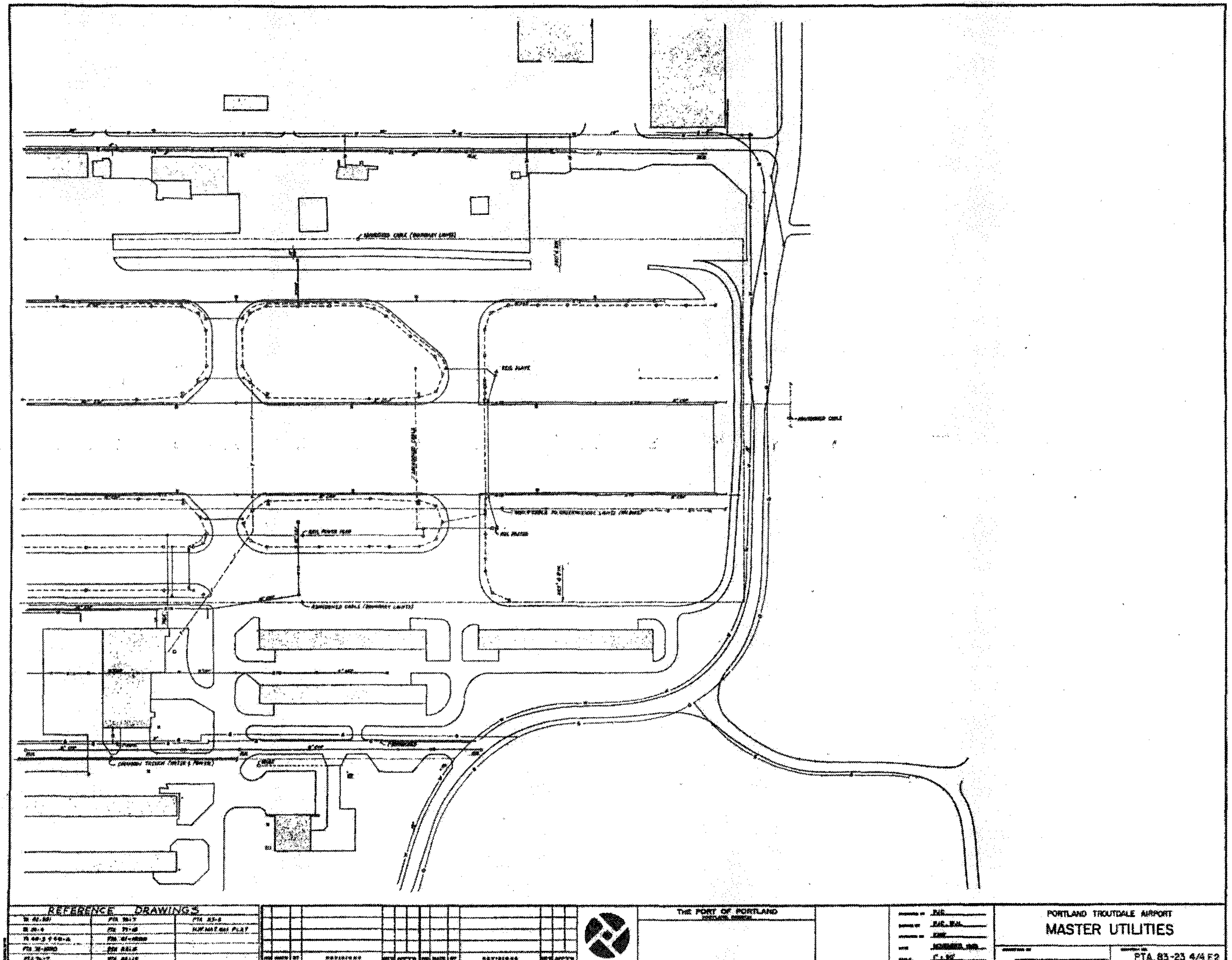

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MICROFILMED

Fig. 1-
1-33

SECURITY

In the aftermath of the terrorist acts of September 11, 2001, airport security has become a more focused issue for general aviation airports. Since Troutdale Airport does not have scheduled air service, it is not required to implement the same security procedures that are used at airports such as at Portland International Airport. However the need to provide increased security at smaller airports such as Troutdale Airport has been identified as a national priority.

The Transportation Security Administration (TSA) is currently considering security requirements for general aviation airports. These increased security needs are in part responsible for the new fencing project described above, which has been accomplished during the period of this master plan update. Specifically, a new 6' high fence with barbed wire at the top has been installed around the entire airfield and aircraft operations areas. In addition, meetings have been held between the Port of Portland and the City of Troutdale Police Department, to develop a memorandum of understanding to cooperatively address security issues at the airport.

Copies of recent documents discussing security at general aviation airports is attached in Appendix A4. Concepts being considered for improved general aviation airport security include:

- Improve perimeter security of airport operations areas;
- Provide additional law enforcement or security presence on airport;
- Establish a relationship with local law enforcement departments;
- Voluntary or mandatory credential checking on airport;
- Use of biometric devices to verify and validate ID;
- Allow airport operators access to law enforcement "watch lists;"
- Increase security awareness training for pilots and FBO's;
- Develop an "airport watch program;"
- Cooperate with the AOPA's 1-800-GA-SECURE program;
- Post security information at prominent locations;
- Improve lighting of critical areas of the airport;
- Improve aircraft ignition and door locks;
- Require aircraft to be stored in locked hangars or by other monitored security systems;
- Perform criminal record background checks on airport employees and tenants; and
- Prepare an airport security plan.

Troutdale Airport is a primary base for Oregon's Civil Air Patrol (CAP). Following the September 11, 2001 terrorist acts, when virtually all general aviation flying was prohibited, the CAP aircraft were in service and flying between Oregon and California to provide transport of emergency supplies. The existence of CAP at Troutdale Airport should be considered a very positive element in the development of an improved security organization for the airport.

AOPA, the State of Oregon, and others, have begun development of a concept of using organizations of local pilots as a form of "neighborhood watch" for general aviation airports. Such an organization would provide a mechanism whereby local pilots "keep an eye out" for suspicious behavior or activities at the airport. This approach has been developed in many of Oregon's communities as the concept of "community policing". Local pilots can provide a first line of defense in detecting suspicious activity at local airports. The "community of pilots" has strong interest in maintaining general aviation as a viable and safe transportation mode, and are an essential part of any ongoing efforts to maintain a safe and secure aviation system.

The Oregon Pilots Association has recently formed the "Troutdale Chapter." As of May, 2002, the group had 37 members, and has a goal to achieve 100 members by December 2002. This group of well organized and dedicated pilots at the airport can be a good source for ensuring local pilot involvement in meeting the security goals of the airport.

Following the terrorist attacks of September 11, 2001, all general aviation flight was grounded for an extended period of time. The concern was that smaller general aviation aircraft might be used for terrorist attacks. When the airspace did finally open for general aviation traffic, it was initially only available for IFR flights.

Eventually VFR flights were permitted, although the extended restrictions point out the importance of maintaining good IFR capabilities at Troutdale Airport. Troutdale Tower in the next few years will be gaining STARS radar capability, out to a radius of 10 miles. This will create an added factor to the ability to maintain security at Troutdale Airport by being able to specifically identify and track aircraft within this radar range.

Within the context of aviation safety and security, and the need for redundancy of facilities, Troutdale Airport in some ways may provide a backup to Portland International Airport. However, detailed consideration of this issue is beyond the scope of this master plan update.

MAINTENANCE

The Port of Portland has two staff at the airport full time to handle the maintenance of the airfield along with the buildings which the Port owns and operates. The peak maintenance period is during the summer due to the addition of grass mowing. The existing buildings owned by the Port are generally old and are a major demand of time and effort for the staff. A copy of a memorandum dated February 26, 2002 summarizing maintenance issues at the airport is attached as Appendix A-6 to this report.

LAND USE PLANNING AND ZONING

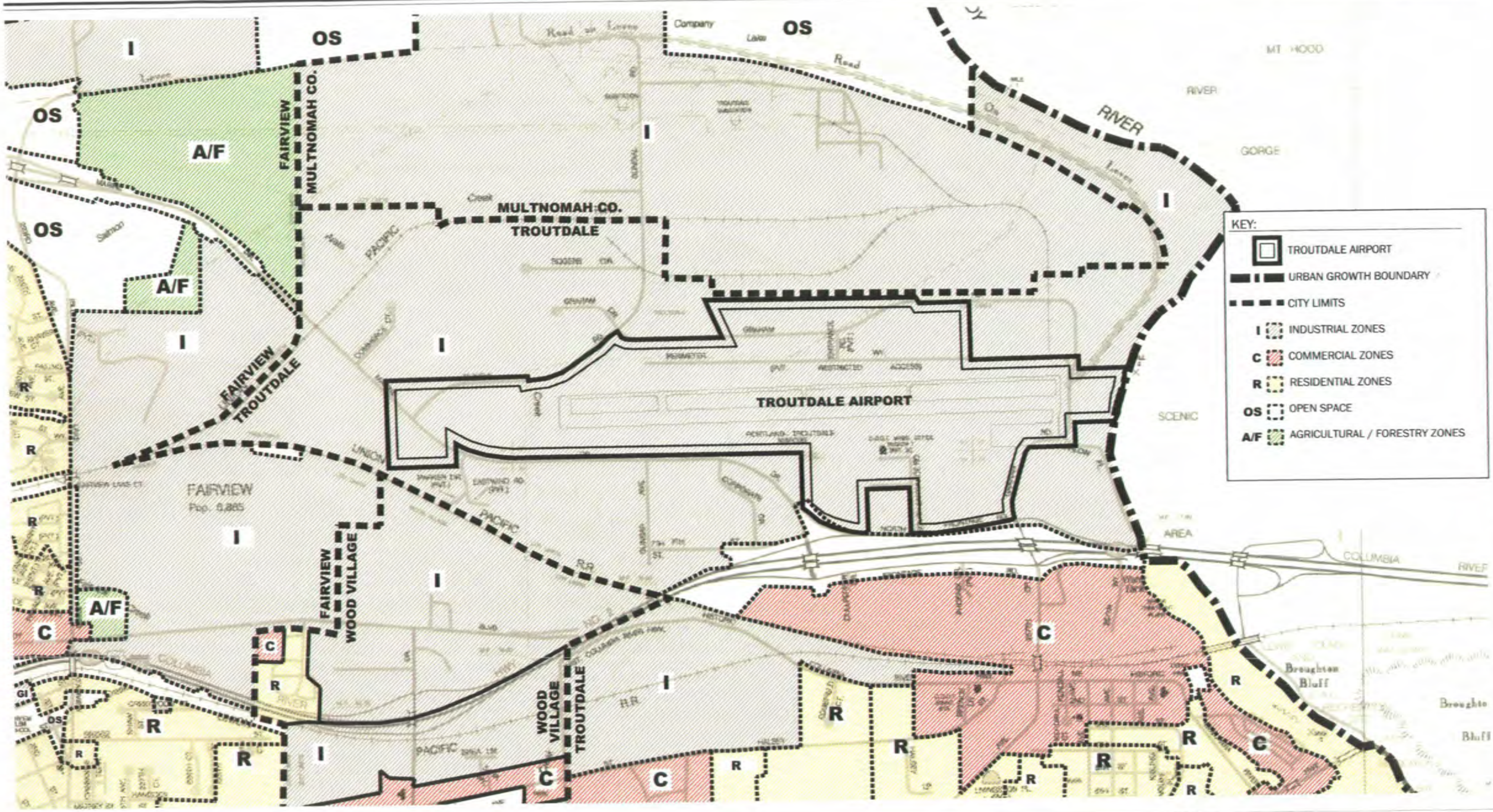
Located within the City of Troutdale, Troutdale Airport is closely bordered by the Cities of Fairview and Wood Village, as well as the Columbia River Gorge National Scenic Area; all within Multnomah County. **Figure 1-9** on the next page shows land use zoning for the lands surrounding the airport. Surrounding land uses bordering the airport to the north, west and southwest are all light to heavy industrial uses. Directly to the east across the Sandy River lies the Columbia River Gorge National Scenic Area: a large tract of federally managed land. Another small area just north of the airport, on the Columbia River, is also designated open space. To the south of the airport is a commercial area, largely serving I-84, which runs between the commercial uses and the airport itself.

With respect to residentially zoned areas in the immediate vicinity of the airport, most are significantly buffered from the airport and its neighboring industrial uses by I-84, running in an east-west direction. The closest residential area is approximately 1,525 feet from the southeastern corner of the airport, on the south side of I- 84, and is zoned Low Density Residential. The closest residential area under approach or departure paths is located approximately 5,200 feet beyond the west end of the runway, in the Blue Lake area.

Impacts and compatibility issues resulting from surrounding land uses can be largely divided into two categories: noise-related issues and flight safety concerns. Since land immediately neighboring the airport is zoned for industrial and commercial uses, with some pockets of open space and agricultural holdings, the compatibility issues surrounding Troutdale Airport relate primarily to flight safety concerns, such as tall structures under approach or departure paths, birds and other wildlife near the runways, and activity generating visibility and/or radio interference.

Airport Overlay Zones are a key tool for cities seeking to mitigate compatibility issues between airports and their surrounding uses. The Cities of Fairview and Troutdale have included Airport Overlay Zoning language in their respective zoning codes; however neither of these cities has a map showing the location of the Airport Overlay Zone. The City of Wood Village does not have an Airport Overlay Zone. This report recommends that these cities update their zoning codes with mapped overlay zones that clearly show where Airport Overlay restrictions are in effect to match those of the Airspace Drawing in Chapter 8 of this report.

Figure 1-9: Land Use Map



0 50' 100' 200' SCALE:1"=100'	N
ARON FAEGRE AND ASSOCIATES | CENTURY WEST ENGINEERING	sheet title: **LAND USE MAP**
source: City of Troutdale Plan Map, City of Fairview Zoning Map, City of Wood Village Plan / Zone Map	figure: **FIGURE 1-9 PAGE 1-36**

INVENTORY OF PILOTS, USERS, & COMMUNITY INTERESTS

During the inventory phase of work, extensive outreach has been made to the pilots, users, and general public to gain input as to issues, needs, or concerns about Troutdale Airport. Pilots, users, and the public were queried during a publicly advertised "Community Open House" session held at the airport on February 28, 2002 from 6 to 8 pm. In addition, a questionnaire was distributed to pilots using Troutdale Airport to gain information as to specific needs, comments, suggestions, and evaluation of the existing facilities and future needs. In addition, a presentation was made to local pilots at an Oregon Pilot Association (OPA – Troutdale Chapter) meeting on April 15, 2002 at 7pm, and their inventory of comments solicited. The inventory of pilots resulted in the following general comments and recommendations:

- New Run-up Area: "A new run-up area is badly needed at the west end of the north taxiway. Also, the run-up pad area on the north side of the west end of the runway needs to be enlarged to provide more run-up space for aircraft."
- Instrument Approach: "There is a very great need for a precision instrument approach or a non-precision instrument approach with at least 600 foot minimums."
- Aircraft Wash Rack: "A wash area is needed for aircraft." [completed 2003]
- South Taxiway Improvement: "Re-do south taxiway to have proper separations from runway."
- Control Tower: "Provide a new control tower on south side of airport."
- Public Restroom & Trashcan: "A public restroom and garbage facilities are needed to be made available to all pilots."

A copy of minutes of the Community Open House and OPA meetings, along with copies of returned questionnaires are attached in Appendices A-7 and A-8.

INVENTORY OF PUBLIC AGENCIES:

On February 28, 2002, a Joint Planning Conference was held at the Troutdale Airport to request that public agencies having an interest in the master planning process initiate input at this time or identify issues they wish to be involved with. Telephone calls followed by written invitations to the meeting were sent to the following public agencies [a * by the name means they were in attendance at the meeting]:

- FAA Airports District Office;
- FAA Control Tower*;
- NRCS/USDA/Soil Water Conservation District;
- US Fish & Wildlife Agency;

- US Environmental Protection Agency;
- Forest Service/Columbia River Gorga NSA;
- Mt. Hood National Forest;
- Oregon Dept. of Aviation*;
- Oregon DOT;
- Oregon DEQ;
- Oregon Dept. of Fish & Wildlife;
- Oregon LCDC;
- Oregon State Historic Preservation Office;
- Oregon Division of State Lands;
- City of Troutdale*;
- Multnomah County Planning;
- Mt. Hood Community College;*
- Metro;
- Multnomah Drainage District 10/Sandy Drainage District*;
- City of Fairview; and,
- Port of Portland*.

During the two hour meeting the following items arose as key issues to be considered during the master planning process:

- Evergreen Airport Closing: With Evergreen Airport closing, its 170 aircraft will have to relocate. This may be a great opportunity for Troutdale Airport to develop an increased base of user aircraft and pilots.
- PDX Security Issues: Some felt that with security needs at PDX becoming greater, it may lead to corporate aircraft leaving PDX in favor of a more accessible airport like Troutdale.
- City of Troutdale: The City of Troutdale is responsible for zoning and development issues and roads on the perimeter of the airport. The City has no current specific concerns that need to be addressed.
- Drainage Issues: The entire airport area is a "managed flood plain" and the Sandy Drainage District wishes to remain involved with the masterplanning of the airport.
- Wetlands Attract Wildlife: Tower staff notes that the many wetlands on the airport attract wildlife, which has resulted in some bird strikes at the airport. The Drainage District has found beaver and

nutria moving up into the area as well and creating dams.

- Forest Service Tanker Aircraft: The Forest Service tanker aircraft are an important user of the airport. Final design of taxiway setbacks should be established which provide adequate clearance for their large firefighting aircraft.
- New Tower Equipment: By May of 2003, the tower will have new radar and radio equipment. Radar services will cover an approximate 10 mile radius around Troutdale Airport.
- Community College Facility: Mt. Hood Community College is planning to use some of the federal property at the NW corner of the airport for classes and pilot training, civil engineering, and general science. Thus the college will be interested in maintaining adequate parking and vehicular access for all of the facilities.
- Science & Technology Park: A strong effort is being made to develop the old Reynolds Aluminum site as a new science and technology park. This project has much support and would be a compatible land use with the airport that would likely result in uses for the airport similar to how Intel Corporation uses Hillsboro Airport.
- Troutdale as a Reliever Airport: Port staff are aware that Troutdale is an important reliever airport for both Portland International Airport and Hillsboro Airport. There are days when both Portland International and Hillsboro are fogged in and Troutdale serves as the only local option for smaller commercial aircraft such as Ameriflight, Horizon, Hillsboro Airport business aircraft, and other aircraft users.
- Security Plans for Troutdale Airport: The Port of Portland is developing a security plan for Troutdale Airport which will include an "airport watch" component along with an intergovernmental agreement with the City of Troutdale. As part of the security upgrade, the Port will soon be installing a new six foot chainlink fence with barbed wire top that will surround the aircraft-active areas of the airport.
- Aircraft Wash Location: The Port is preparing to install an aircraft wash area and has some funding available to do this. As this Master Plan is being completed, this project is under construction.
- Forest Service Tanker Site: The Forest Service uses its site at the airport as a "re-load base" since the aircraft are normally based at Redmond or Moses Lake. They only come to Troutdale when needed for firefighting in this region. Occasionally the base is also used for helicopter or other fixed wing aircraft that are used for observing fires. The Forest Service looks forward to improving the taxiway separation and may be able to assist in funding.

A full copy of the meeting minutes from the Joint Planning Conference are provided in Appendix A-4 of the master plan.

AIRPORT ACTIVITY

Aviation activity at Troutdale Airport has fluctuated since the last airport master plan was completed in 1990. At first activity increased substantially, reaching a peak in 1996, and then declining through to the most recent data of 2001. The 1990 master plan predicted a steady increase in based aircraft and operations, which is not reflected in current levels of activity. However, most other general aviation airports in the Portland-Vancouver metropolitan area did have steady increases in based aircraft and operations during this period (see Chapter 2). Based on the overall regional trends, the decreases in Troutdale Airport would appear to be related to specific local conditions rather than regional demand factors.

Figure 1-10 summarizes recent historical airport activity. The solid line indicates total aircraft operations (one landing and one takeoff equals two operations) as listed in TAF records (year 2001 uses air traffic control tower data as TAF data is not yet available for that year). The dashed line indicates instrument operations only. Trend lines for the data, using a 3rd degree polynomial are also shown. The spreadsheet containing this data with a listing of the sources is provided in Appendix A-9. The traffic data indicates that airport operations experienced the most recent peak about 1996 (120,000 operations), but has declined steadily to current levels of around 75,000 operations per year. It is interesting to note that during the same period, the number of based aircraft has remained relatively steady. This suggests that the type and amount of flight activity on the airport changed during this period, though the causes of the changes remains unknown at this time.

Figure 1-10: Troutdale Airport Aircraft Operations 1974 - 2001

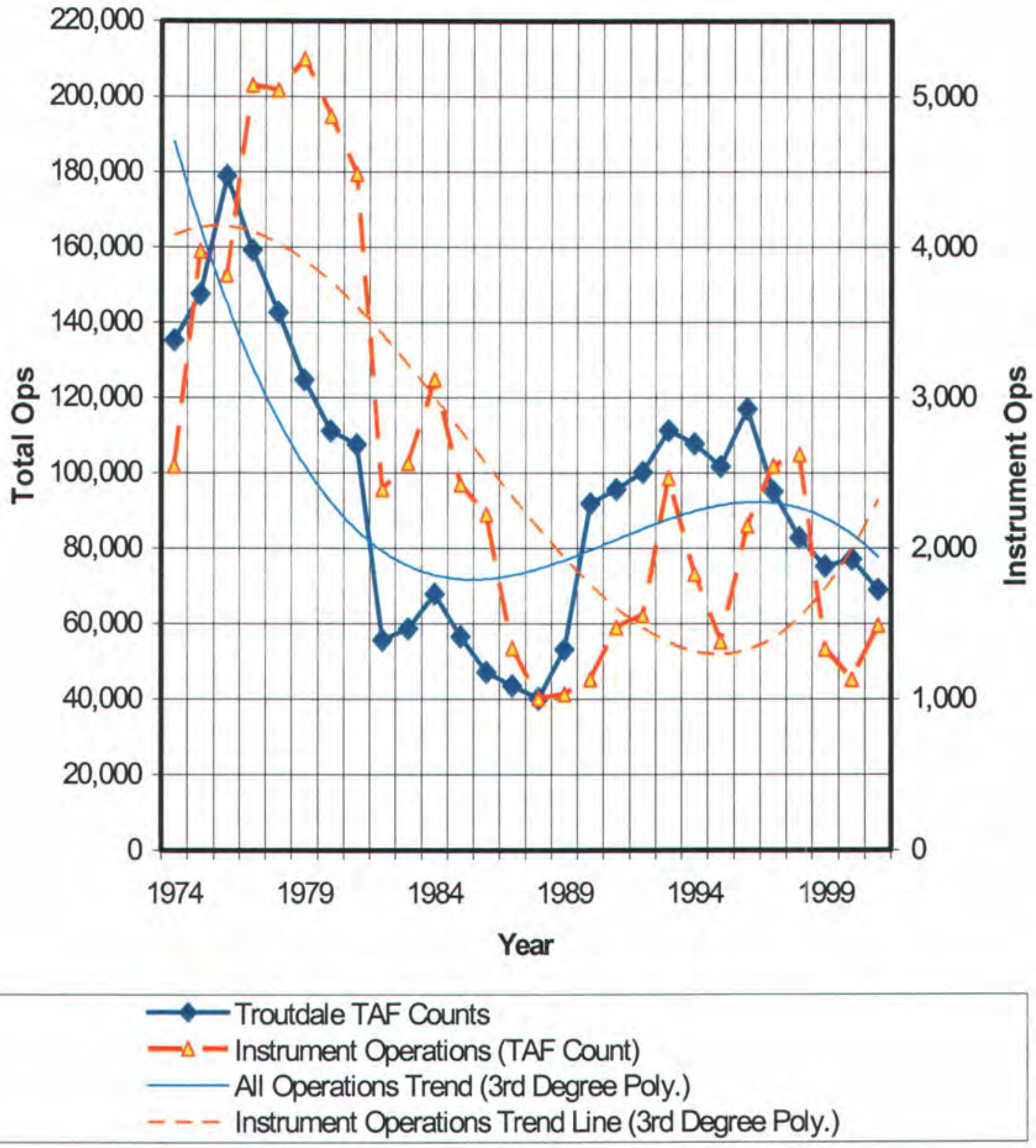


Figure 1-11 shows the history of numbers of based aircraft at Troutdale Airport for the period 1980 through 2001.

Figure 1-11: Troutdale Airport Based Aircraft 1974 - 2001

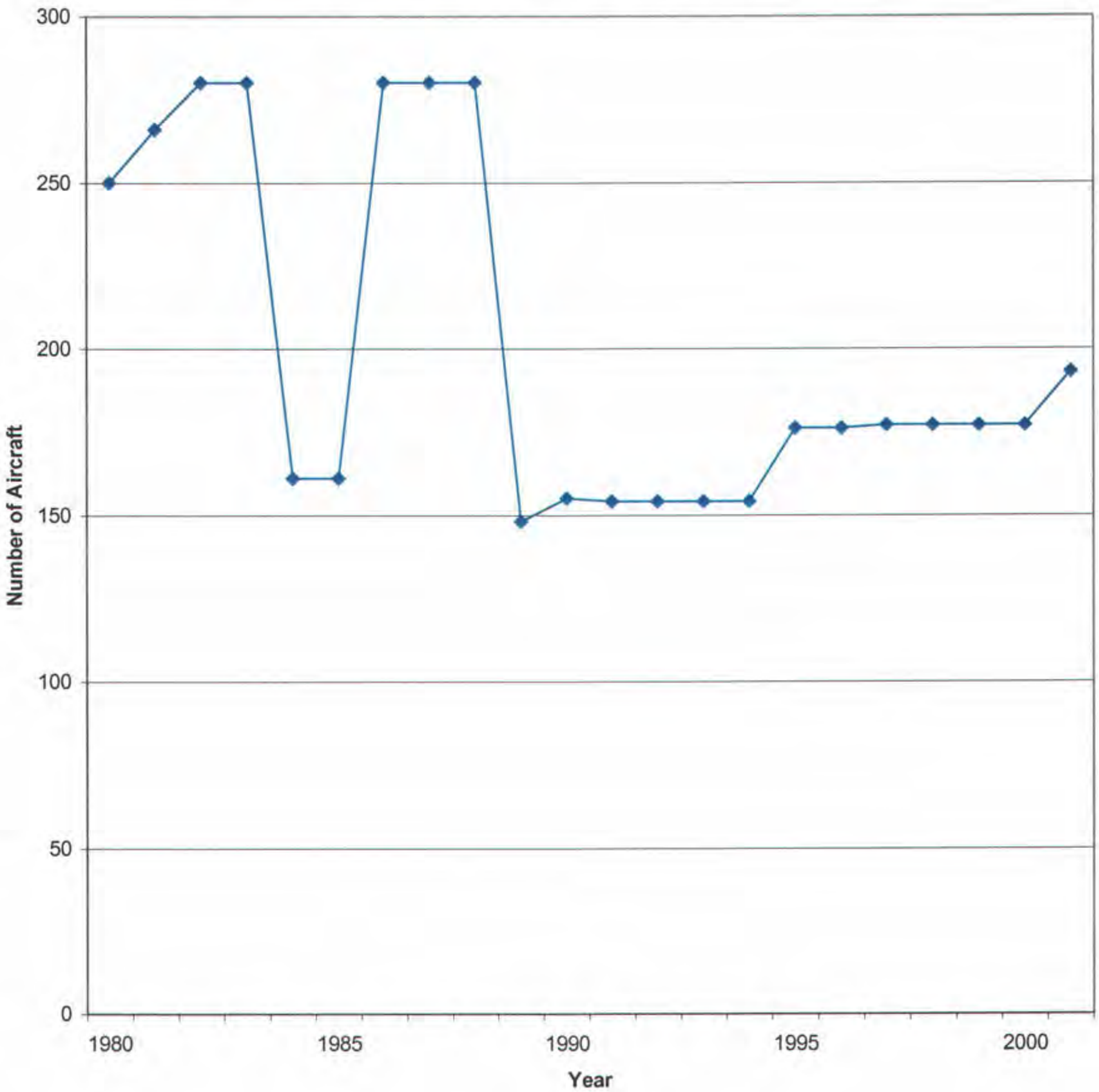


Table 1-12 below lists the current (June 2002) estimate of based aircraft at the airport, broken down by tenant and type of aircraft. This list is based on interviews with each of the tenants on the airport. It is believed that the number of aircraft at the airport during the prior year was approximately the same, so the 2002 current total was used in Figure 1-8 for the 2001 value, in lieu of the TAF number of 177.

Table 1-12: Troutdale Airport Based Aircraft

	TABLE 1- : TROUTDALE AIRPORT BASED AIRCRAFT					
			6/15/02			
HANGAR	***AIRCRAFT TYPE***					
OWNERSHIP	***SEL***	***SEL-HP***	***MEL***	***HC***	***JET***	***Subtotals***
PLS Hangars						
A	8	3	1			
B	7	4	1			
C	11	1				
D	8	4				
E	9	4				
	43	16	2			61
NWA Hangars						
A	5	5				
B	8	2				
C	9					
D	8	1				
E	5	5				
F	6	3	1			
G	1	4	2			
	42	20	3			65
ROSHOLT PROPERTIES	2	3	3			8
CONDOMINIUM HANGARS	10					10
PORT OF PORTLAND (1)	1					1
PREMIER	16	3	4	1	1	25
GORGE WINDS	5		1			6
EAGLE FLIGHT CENTER	8					8
RIGHT APPROACH	8		1			9
Totals	135	42	14	1	1	193
						193
NOTES:	1. Abandoned plane on south apron.					
	2. SEL = Single Engine Land; HP = high performance					
	MEL = Multi-engine Land; HC = Helicopter; Jet = Business Jet					
	3. Data collected by Aron Faegre & Associates					

FUEL ACTIVITY

Aviation fuel sales at Troutdale Airport were reviewed for the period July 1996- April 2002 and are summarized by month in **Figure 1-12** and by year in **Figure 1-13**. The records are from the Port of Portland and do not differentiate between avgas and jet fuel.

Figure 1-12 shows monthly sales for the past 5 fiscal years (the Port of Portland accounting year ends on June 30th). The graph shows a regular annual cycle with peak sales during July and August, and minimum sales in December and January. The amplitude of change is approximately 25,000 gallons per month with a minimum usage of approximately 10,000 gallons per month. A major shift in quantities of fuel sales occurred October 1998, which must reflect some basic structural change to the character of the airport tenancies. Prior to that the amplitude of change was in the 30,000 to 40,000 gallons per month, with minimum usage of approximately 30,000 gallons per month. Thus, it appears that there was especially a strong base of use throughout the year that is no longer in place.

Figure 1-12: Troutdale Airport Fuel Sales by Month

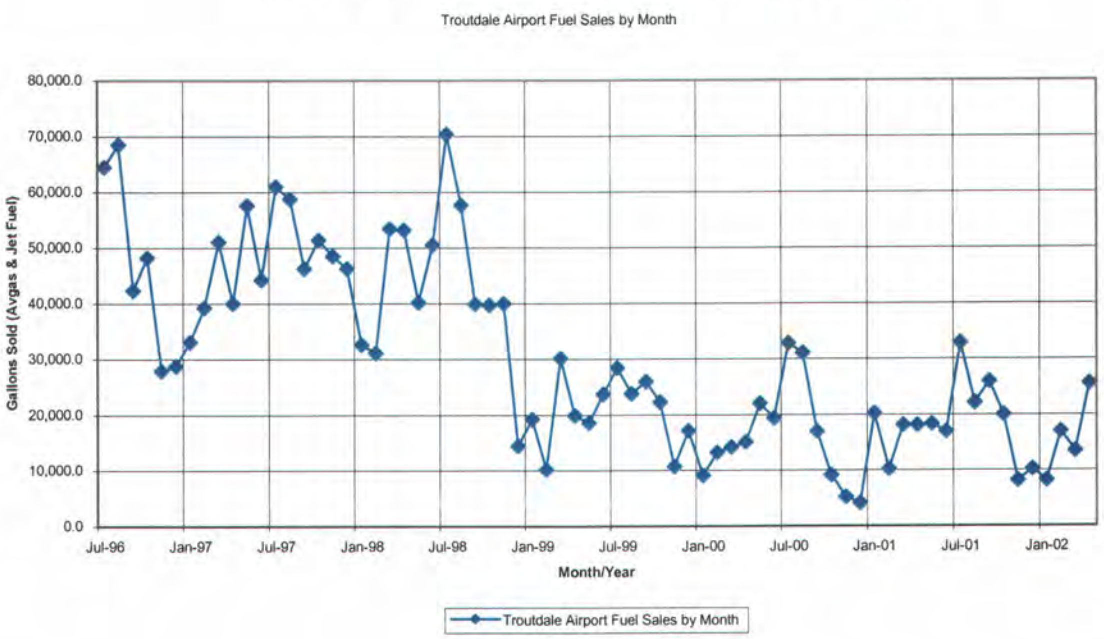
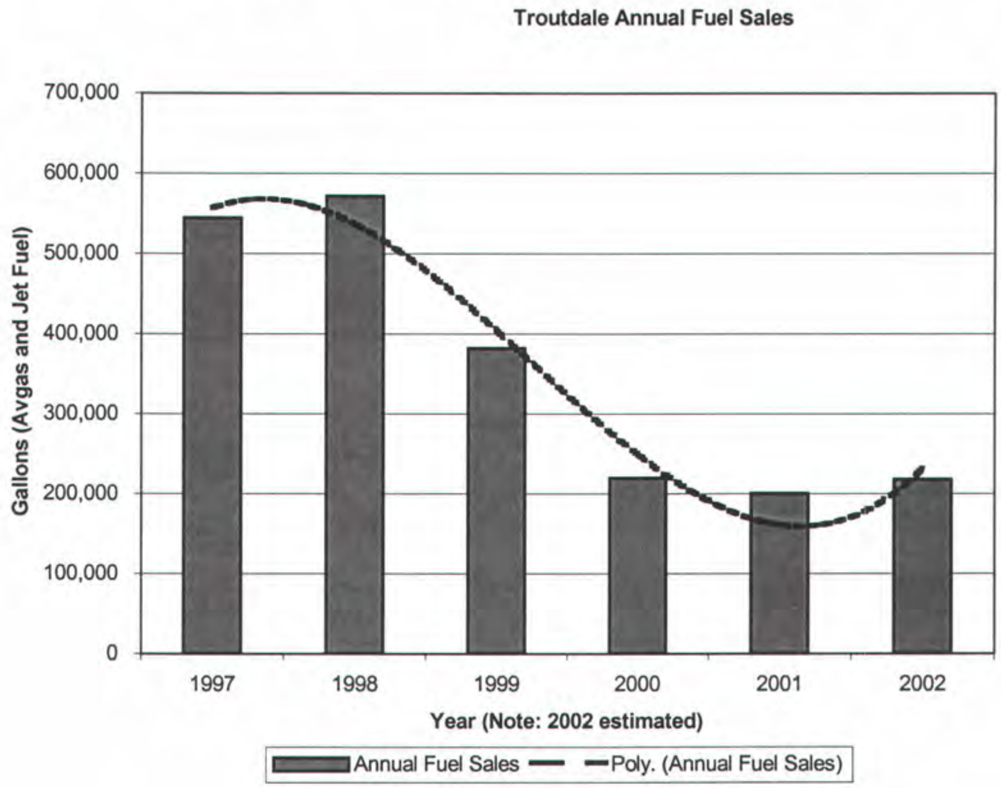


Figure 1-11 shows annual sales for the past 5 fiscal years (the Port of Portland accounting year ends on June 30th). May and June for fiscal year 2001 is extrapolated to include similar sales to what occurred in 2000. The graph shows the major change in sales that occurred between 1997 and 1999. A third order trend analysis projects that fuel sales may now be on the increase.

Figure 1-13: Troutdale Airport Fuel Sales by Year (June to June)



CHAPTER TWO

Airport Future Role

INTRODUCTION

TROUTDALE AIRPORT STRATEGIC ANALYSIS

The objective of this section is to analyze the existing role of Troutdale Airport within the Portland Metro area system of airports and to determine what alternative roles are available for it. Following a discussion of these alternatives, a recommendation will be made as to what specific role Troutdale Airport should have over the next 10 to 20 year planning period.

AIRPORT ROLE WITHIN FAA SYSTEM

Troutdale Airport is a publicly owned and operated airport providing services to the greater Portland metropolitan area. In particular, the airport serves the eastern urban area of Multnomah County, Oregon, along with the southeastern portion of Clark County, Washington. The airport is included in the National Plan of Integrated Airport Systems (NPIAS), published by the US Dept. of Transportation, Federal Aviation Administration. The FAA's NPIAS plan contains approximately 3,344 airports. These airports are intended to serve as a national system of public-use airports accessible to all pilots throughout the United States. The NPIAS is an annually published document which includes capital improvement recommendations for maintaining and developing these public use airports over the next 10 year period and it defines federal funding availability based on the particular service level and role for each airport.

According to the NPIAS, the role for Troutdale Airport is presently designated as a general utility reliever airport. By means of its runway length, width, and pavement-bearing capacity, it is intended to accommodate up to type B-II[1] aircraft. It is not intended to provide air carrier service, but should accommodate the operation of business and corporate aircraft of greater than 12,500 pounds. By remaining as an airport within the NPIAS plan, FAA funds are typically available for up to 90% of the cost of major airport improvements that maintain its service capability.

TROUTDALE AIRPORT ROLE WITHIN PORT OF PORTLAND AIRPORT SYSTEM

Troutdale Airport is one of 4 airports owned and operated by the Port of Portland. The Port is a special-purpose government entity created by the Oregon Legislature with responsibilities for providing aviation, maritime, and industrial park facilities in the Portland metropolitan area. Besides Troutdale Airport, the Port also operates Portland International Airport, Hillsboro Airport, and Mulino Airport. The Port of Portland's boundaries encompass Multnomah, Washington, and Clackamas Counties.

Portland International Airport is the primary commerical airport for scheduled air service for the larger Portland metropolitan area. Troutdale, Hillsboro, and Mulino Airports are operated by the Port under the concept of "reliever airports". There is one reliever airport in each of the counties that the Port of Portland serves. In part, the goal of a reliever airport is to attract recreational and other non-schedule aviation activity in order to maximize the efficiency and capacity of Portland International Airport, as the primary airport to serve scheduled commercial service for the metropolitan area.

AIRPORT SERVICE AREA

The airport service area refers to the area surrounding an airport that is directly affected by the activities at that airport. It is not uncommon to have other airports located within a service area, although the services or facilities available often define the size of the service area. Normally a 30 to 60-minute surface travel time is used to approximate the boundaries of a service area. **Figure 2-1** shows a map of the greater Portland region, with public airports in this region identified, along with an estimate of the drive time from Troutdale Airport shown as contours on the map. The 15 minute surface travel time covers much of the "Four Cities" area, along with a portion of east Portland. The 60 minute surface travel time covers most of the metropolitan area.

Table 2-1 lists these public airports and indicates their distance and drive time from Troutdale Airport, along with their number of based aircraft, runway length and type, lighting, type of approach, and services available. Each airport was contacted to attempt to determine its plans for expansion. **Table 2-2** and **Figure 2-2** provide Based Aircraft Historical Data for each airport for 1971 through 2002. **Figure 2-3** provides Based Aircraft Historical Data for groupings of the airports. Following this table, each airport is described in detail.

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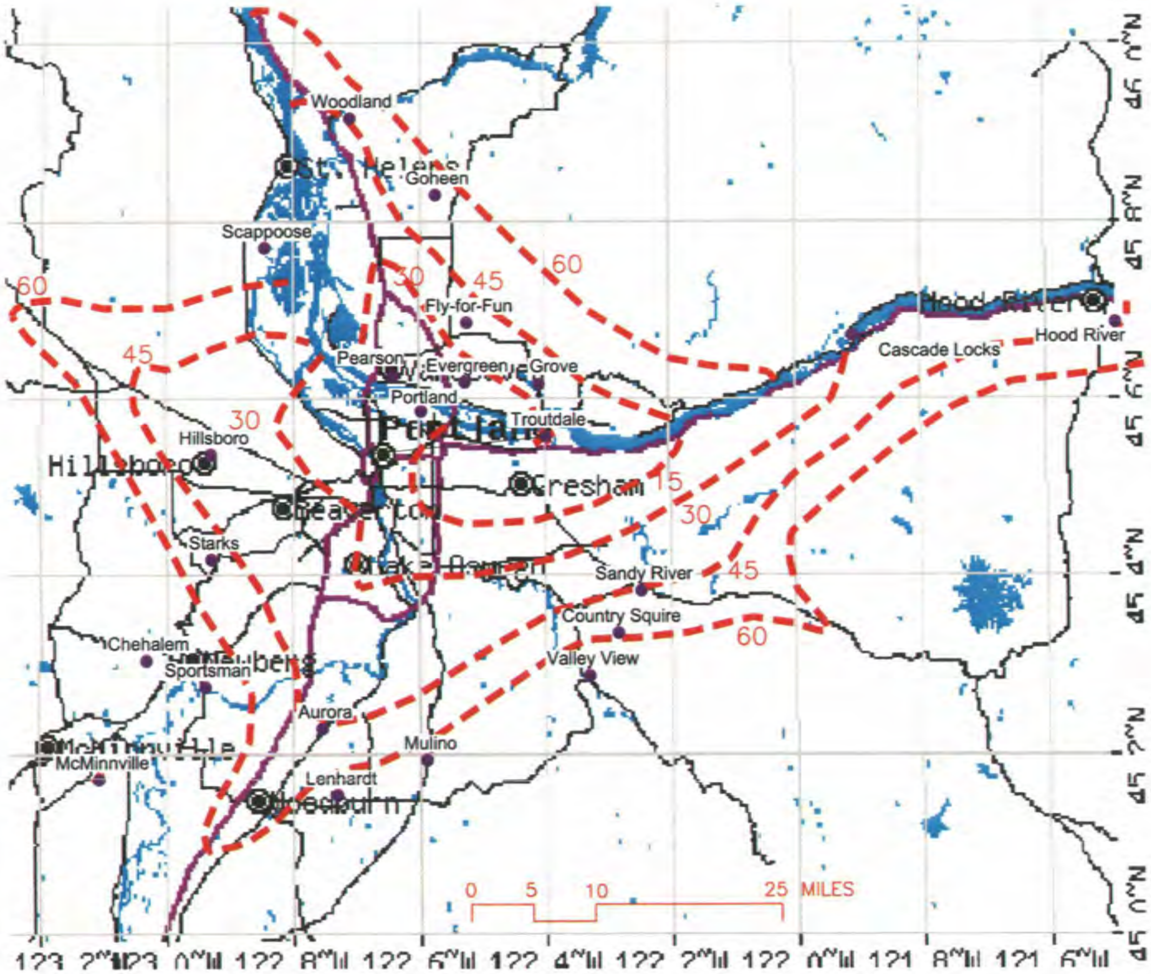
[1] Category B means the airport is designed to accommodate aircraft with approach speeds of at least 91 but less than 121 knots; Group II means the airport is designed to accommodate aircraft with wingspans of at least 49 feet but less than 79 feet

At the start of the historical data in 1971 Troutdale Airport had the region's most based aircraft of any airport. Growth was strong for many years, but after the decline of the GA industry in the early 1980's, Troutdale Airport showed virtually no growth. The past four years show growth returning to the airport.

The figure showing the graph of data for all 18 of the airports makes clear that there can be a wide variability in airport growth and decline over time. Aurora, Scappoose, and McMinnville airports have had a "boom" in hangar construction which has fueled very strong growth at those locations. Hillsboro has shown a steady growth over the span of 15 years. Portland International shows a decline in GA aircraft, as many aircraft find new homes in surrounding airports such as Aurora, Scappoose, and Hillsboro, in part to avoid the heavier commercial jet and airline service.



0 5' 10' 20' SCALE:1"=10'	ARON FAEGRE AND ASSOCIATES with Century West Engineering	sheet title: DRIVE TIME FROM REGIONAL AIRPORTS
N	source: TIGER Map	figure: PAGE 2-4 FIGURE 2 - 1

Table 2-1: Portland Region Public Airports

Portland Region Public Airports — Table 2-1

Troutdale Airport Master Plan

Community	Airport	County	Direction(1)	Drive Time (2)	Owner	Use	Based A/C(3)	Facilities(4) Rwys	Length	Surf	Lgt	Appr	Svcs(5) Gas	Jet	Mntn	Rent	Food	CT	Psgr
Aurora	Aurora State	Marion	25 SSW	45 min.	State	Pub	387	1	5004	Asph	Yes	NP	X	X	X	X			
Battle Ground	Goheen	Clark	18 NW	54 min.	Pvt	Pub	40	1	2600	Turf	Yes	Vis	X		X	X			
Camas	Grove	Clark	4 N	38 min.	Pvt	Pub	67	1	2710	Asph	Yes	Vis	X		X	X			
Cascade Locks	Cascade Locks	Hood River	22 E	36 min.	State	Pub	0	1	1800	Asph	No	Vis							
Estacada	Valley View	Clackamas	17 SSE	1 hr. 6 min.	Pvt	Pub	33	1	3780	Asph	Yes	Vis	X		X				
Hillsboro	Hillsboro	Washington	23 W	37 min.	Port(6)	Pub	392	2	6600	Asph	Yes	Prec	X	X	X	X	X	X	
Hillsboro	Stark's Twin Oaks	Washington	25 WSW	52 min.	Pvt	Pub	100	1	2150	Gravel	No	Vis	X		X	X			
Hood River	Hood River	Hood River	38 E	1 hr. 6 min.	Pvt	Pub	80	1	3040	Asph	Yes	Vis	X		X	X	X		
Hubbard	Lenhardt	Clackamas	28 SSW	1 hr. 1 min.	Pvt	Pub	41	1	3200	Asph	Yes	Vis	X		X	X			
McMinnville	McMinnville	Yamhill	38 SW	1 hr. 39 min.	City	Pub	140	2	5420	Asph	Yes	Prec	X	X	X	X	X		
Mulino	Mulino	Clackamas	25 SSW	47 min.	Port(6)	Pub	53	2	3600	Asph	Yes	Vis				X			
Newberg	Chehalem	Yamhill	31 WSW	1 hr. 33 min.	Pvt	Pub	26	1	2285	Asph	Yes	Vis	X		X	X			
Newberg	Sportsman	Yamhill	28 SW	1 hr. 9 min.	Pvt	Pub	53	1	2745	Asph	Yes	Vis	X		X	X			
Portland	Portland Intl.	Multnomah	8 W	19 min.	Port(6)	Pub	69	3	11100	Asph	Yes	Prec	X	X	X	X	X	X	X
Sandy	Country Squire	Clackamas	16 SSE	43 min.	Pvt	Pub	27	1	3095	Asph	No	Vis				X			
Sandy	Sandy River	Clackamas	13 SE	46 min.	Pvt	Pub	34	1	2115	Turf	No	Vis			X	X			
Scappoose	Scappoose	Columbia	25 NW	1 hr. 5 min.	Port(7)	Pub	170	1	5100	Asph	Yes	Vis	X	X	X	X			
Troutdale	Portland-Troutdale	Multnomah	-	-	Port(6)	Pub	177	1	5400	Asph	Yes	NP	X	X	X	X		X	
Vancouver	Evergreen	Clark	8 WNW	22 min.	Pvt	Pub	165	2	2120	Asph	Yes	Vis	X		X	X			
Vancouver	Pearson	Clark	12 WNW	27 min.	City	Pub	210	1	3275	Asph	Yes	NP	X	X	X	X			
Vancouver	Fly-For-Fun	Clark	10 NNW	35 min.	Pvt	Pub	7	1	2580	Turf	No	Vis							
Woodland	Woodland State	Cowlitz	25 NNW	40 min.	State	Pub	16	1	1965	Gravel	Yes	Vis							

1. Distance (in Nautical Miles) and Direction from Portland-Troutdale
2. Distance (in minutes) driving from Portland-Troutdale
3. FAA Airport Master Records (Form 5010), 4-18-02
4. Facilities: Rwys = Number of Runways
   Long = Length of Longest Runway (feet)
   Surf = Runway Surface (concrete/asphalt/gravel/turf/dirt)
   Lgt = Runway Lighted (yes/no)
   Appr = Approach Type (precision/nonprecision/visual)
5. Services: Gas = Aviation Gasoline
   Jet = Jet Fuel
   Mntn = Aircraft Maintenance
   Rent = Aircraft Rental
   Food = Restaurant
   CT = Air Traffic Control Tower
   Psgr = Scheduled Passenger Airline Service
6. Port of Portland
7. Port of St. Helens

Table 2-2: Portland Region Public Use Airports Based Aircraft Data

Portland Region Public Use Airports		Table 2-2						
Based Aircraft Historical Data								
Troutdale Airport Master Plan								**Annual Avg**
7/12/2002								**Growth Rate**
	1971	**1976**	**1979**	**1983**	**1986**	**1988**	**2002**	**last 14 yrs**
Clackamas County, OR								
Estacada/Valley View			28	25	20	23	33	2.6%
Hubbard/Lenhardt	20	23	24	23	12	10	41	10.6%
Mulino	26	26	33	34	25	25	53	5.5%
Sandy/Country Squire		4	23	25	21	21	27	1.8%
Sandy/Sandy River	32	35	32	34	14	17	34	5.1%
County Total	78	88	140	141	92	96	188	4.9%
Multnomah County, OR								
Portland International	130	100	149	93	110	82	69	-1.2%
Troutdale/Portland	188	230	282	149	154	150	193	1.8%
County Total	318	330	431	242	264	232	262	0.9%
Washington County								
Hillsboro/Stark's Twin Oaks			66	66	44	78	100	1.8%
Portland-Hillsboro	156	275	355	320	303	350	392	0.8%
County Total	156	275	421	386	347	428	492	1.0%
Port of Portland District	552	693	992	769	703	756	942	1.6%
(3 Counties)								
Columbia County, OR								
Scappoose	38	53	63	58	48	48	170	9.5%
County Total	38	53	63	58	48	48	170	9.5%
Yamhill County, OR								
McMinnville	57	36	77	63	60	65	140	5.6%
Newberg/Chehalem							26	
Newberg/Sportsman	36	42	71	63	42	45	53	1.2%
County Total	93	78	148	126	102	110	219	5.0%
Clark County, WA								
Battle Ground/Goheen	10	18	31	13	24	9	40	11.2%
Camas/Grove	20	35	35	35	48	45	67	2.9%
Clark County (closed)	31	50	80	81	100	101	0	-100.0%
Vancouver/Evergreen	155	179	203	224	250	243	165	-2.7%
Vancouver/Fly-For-Fun							7	
Vancouver/Pearson	170	170	173	177	170	164	210	1.8%
County Total	386	452	522	530	592	562	489	-1.0%
Marion County								
Aurora	100	144	247	231	223	223	387	4.0%
County Total	100	144	247	231	223	223	387	4.0%
Portland Metro Area	1,169	1,420	1,972	1,714	1,668	1,699	2,207	1.9%
(Portions of 7 Counties)								
Hood River County								
Cascade Locks	0	0	0	0	0	0	0	
Hood River				75	58	59	80	2.2%
County Total	0	0	0	75	58	59	80	2.2%
Cowlitz County								
Woodland	16	16	16	16	16	16	16	0.0%
County Total	16	16	16	16	16	16	16	0.0%
Greater Portland Region	1,185	1,436	1,988	1,805	1,742	1,774	2,303	1.9%
(Portions of 9 Counties)								
Notes:								
1. Includes airplanes, helicopters, and ultra-lights based at airports.								
2. Most data from years 1971 through 1988 from Troutdale Master Plan, dated December 1990.								
3. Aurora, Hood River, and Scappoose data from their most recent Master Plans.								
4. Table prepared by Aron Faegre & Associates.								

Figure 2-2: Portland Region Public Airports - Based Aircraft History

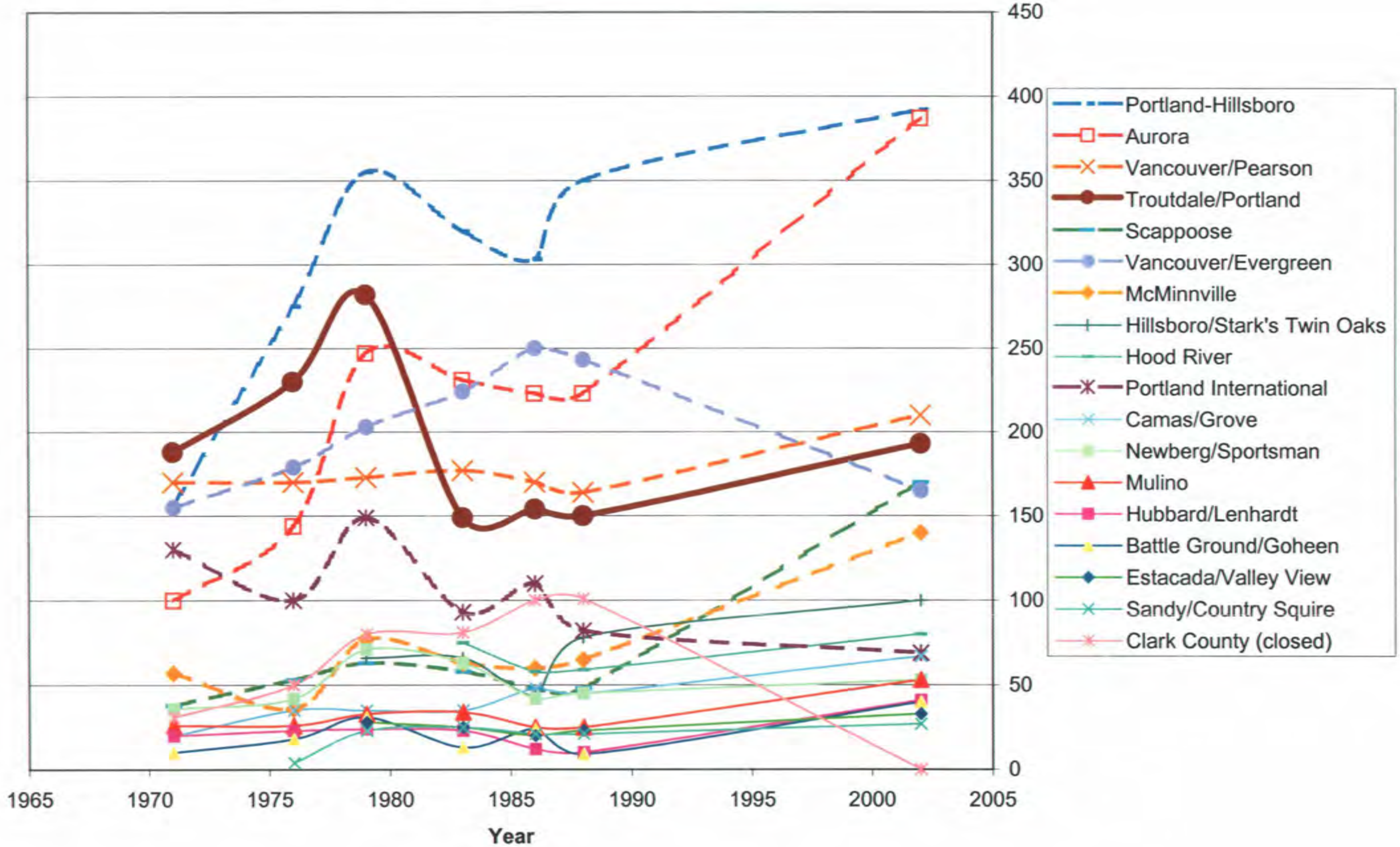
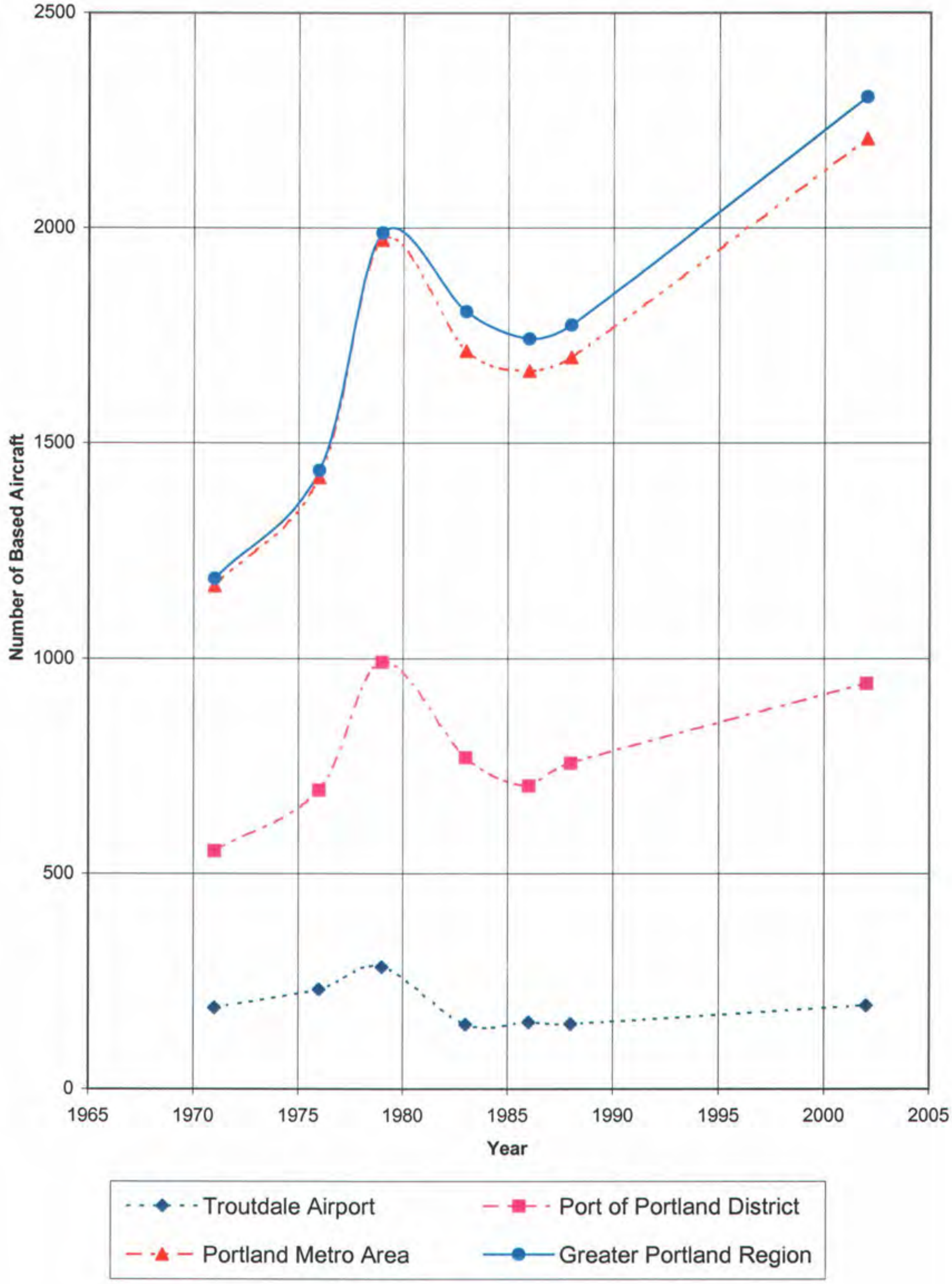


Figure 2-3 : Portland Region Public Airports - Groupings of Based Aircraft



REGIONAL PUBLIC AIRPORTS (ALPHABETICAL BY CITY)

All twenty-one public airports in the region are considered below:

Aurora State Airport
Aurora State Airport is located approximately 25 nautical miles SSW of Troutdale Airport alongside Interstate 5, near the city of Aurora, Oregon (Marion County). Based on a "map quest" analysis (www.mapquest.com), the drive between Troutdale and Aurora State Airports is 37 miles, a drive taking 45 minutes. The most recent master plan update was prepared in October of 2000 by W & H Pacific. The October, 2000 master plan identifies for the base year 1997 that the airport had 256 aircraft with annual operations of 86,825.
FAA Form 5010, dated 4-18-02, identifies the runway as being 5,004 feet long, with 387 based aircraft, and 73,895 annual operations.

There has been a rapid growth based aircraft at Aurora Airport during the past 5 years. Major new hangar developments have been created on private lands adjacent to the airport, with through-the-fence operations then accessing the airfield. In addition, significant aviation-related businesses such as Pacific Avionics, Van's Aircraft, and Artechs (ELT manufacturer), have moved their operations to private property adjacent to the airfield during this same period. The SE quadrant of the airport still has approximately 20 acres of land available for hangar or aviation related business development. The airport is believed to be becoming more and more a base for business aviation uses, which include twins and light jets.

Battle Ground/Goheen Airport
Goheen Airport is located approximately 18 nautical miles NW of Troutdale Airport in Battle Ground, Washington (Clark County). Based on a "map quest" analysis (www.mapquest.com), the drive between Troutdale and Goheen Airports is 29 miles, a drive taking 54 minutes. Goheen Airport is a privately owned airport open to the public. FAA Form 5010, dated 4-18-02, identifies that there are two runways, the longest being 2,600 feet of turf, with 29 based aircraft and 1,620 annual operations. A telephone call to G. C. Goheen, owner of the airport, identifies that there are currently 40 based aircraft. The airport has 100 acres of land, so there is plenty of room for many more hangars should demand be present in the future.

Camas/Grove Field
Grove Field is located approximately 4 nautical miles north of Troutdale Airport in Camas, Washington (Clark County). Based on a "map quest" analysis (www.mapquest.com), the drive between Troutdale and Grove Fields is 24 miles, a drive taking 38 minutes. It is a public airport owned by the Port of Camas-Washougal. FAA Form 5010, dated 4-18-02, identifies the runway length as 2,710 feet, with 61 based aircraft and 12,600 operations per year. A telephone call to Sheldon Tyler, Port General Manager at the Port of Camas-Washougal, indicates that they have 67 based aircraft at this time, and that their plans for the future could include more hangars, but none are in the works now.

Cascade Locks Airport

Cascade Locks Airport is located approximately 22 nautical miles east of Troutdale Airport near Cascade Locks, Oregon (Hood River County). Based on a "map quest" analysis (www.mapquest.com), the drive between Troutdale and Cascade Locks Airports is 29 miles, a drive taking 36 minutes. Cascade Locks Airport is owned by the State of Oregon and is open to the public.FAA Form 5010, dated 4-18-02, identifies the runway as being 1,800 feet long, with 0 based aircraft, and 1,100 annual operations.

Estacada/Valley View Airport

Valley View Airport is located approximately 17 nautical miles SSE of Troutdale Airport near Estacada, Oregon (Clackamas County). Based on a "map quest" analysis (www.mapquest.com), the drive between Troutdale and Valley View Airports is 25 miles, a drive taking 1 hour, 6 minutes. Valley View Airport is a privately owned airport open to the public. FAA Form 5010, dated 4-18-02, identifies the runway as being 3,780 feet long, with 33 based aircraft, and 2,965 annual operations.

A telephone call to Robert Veley, owner of the airport, who confirmed the reported number of based aircraft is accurate. He also said that they are probably the least expensive hangar rental space in the metro area. They have 135 acres, 10 acres of which is available for future hangars. In addition they have 2-acre parcels which are available for purchase and construction of a house, with access to the airport. Mr. Veley is a strong believer that housing on an airport is helpful to that airport, in that it maintains people around for security and for support in the community. However he also very strongly believes in the need for very strong CCNR's (insert words abbreviated) in order to protect the airport. The airport does not sell fuel but mechanic Tom Murphy provides FBO services.

Hillsboro Airport

Hillsboro Airport is located 23 nautical miles west of Troutdale Airport, at the west end of the Portland metropolitan area, in within the city limits of Hillsboro, Oregon (Washington County). Based on a "map quest" analysis (www.mapquest.com), the drive between Troutdale and Hillsboro Airports is 32 miles, a drive taking 37 minutes. The airport is owned by the Port of Portland and is part of the FAA's NPIAS system. A master plan of the Hillsboro Airport was completed in October, 1996 by W & H Pacific. Hillsboro Airport is the second-most active airport in the state of Oregon, following only behind Portland International Airport. At the time of that master plan, there were 368 based aircraft and 221,185 annual operations. FAA Form 5010, dated 4-18-02, identifies two runways, the longest being 6,600 feet, with a total of 392 based aircraft, and 222,300 annual operations.

The Hillsboro area has had rapid economic growth during the past 20 years due to the large number of high-tech industries (especially Intel Corporation) that have developed large campuses in the area. This has resulted in a large amount of corporate and business aviation activity at the airport. In addition, the airport has a lot of use as a base for airplane and helicopter training, along with the basing of recreational aircraft.

Hillsboro/Stark's Twin Oaks Airpark

Stark's Twin Oaks Airpark is located approximately 25 nautical miles WSW of Troutdale Airport near Hillsboro, Oregon in Washington County. Based on a "map quest" analysis (www.mapquest.com), the drive between Troutdale and Stark's Twin Oaks Airparks is 35 miles, a drive taking 52 minutes. It is a privately owned airport that is open to the public. FAA Form 5010, dated 4-18-02, identifies the runway length at 2,465 feet, with 98 based aircraft and 22,195 annual operations. A telephone discussion with Bob Stark, the owner, finds that the most current number of based aircraft is 100. Mr. Stark indicates that plans are underway for the basing of 18 additional aircraft there in the next year and he said the 100 acre property has plenty of room for more hangars, if demand is present for them.

Hood River Airport

Hood River Airport is located approximately 38 nautical miles east of Troutdale Airport in Hood River, Oregon (Hood River County). Based on a "map quest" analysis (www.mapquest.com), the drive between Troutdale and Hood River Airports is 51 miles, a drive taking 1 hour, 6 minutes. Hood River Airport is a publicly owned airport open to the public. FAA Form 5010, dated 4-18-02, identifies that the runway is 3,040 feet long, with 80 based aircraft, and 13,700 annual operations.

Hubbard/Lenhardt Airpark

Lenhardt Airpark is located approximately 28 miles SSW of Troutdale, near Hubbard, Oregon (Clackamas County). Based on a "map quest" analysis (www.mapquest.com), the drive between Troutdale and Lenhardt Airparks is 46 miles, a drive taking 1 hour, 1 minute. It is a privately owned airport but is available for public use. It is undergoing significant hangar development projects and is attempting to attract the smaller recreational aircraft as a place for basing their aircraft. FAA Form 5010, dated 4-18-02, identifies the runway as being 3,200 feet long, with 23 based aircraft, and 6,000 per year. In a telephone discussion with Jack Lenhardt, owner of the airport, he stated the most current number of based aircraft is 41 and that hangars for additional aircraft are currenty on the drawing boards. He plans to expand to as many as 100 based aircraft in five years.

McMinnville Airport

McMinnville Airport is located approximately 38 nautical miles SW of Troutdale Airport in McMinnville, Oregon (Yamhill County). Based on a "map quest" analysis (www.mapquest.com), the drive between Troutdale and McMinnville Airports is 61 miles, a drive taking 1 hour, 39 minutes. McMinnville Airport is a public airport owned by the City of McMinnville and is open to the public. FAA Form 5010, dated 4-18-02, identifies the two runways as being 5,420 feet and 4,676 feet, with 140 based aircraft, and 63,500 annual operations.

Mulino Airport

Mulino Airport is located approximately 25 nautical miles SSW of Troutdale Airport in Mulino, Oregon (Clackamas County). Based on a "map quest" analysis (www.mapquest.com), the drive between Troutdale and

Mulino Airports is 33 miles, a drive taking 47 minutes. Mulino Airport is owned by the Port of Portland and is open to the public. FAA Form 5010, dated 4-18-02, identifies the runway as being 3,600 feet long, with 53 based aircraft, and 21,300 annual operations.

Newberg/Chehalem Airpark

Chehalem Airport is located approximately 31 nautical miles WSW of Troutdale Airport in Newberg, Oregon (Yamhill County). Based on a "map quest" analysis (www.mapquest.com), the drive between Troutdale and Chehalem Airports is 45 miles, a drive taking 1 hour, 33 minutes. Chehalem Airport is privately owned and is open to the public. FAA Form 5010, dated 4-18-02, identifies the runway as being 2,285 feet long, with 9 based aircraft, and 7,800 annual operations. A telephone call to Dennis Sturdevant, owner of the airport, identifies that there are currently 26 based aircraft. Future plans for the airport are for 8 more hangar spaces in four months. More hangars will be constructed as demand calls for them.

Newberg/Sportsman Airpark

Sportsman Airpark is located approximately 28 nautical miles SW of Troutdale Airport in Newberg, Oregon (Yamhill County). Based on a "map quest" analysis (www.mapquest.com), the drive between Troutdale and Sportsman Airparks is 39 miles, a drive taking 1 hour, 9 minutes. It is a privately owned airport that is open to the public. FAA Form 5010, dated 4-18-02, identifies the runway length as being 2,745 feet, with 53 based aircraft, and 11,650 annual operations. A telephone discussion with Jerry Dale, the owner of Sportsman Airpark, indicates that there are currently approximately 53 aircraft based at the airport and that plans for future expansion of the airport. The airport has room to construct 150 to 200 hangars, should the demand ever be present for this need. He would only build hangars as there is specific need.

Portland International Airport

Portland International Airport is located 8 nautical miles west of Troutdale Airport in Portland, Oregon (Multnomah County). Based on a "map quest" analysis (www.mapquest.com), the drive between Troutdale and Portland International Airports is 13 miles, a drive taking 19 minutes. FAA Form 5010, Dated 4-18-02 identifies the three runways ranging in length from 7,001 feet to 11,000, with a total of 69 based general aviation aircraft, with 37,789 general aviation annual operations.

Sandy/Country Squire Airpark

Country Squire Airpark is located approximately 16 nautical miles SSE of Troutdale Airport near Sandy, Oregon (Clackamas County). Based on a "map quest" analysis (www.mapquest.com), the drive between Troutdale and Country Squire Airpark is 18 miles, a drive taking 43 minutes. FAA Form 5010, dated 4-18-02, identifies the runway as being 3,095 feet long, with 27 based aircraft, and 2,000 annual operations. Attempts to contact Arthur Skipper, owner of the airport, were not successful, so no currect data is available.

Sandy/Sandy River Airport

Sandy River Airport is located approximately 13 nautical miles SE of Troutdale Airport near Sandy, Oregon (Clackamas County). Based on a "map quest" analysis (www.mapquest.com), the drive between Troutdale and Sandy River Airports is 18 miles, a drive taking 46 minutes. Sandy River Airport is a privately owned airport open to the public. FAA Form 5010, dated 4-18-02, identifies the runway as being 2,115 feet long, with 24 based aircraft, and 11,500 annual operations. A telephone discussion with the owners identified that there are currently 34 aircraft (includes 11 ultra-lights) on the airport. The airport has room to add more hangars. There is no fuel available at the airport so Troutdale is regularly used for this purpose.

Scappoose Industrial Airpark

Scappoose Industrial Airpark is located approximately 25 miles NW of Troutdale Airport, within the city limits of Scappoose, Oregon (Columbia County). Based on a "map quest" analysis (www.mapquest.com), the drive between Troutdale and Scappoose Airports is 42 miles, a drive taking 65 minutes. This fairly long time period is due to the fact that access to Scappoose Airport has to be through the City of Portland and then north along the west side of the Columbia River, since there are no bridges across the river north of Portland until one gets to Kelso.

The most recent airport layout plan update was created in December of 1994 by W & H Pacific. At that time there were 106 aircraft based at the airport, with a total of 43,143 aircraft operations in that year. The airport is classified as ARC B-II, Small (less than 12,500 lbs.) but was anticipated to drop the "Small" category as heavier aircraft made more use of the airport in future years. The most recent FAA Form 5010, dated 4-18-02, lists 150 based aircraft (which includes 20 ultra-lights). Total number of operations are listed at 60,155. The runway length is listed as 5,100 feet. In telephone discussion with John Helm, manager of Transwestern Aviation, the airport FBO, he indicated there are probably as many as 170 aircraft total at the airport and some aircraft are expected to move over from Evergreen Airport.

Vancouver/Evergreen Airport

Evergreen Airport is located 8 miles WNW of Troutdale Airport in Vancouver, Washington (Clark County). Based on a "map quest" analysis (www.mapquest.com), the drive between Troutdale and Evergreen Airports is 16 miles, a drive taking 22 minutes. It is a privately owned airport open to the public that has long been a base for older "antique" aircraft. According to FAA Form 5010, dated 3-22-01, the runway is 2,120 long, there are 165 based aircraft, with 200,050 operations per year.

The original owner of the airport was Wally Olson, well known in the Northwest as one of the most knowledgeable people about antique aircraft. Mr. Olson recently passed away and there has been much discussion in the past year as to whether the airport would continue or would be developed for other uses. A report titled "Evergreen Airport Public Ownership Feasibility Study [undated]" was prepared in early 2001 for the Port of Vancouver and the City of Vancouver. The purpose of the report was to determine whether the

Port of Vancouver should purchase the property to retain it as an airport. The report notes that the number of operations seems higher than what is actually occurring.

Although the report recommended that the Port of Vancouver take over ownership of the airport, the end result has been that Evergreen Airport is expected to cease operations next year, and its land will be turned over to other urban uses. Thus all of the aircraft based at Evergreen Airport will need to relocate to other airports within the next year.

With the upcoming closure of Evergreen Airport with its many aircraft, Troutdale Airport could develop a strategy of building inexpensive hangars to attract some of those 165 based aircraft to Troutdale Airport. Because Troutdale Airport is so close to Evergreen, it would potentially be an easy relocation for those pilots. Also, it is believed that the majority of aircraft at Evergreen belong to Oregon pilots, thus a move to Troutdale Airport may represent a closer basing option.

Vancouver/Fly-for-Fun Airport

Fly-for-Fun Airport is located 10 nautical miles NNW of Troutdale Airport in Vancouver, Washington (Clark County). Based on a "map quest" analysis (www.mapquest.com), the drive between Troutdale and Fly for Fun Airports is 22 miles, a drive taking 35 minutes. Fly-for-Fun Airport is a privately owned airport open to the public. FAA Form 5010, dated 4-18-02, identifies that the runway is 2,580 feet of turf, with 7 based aircraft, and 3,000 annual operations. A telephone discussion with the owners identified that there are currently 7 aircraft at the airport. There is some possibility that additional hangar space will be created in the future.

Vancouver/Pearson Field

Pearson Field is located 12 nautical miles WNW of Troutdale Airport, across the Columbia River in Vancouver, Washington (Clark County). Based on a "map quest" analysis (www.mapquest.com), the drive between Troutdale and Pearson Field is 19 statute miles, a drive taking 27 minutes. The airport is owned by the City of Vancouver and is part of the FAA's NPIAS System. A master plan of Pearson Field was completed in the spring of 2002 by URS of Seattle, Washington.

It is the only airport in the United States that operates adjacent and partially within the boundaries of a National Historic Reserve -- Vancouver National Historic Reserve. Terms of the operating relationship between the National Park Service and Pearson Field place limitations on its future use. One aspect of the agreement is that the number of based aircraft at the airport is limited to 175 (not including aircraft located at the museum or the FBO for maintenance or repair). The most recent FAA Form 5010 (dated 4-18-02) identifies the runway as 3,275 feet long, a total of 210 based aircraft, and annual operations of 41,100.

According to the recent Master Plan there are presently 198 aircraft based at the airport, so in the near term there will be a need for other airports to accommodate 23 of these aircraft. The amount of aircraft using the airport in 1999 was listed in the recent Master Plan as 58,400 operations. The total number of aircraft operations at the airport is anticipated to decrease to 54,800 in the year 2005 (due to reduction in number of based aircraft) and then slowly increase in the years beyond that. It is estimated that by 2005 the number of aircraft based at Pearson will be down to this 175 agreed upon limit. Given the closeness of Troutdale Airport to Pearson Airport, many of these aircraft could potentially be attracted to Troutdale, if comparable facilities were available for them.

Woodland State Airport
Woodland State Airport is located approximately 25 nautical miles NNW of Troutdale Airport in Woodland, Washington (Cowlitz County). Based on a "map quest" analysis (www.mapquest.com), the drive between Troutdale and Woodland Airports is 37 miles, a drive taking 40 minutes. FAA Form 5010, dated 4-18-02, identifies that the runway is 1,965 feet long, with 16 based aircraft, and 3,600 annual operations.

INVENTORY OF BASED AIRCRAFT

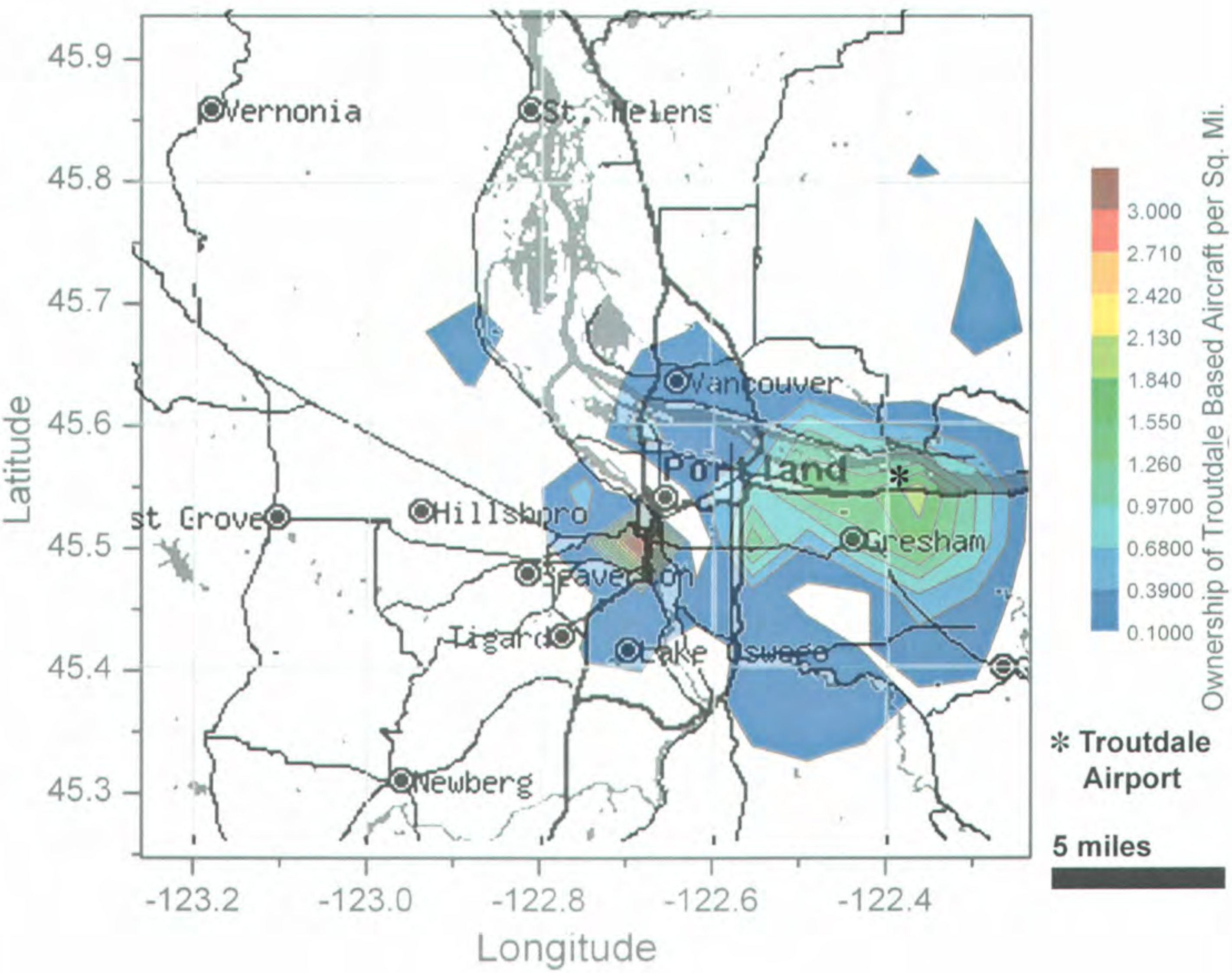
Each of the on-airport FBO's, maintenance facilities, and hangar owners were contacted and asked to provide information as to existing based aircraft in each of their facilities, along with the location of the owner. A summary of existing based aircraft was provided in Table 1-16 of Chapter 1. Troutdale Airport in fact serves pilots located throughout the Portland-Vancouver greater metropolitan area.

The attached figures provide graphic representations of the geographical density of owners of Troutdale based aircraft. The graphs were created by determining the number of owners of based aircraft in each ZIP code and then dividing that number of aircraft by the area of the ZIP code. This data was then developed as 3-D graphs showing the density of ownership of Troutdale Airport based aircraft, throughout the greater Portland-Vancouver metropolitan area. **Figure 2-4** is provided for all aircraft as a color coded two dimension map, while **Figure 2-5** provides this data in a more visual 3-D form. The base data for these figures is provided in Appendix B-1.

The figures show that aircraft owners come from all over the Portland Metropolitan area. However, it is interesting that there are three peaks of density, one around the airport, a second east of the I-205 and Division Street intersection, and a third in SW Portland close to downtown. The majority of the ownership comes from the Troutdale to I-205 area, however the peak in density comes from downtown Portland. It is also noteworthy that there is not a peak over the Vancouver area.

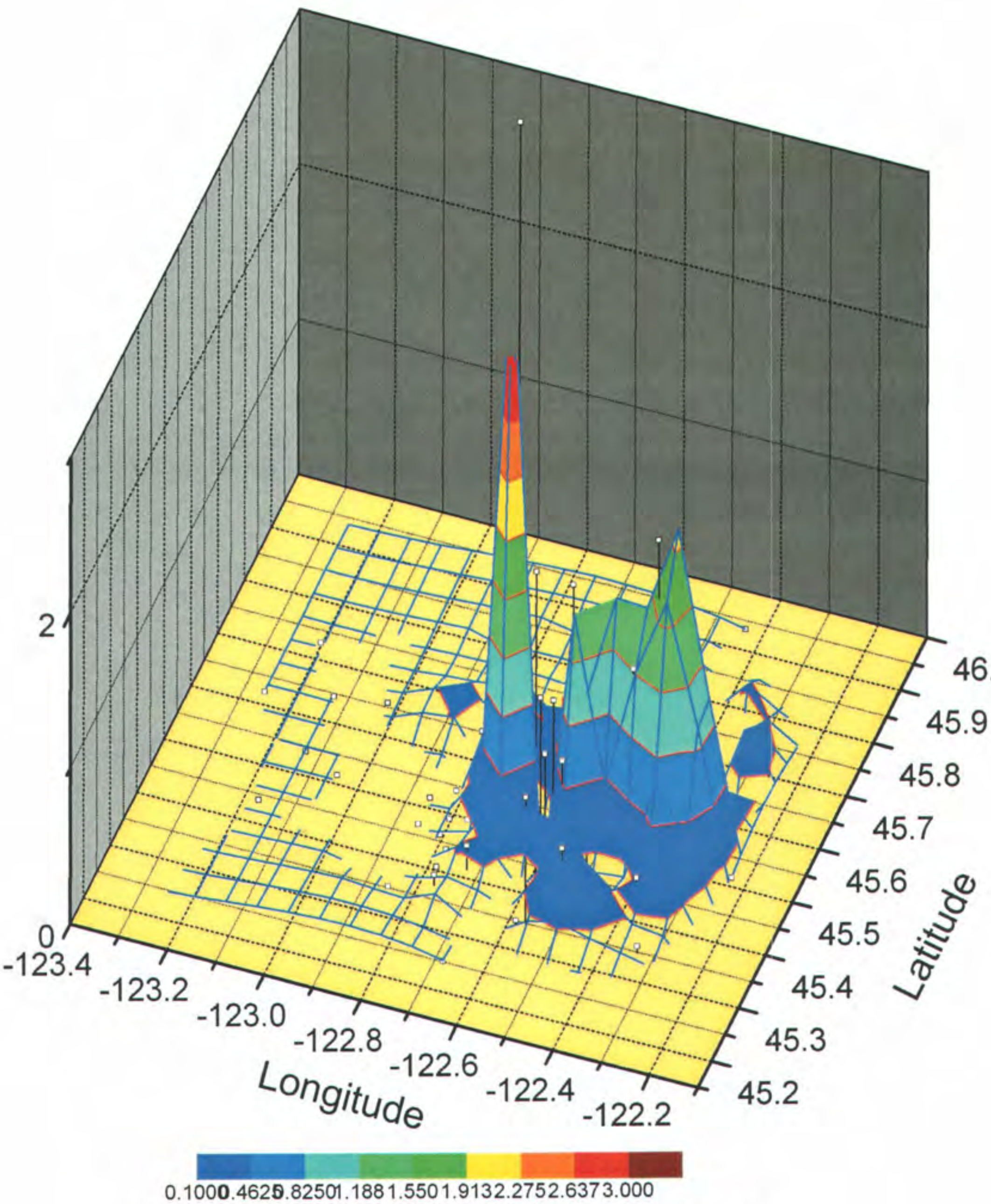
A second set of data is shown in **Figure 2-6** and **Figure 2-7** to show this same information for ownership of more business oriented aircraft – specifically for twin engine, helicopter, and jet aircraft. Ownership density is similar to that of the prior figures, except that the peaks are more narrowly located to the Troutdale-Gresham area (not all the way to I-205), and to downtown Portland, with a new peak in downtown Vancouver. A new minor peak occurs in the Happy Valley area.

Figure 2-4: Ownership of Troutdale Based Aircraft per Sq. Mi.



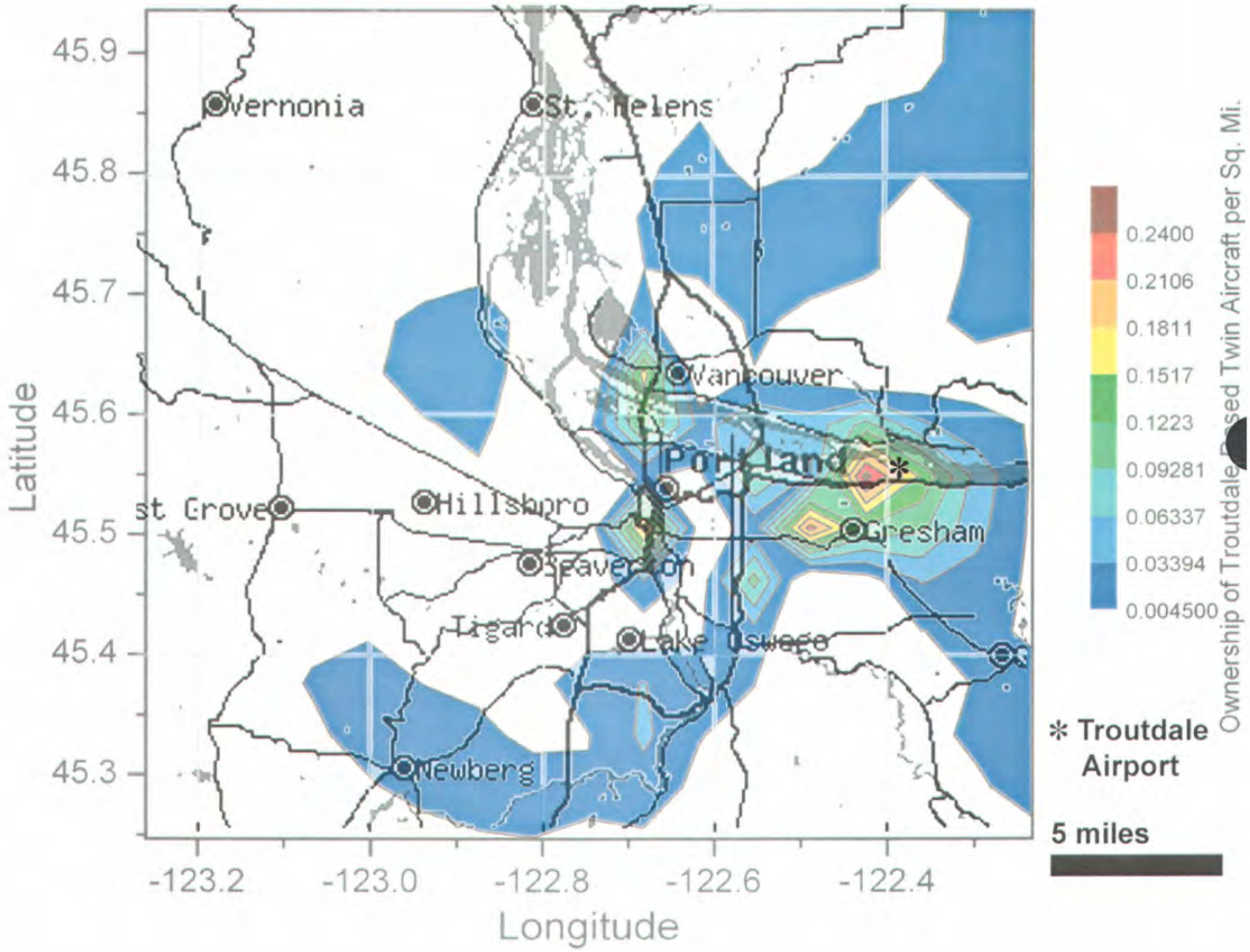
Source: Aron Faegre & Associates, 2002.

Figure 2-5: Ownership of Troutdale Based Twin Aircraft per Sq. Mi. (3-D Plot)



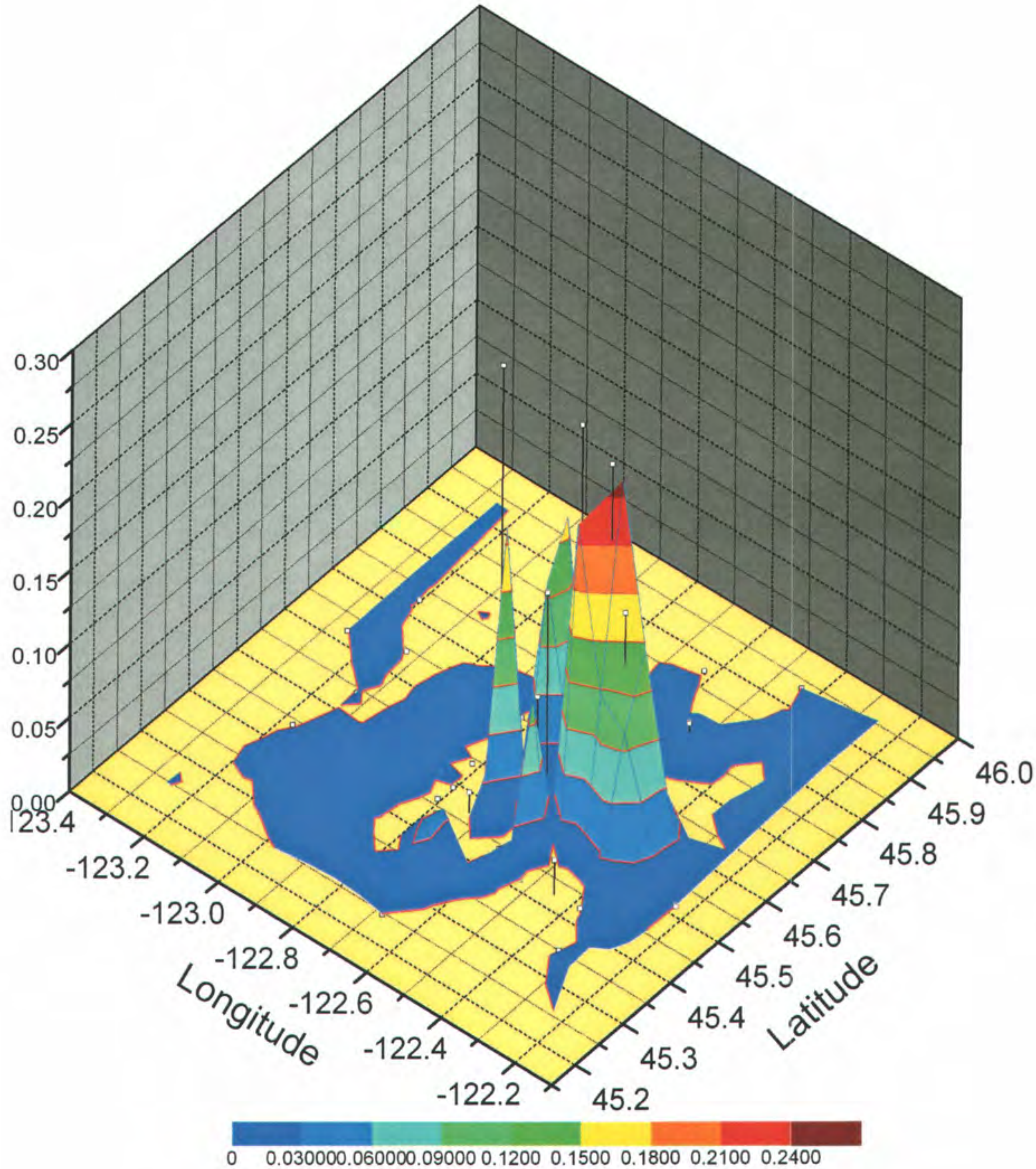
Source: Aron Faegre & Associates, 2002.

Figure 2-6: Ownership of Troutdale Based Twin Aircraft per Sq. Mi.



Source: Aron Faegre & Associates, 2002.

Figure 2-7: Ownership of Troutdale Based Twin Aircraft per Sq. Mi. (3-D Plot)

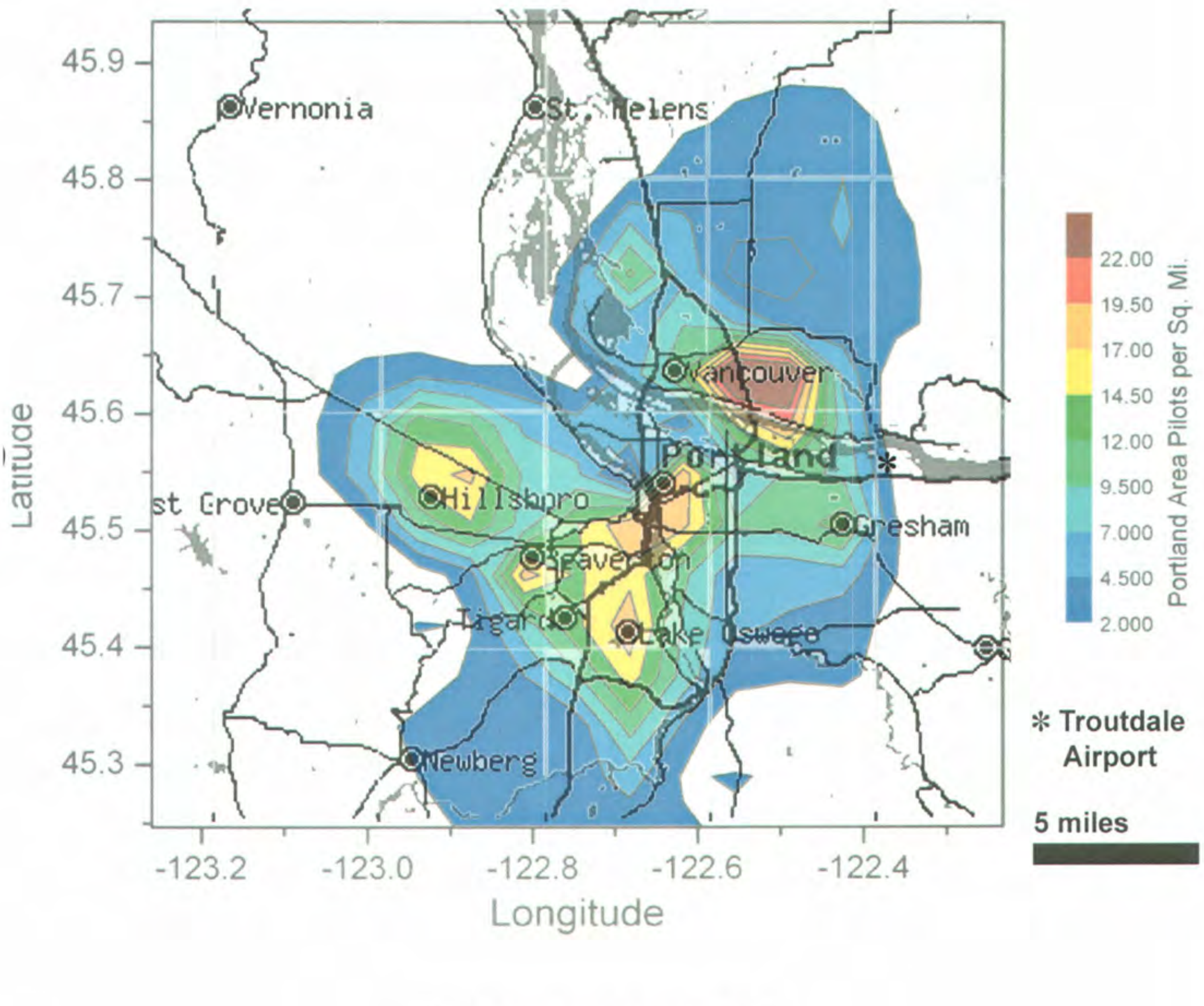


Source: Aron Faegre & Associates, 2002.

INVENTORY OF AVAILABLE PILOTS IN GREATER PORTLAND AREA

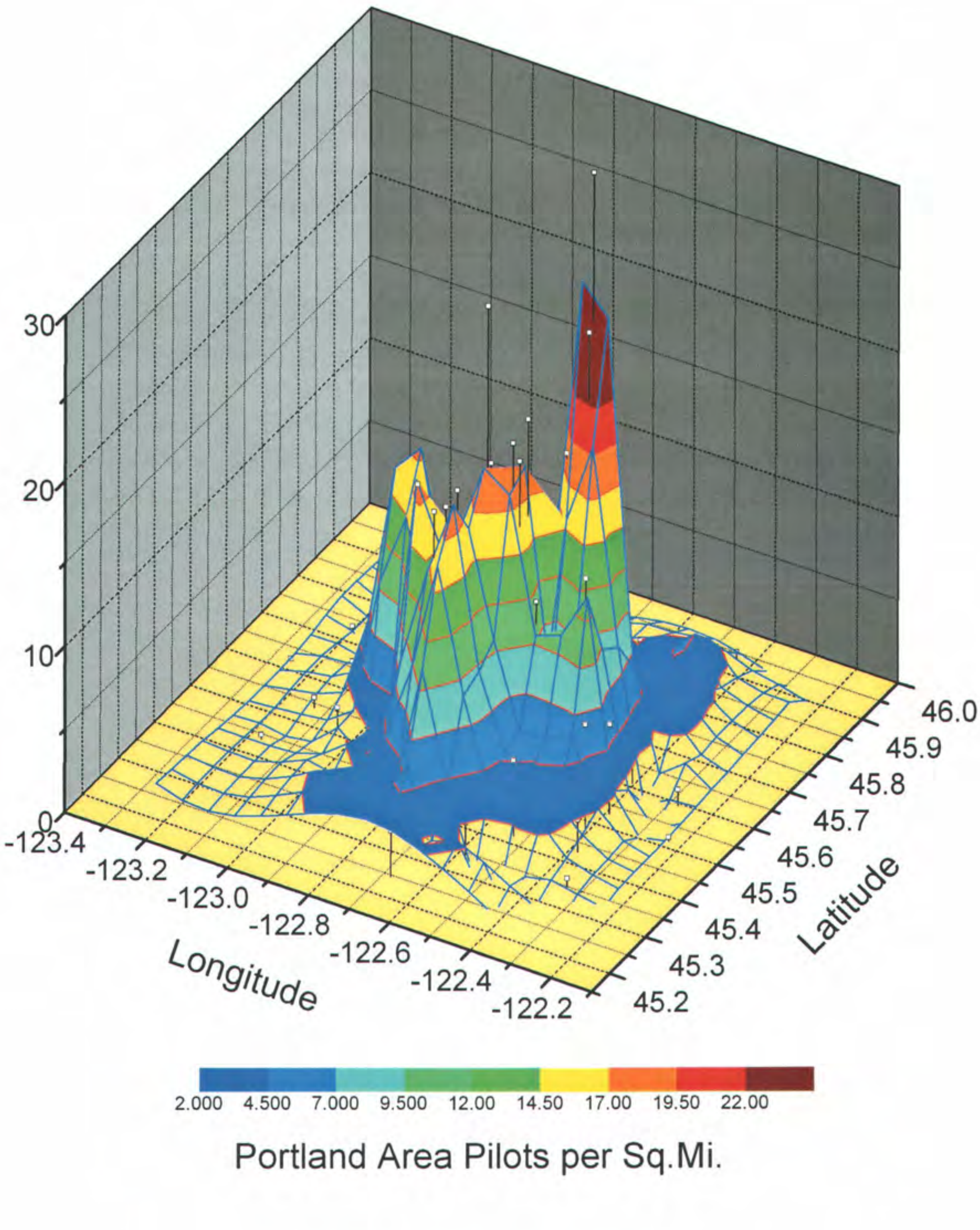
Using FAA airman records, the numbers of pilots in each ZIP code within the Portland-Vancouver metropolitan area were determined. There are found to be 5,899 pilots within the zip code areas analysed. **Figure 2-8** and **Figure 2-9** show the resultant density of pilots per square mile. The peak of density is located across the Columbia River in Vancouver adjacent to the I-205 Bridge. Troutdale Airport is located 8 miles southeast from this peak of pilot density. The center of gravity of the pilot density 3-D graph appears to be in downtown Portland, approximately 11 miles west from Troutdale Airport. The graph shows that the greatest density of pilots is in Vancouver, Washington, however in a more general sense the density follows the density of population within the greater Portland metropolitan area. Troutdale Airport is exceptionally well located to serve the pilot community identified by this figure. The base data for these figures is provided in Appendix B-1.

Figure 2-8: Portland Area Pilots per Sq. Mi.



Source: Aron Faegre & Associates, 2002.

Figure 2-9: Portland Area Pilots per Sq. Mi. (3-D Plot)



Source: Aron Faegre & Associates, 2002.

CONCLUSIONS

The location of Troutdale Airport is excellent in many ways, that can be summarized as follows:

- Pilot Population: Troutdale Airport is well located to serve the pilot community in the Portland-Vancouver area.
- Nearby Airports Closing: Clark County airport closed several years ago, and now Evergreen Airport will be closing in the next year. The closing of Evergreen Airport will necessitate the relocation of a large number of aircraft to nearby airports. Troutdale can accommodate some of the demand for aircraft storage and service created by this airport closure.
- Freeway Access: Troutdale Airport is located adjacent to Interstate 84, which makes it easily accessible to most of the greater metropolitan Portland area.
- Surrounding Industrial Land Use: Troutdale Airport is surrounded by industrial land use on three sides and dedicated open space on the fourth side. This avoidance of having residential land uses adjacent to the airport means that the common conflict between airports and residential areas can be avoided in perpetuity, as long as the current zoning is retained.
- Adjacent Abandoned Industrial Site: The Reynolds Aluminum plant site of 539 acres has discontinued its production of aluminum. It is anticipated that the site will be redeveloped as industrial property. This kind of development may have a very positive, symbiotic relationship with the adjacent airport, since many industries commonly make use of small aircraft as part of its business transportation standard operations.
- Closeness to Portland International Airport: Troutdale Airport is fairly close to Portland International Airport, which means that it can function as a reliever for traffic with a similar destination in the Portland metropolitan area.
- Weather Related: It is commonly known by pilots and weather observers that there are days when Troutdale Airport is clear of fog, that Portland International Airport is fogged in with 0/0 conditions. Since Troutdale Airport is closer to the narrow portion of the Columbia River Gorge, there is commonly some wind that blows the fog clear of the airport and its immediate surroundings. Thus Troutdale Airport does provide a nearby weather alternative for small to medium sized aircraft, especially for the package delivery type flights that do not have advanced landing systems for extremely low visibility conditions.
- Land Area: Troutdale Airport appears to have land area to accommodate continuing growth over the next 20 to 50 years.
- Control Tower: The availability of a control tower on the airport ensures a higher level of security and safety for mixing of different aircraft sizes and speeds.
- Instrument Approach Capabilities: Troutdale Airport currently has only one instrument approach,

with a relatively high minimum descent altitude. However, initial analysis of the airspace indicates that it may be possible in the future to provide significantly improved non-precision approaches to the airport with significantly lower minimum descent altitudes.

- Well Located to Serve East Multnomah County: Troutdale Airport is the only public airport well located to serve the cities of Troutdale, Gresham, Fairview, and Wood Village, along with the adjacent Multnomah County areas outside of the urban growth boundaries.
- Business Aviation: The runway length and strength is adequate for twin aircraft and light business jets, which is not available at other close-by public airports. In this regard, Troutdale has the potential to serve business users similar to that to Hillsboro, Scappoose, and Aurora Airports.

TROUTDALE AIRPORT ROLE

Troutdale Airport is well suited to continue to serve the Portland-Vancouver area as a B-II reliever airport, with emphasis on providing access for business and recreational pilot users in the east sector of the Portland-Vancouver area. With the exception of Portland International Airport, there is no nearby airport which can serve this role. With the loss of Clark County Airport three years ago, and the loss of Evergreen Airport next year, -- the two closest GA airports to Troutdale -- the need for Troutdale Airport to serve this GA fleet should be expected to increase in the future.

CHAPTER THREE

Aviation Activity Forecasts

Introduction

The purpose of this chapter is to update forecasts of aviation activity for Troutdale Airport. Aviation activity includes based aircraft, aircraft operations (takeoffs and landings) and other related items such as peaking characteristics. Forecasts are developed for short-, intermediate- and long-term periods within the twenty-year planning period of the master plan. The forecasts will be translated into gross facility needs, which will be addressed through facility developments during the planning period.

Airport activity forecasting for a 20-year master plan is a difficult task, since it involves an attempt to predict the future for activities that are by their nature very dependent on a great number of other forces and factors. With the advent of computers that can process large amounts of data and attempt to find patterns, a new field called "non-linear dynamics" has emerged. It has been moderately successful in predicting weather patterns up to a week in advance, however, attempts to apply it to predicting the stock market, or long-term economy of the United States, have so far failed. Given the kind of extreme events that can occur – such as the terrorism acts September 11th, 2001 – it is safe to say that it is unlikely any forecasting model can ever be created that would be truly reliable. Thus, there probably never will be a methodology that can with good assurance, reliably predict with certainty, the future activity levels at Troutdale Airport.

Another area of difficulty in performing aviation forecasting is the problem of the accuracy of the data. Based aircraft can be determined by physically going around the airport and opening every hangar and counting the airplanes. However, some aircraft may be out on trips, and some may only be on the airport for maintenance. Counting based aircraft is thus even a job that requires some sleuthing and interpretation. Unfortunately, most airports probably only receive a detailed, accurate based aircraft count at the time of a master plan update, so the FAA's records for the years in between may have great inaccuracies. Fortunately, Troutdale Airport has a control tower, so that actual records of airport operations during the hours of 6am to 10pm are relatively much more accurate (most GA airports do not have a tower). Airport operations outside of those hours are estimated by the FAA and added to the numbers for the FAA TAF records[1].

Given that our predictions must exist with perhaps even large levels of uncertainty, what are we to do? Why do we even do forecasting? There are several answers to this dilemma. First and foremost, airport master plans are "living documents." They are intended to provide the best information available at a given moment in time, but are not expected to be 100% accurate in their predictions. It is recognized that they will undoubtedly not "hit the mark" precisely, but it is hoped they will be close. If initial conditions change sufficiently, then an updated airport master plan will be needed!

Second, a forecast can attempt to review other predictions concerning the major, significant forces commonly known to act on an airport, and then compare that data and evaluate their reliability. This data is available at the local, state, and federal levels. Thus, local predictions of population trends, or expected economic changes for the airport service area are evaluated over the 20-year period. Likewise, both the State of Oregon and the FAA's predictions concerning aviation activity or trends for certain classes of aviation technology are considered.

Following this review or local, state, and federal data, it is common to then consider several different scenarios that could result at the airport. In particular it is useful to examine predicted outcomes that predict minimal growth levels, along with outcomes that predict higher growth levels. This allows for a kind of "sensitivity analysis" whereby the differences in outcome – over the 20-year period – can be examined. A low growth model might predict a total of say 200 based aircraft at the airport at the end of the 20-year period, whereas a higher growth model might predict 250 based aircraft. This allows the master plan to then evaluate the question of whether this difference would be significant. As long as sufficient property is available on the airport, a difference of 50 planes (in this example) might not be very significant. On the other hand, if the addition of 50 airplanes were determined to trigger the need under FAA's safety guidelines for the construction of a second taxiway, then this might represent a significant action.

By looking at a modest range of airport growth options, it should be possible to determine the probability of the need for such fundamental improvements as new taxiways, runway extensions, and general airport property needs. And it is precisely this kind of sensitivity analysis that will follow the forecast analysis,

[1] Even this FAA data can be puzzling. For example, the Troutdale Tower data for 1997 shows more operations than does the TAF data which includes operations occurring when the tower is closed. (See Appendix A-9). Thus, measurement of operations at an airport should not be considered an "exact science."

in the facilities analysis chapter and the facilities alternatives chapter. Then, with the master plan serving as a "living plan," the actual events that unfold at an airport and in its surrounding community can be examined within the context of the alternatives considered in the master plan. The master plan then serves as a guide to help the community determine which changes to the airport might best help it to serve the community.

Forces and Factors influencing Aviation Activity

When we look at the numbers of based aircraft and the numbers of aircraft operations at Troutdale Airport during the last twenty to twenty-five years (see Figures 1-10 and 1-11), we see that swings of as much as 50% have occurred in a matter of only a couple of years. The factors that contribute to changes in aviation activity at most general aviation airports range from long-term changes in population, to the desirability of particular services at an airport, to trends within the aviation industry, to changes in the needs of local business and industry in the community.

Some activities at an airport, or within the airport's service area, such as hangar development trends, airport closures, and the availability of services often directly effect growth on a short-term basis. Yet, short-term change can lead to long-term change. Once aircraft are based at an airport (especially when financial investment is made at an airport by the aircraft owners) the airport may retain this growth on a long-term basis. Broad industry trends in areas such as student pilot starts in flight training, aircraft utilization levels, or aircraft manufacturing levels may be expected to have some effect on local airport activities. However, at many airports, broader industry trends may be offset by unique conditions such as a highly successful FBO, flight school, or maintenance shop, which can significantly effect local activity.

Weather can also be an important factor at an airport, and probably is one for Troutdale. As was discussed in Chapter 1, on the positive side the gorge winds probably provide more VFR weather than is available at other Portland area public airports. However, in a year when there are less gorge winds, or when ice storms are particularly bad in Troutdale, weather may be a factor that could cause pilots to leave the airport.

In forecasting the activities at Troutdale Airport over the next twenty years, we must look at this diversity of forces – from national to local, from short term to long term – and attempt to determine which will be most significant in Troutdale's future. In the following sections of this chapter, within the context of these various forces, a twenty-year forecast will be presented.

Aviation Industry Trends

The general aviation industry has enjoyed a sustained recovery from the mid-1990s through 2000, which followed a downturn that had existed prior to that time back to the early 1980s. The effects of this positive market trend are visible at many general aviation airports in the form of increased activity, development of new facilities, and increased private investment in hangars and aviation-related businesses. However, activity in many segments of the industry declined in 2001 and 2002 due a deteriorating economy and the negative effects of the September 11th attacks.

The Federal Aviation Administration (FAA) recently revised the assumptions used to support its long-term aviation forecasts in an attempt to reflect the significance of recent events. The following assessment of the general aviation industry is provided in the recently updated long term forecasts2:

> *"The turnaround in the general aviation industry that began with the passage of the General Aviation Revitalization Act of 1994 appears to have slowed considerably in 2001. While the slowdown in U.S. economic activity can be partially blamed for the slowing of demand for general aviation products and services, the events of September 11th and their aftermath are expected to have the greatest and longest impact on the general aviation industry....General aviation activity counts at FAA air traffic facilities were down significantly during most of 2001. Operations at combined FAA and contract towers were down 5.7 percent, with itinerant operations down 6.2 percent and local operations down 5.0 percent from 2000 activity."*

It is not known to what extent the long-term prospects for industry growth will be affected by current conditions. However, the current level of uncertainty makes long-term forecasts particularly vulnerable to sudden, unexpected and dramatic shifts in activity. Since these external factors cannot be predicted, it appears reasonable to assume that the underlying strength of the general aviation industry gained over the last several years provides the infrastructure needed to support modest growth over an extended period.

It is important to remember that the primary challenges facing the national air transportation system prior to the recent crisis focused largely on system-wide capacity deficiencies and increasing flight delays for the national commercial air transport system. Although these factors may have been temporarily mitigated by the recent declines in commercial aviation activity, they will eventually again become key issues in civil aviation. The current growth in business related general aviation, particularly in the areas of fractional ownership of business aircraft and increased charter activity responds effectively to a variety of user needs. To the extent that general aviation can offer an attractive, competitive transportation option, airports like Troutdale, that are able to accommodate this activity will benefit.

Based on the more detailed discussion of factors presented in the following pages, it appears to be reasonable for the purposes of developing master plan forecasts, to assume that on the whole, and at Troutdale Airport in particular, general aviation will experience modest-to-moderate growth during the current twenty year planning period. It also seems reasonable to expect periodic short-term swings in activity if the industry is forced to respond to external events.

[2] FAA Long-Range Aerospace Forecasts, Fiscal Years 2015, 2020 and 2025 (June 2001).

FAA Activity Data

Table 3-1 summarizes the growth in the general aviation fleet, by aircraft type, that occurred between 1994 and 2001. During this period, the overall fleet increased by 25 percent, which represents an annual average growth rate of 3.2%. Some aircraft types, such as business jets, helicopters, and experimental aircraft increased at annual average rates of 7 to 9% during that seven-year period. Others, such as the piston single engine (which is the work-horse of the GA fleet) increased at only 2.2% annual average growth rate for the seven-year period. While the demand factors for each aircraft type differ, the overall growth trend appears to reflect a revitalized industry with some particularly strong segments. Given that the northwest region is home to Van's Aircraft, Lance Air, and Kit Fox – three of the most popular manufacturer's of homebuilt aircraft – that growth segment may have more impact on airports in the northwest region.

Table 3-1: Summary of Active General Aviation and Air Taxi Aircraft (1994-2001)

Aircraft Type	1994	2001 Est.	Overall Increase/ Decrease (Total Aircraft)	Overall Increase/ Decrease (Percentage)	7-year Annual Average (Percent.)
Piston Single Engine	127,351	148,000	+20,649	+16.2 %	+2.2 %
Piston Multi Engine	14,801	21,000	+6,199	+41.9 %	+5.1 %
Turboprop	4,092	5,750	+1,658	+40.5 %	+5.0 %
Turbo Jet	3,914	7,150	+3,236	+82.7 %	+9.0 %
Rotorcraft Piston	1,627	2,700	+1,073	+65.9 %	+7.5 %
Rotorcraft Turbine	3,101	4,450	+1,349	+43.5%	+5.3%
Experimental	12,144	20,400	+8,256	+67.9 %	+7.7 %
Other	5,906	6,700	+794	+13.4 %	+1.8 %
Total	**172,935**	**216,150**	**43,215**	**+25.0 %**	**+3.2 %**

Source: FAA General Aviation and Air Taxi Activity Surveys. Year 2001 data estimated by FAA.

General Aviation Manufacturers Association (GAMA)

The General Aviation Manufacturers Association (GAMA) Industry Review and Market Outlook for 2002 provides an assessment of industry activity in 2001. Despite the adverse effects of events following September 11th, the industry still managed to provide some positive signs of market strength, particularly in the area of business aviation. Included among the reports findings:

- *For a sixth year in a row, the general aviation industry set an all-time record for billings in 2001.*
- *Total shipments for airplanes produced worldwide slipped 4.5 percent, from 3,140 units to 2,999 units in 2001.*
- *Total shipments of business jets increased 3.6 percent between 2000 and 2001.*
- *Total turboprop shipments increased 1.4 percent in 2001.*
- *Total piston shipments were down in 2001, falling 8.9 percent.*
- *Total shipments of single-engine pistons fell 11.7 percent in 2001.*
- *Total shipments of multi-engine pistons increased 42.7 percent in 2001.*
- *Student pilot starts were down 3.3 percent in 2001.*[3]
- *A Cessna Aircraft Company survey found that 40 percent of the people who are buying Cessna's piston-engine airplanes are new pilots. New Piper is reporting similar statistics.*
- *The total number of corporate operators in the United States increased by 5 percent in 2001.*
- *The number of individuals and companies in the United States that own a fractional share of an airplane increased by 22.3 percent in 2001.*
- *The number of airplanes in fractional programs grew 19.3 percent in 2001.*
- *GAMA members companies reported that approximately 17 percent of their total turbine deliveries in 2001 went to fractional programs.*
- *Charter activity increased by 26 percent in 2001.*

The GAMA report highlights the strength of the business aviation segment, as reflected by increases in deliveries of new multi-engine piston, turboprop and business jet aircraft, combined with increases in fractional aircraft ownership, corporate operators, and charter activity. Although concerns about the current economic recession continue, there is optimism that student pilot starts and deliveries of single-engine piston aircraft will rebound in the near future to strengthen that segment of general aviation. Despite the slight downturn in aircraft deliveries last year, it is encouraging to note that 2000 and 2001 were the two highest single-year delivery totals for U.S. manufactured aircraft since 1983. According to GAMA data, the average age of the U.S. general aviation fleet is 27 years, although the average age of 4-seat single engine aircraft is 32 years.

It is also interesting to note that sales of new turbine aircraft are now approaching and may soon be exceeding the record sales of the early 1980s. Although it is difficult to draw specific conclusions from national industry data, the events highlighted in the GAMA report suggest that airports, such as Troutdale, that are able to accommodate a broad range of business aviation users may benefit most from the current industry trends.

[3] AOPA has challenged this statistic in an April 16, 2002 release, and suggests that there is underreporting due to a switch in the FAA's electronic-based reporting system and a large number of "orphan" records. Based on AOPA's data there has been marginal increases rather than a decrease.

FAA Long Term Activity Forecasts

As noted above, the FAA recently revised its long-term aviation forecasts to reflect the recent downturns experienced in the industry. The current FAA Terminal Area Forecasts (TAF) (2001-2015) have not been revised, but include a disclaimer regarding the effects of "September 11 and the economic downturn." A summary of the FAA's growth assumptions used in developing their long-range aviation forecast (2001-2013) is provided in **Table 3-2.** Appendix C-1 contains FAA's Executive Summary of the 2001 TAF forecasts.

Table 3-2: FAA Long Range Forecast Growth Assumptions[4]

Activity Component	Forecast Annual Average Growth Rate (2001-2013)
Active GA Aircraft Fleet	+0.3% per year
Turbine Aircraft (FW & Rotor)	+1.8% per year
Business Jet	+3.5% per year
Piston (FW & Rotor)	+0.2% per year*
Hours Flown (all aircraft)	-2.2% in 2002; +0.4% in 2003; then +1.5% through 2013
Hours Flown (turbine aircraft, including rotor)	+2.2 percent
Hours Flown (piston aircraft, including rotor)	+0.7 percent
Hours Flown (business jet)	+4.1 percent
Tower Operations	-2.6% in 2002; +7.1% in 2003; then +1.7% through 2013
Instrument Operations at FAA and Contract Towers	-4.2% in 2002; +4.6% in 2003; then +2.0% through 2013
Active General Aviation Pilots	+0.8%
Student Pilots**	-4.5% in 2002; -1.2% in 2003; then +1.0% through 2013

* FAA forecasts piston fleet to increase by an annual average rate of 0.4% after 2004, following anticipated declining numbers in the 2002-2004 time period.
** AOPA has contradicted FAA's student pilot numbers citing a 13 percent undercount of student pilot certificates in 2000 and 2001. AOPA claims that this error significantly reduces forecast levels of activity. (See Footnote 2).

The FAA's current long-term forecasts project a very conservative increase of 9,110 aircraft in the U.S. general aviation fleet between 2002 and 2013, which is only about one-fifth of the growth experienced

[4] FAA Long Term Aviation Forecasts, updated 2002.

during the last seven years. It would indicate an annual average growth of only 0.37%. Forty percent of the forecast increase in the fleet consists of new business jets, while other aircraft types will increase modestly, except for multi-engine piston aircraft, which are expected to decline slightly.

According to FAA data, the number of active pilots declined during fourteen of the last nineteen years and is currently about 20 percent below 1981 levels. However, on a positive note, the number of active pilots increased during two of the last three years ending in 2000. Contrary to the FAA's current declining projection for student pilots, AOPA projects a 16 percent increase in the number of student pilots over the next five years based on their extensive review of data.

The FAA 2001-2015 Terminal Area Forecasts (TAF) projects that total airport operations within the Northwest Mountain Region will increase 17.5 percent by 2015, which is an annual average increase of approximately 1.08 percent.

The FAA's long-term forecasts for hours flown, tower operations and instrument operations reflect modest annual average growth rates ranging from about 1.5 to 2.0 percent over the next ten years. Certain segments of activity, such as hours flown for turbine aircraft, (particularly business jets) are expected to increase at rates between 2 and 4 percent per year.

Local/Regional Trends

<u>Greater Portland Regional Area</u>

As noted in Chapter Two, the number of based aircraft located at airports within the Greater Portland Region has increased at an annual average rate of 1.9 percent, over the last fourteen years. This growth represents a recovery from an extended decline that lasted through most of the 1980s. According to available data, the number of aircraft currently based at airports in the Greater Portland Region appears to represent an all-time high, and is certainly well above the most recent peaks, which were recorded in the late 1970s.

In addition to the natural increase in the number of based aircraft within the region, available data suggests that movement of aircraft between airports is relatively common. Factors such as airport closures or changes in the availability or price of fuel, FBO or maintenance services, flight training and hangar space within the region appear to be leading contributors to this migration. As noted in **Table 2-2**, in Chapter Two, several airports within the local region have experienced above-average increases in based aircraft totals in recent years.

Troutdale Airport

The number of based aircraft at Troutdale Airport has increased from approximately 150 (in 1988 when the master plan was last updated) to 193 (current count). Although the aircraft totals fluctuated during this fourteen-year period, the overall net increase from 1988 to 2002 was 28.7 percent, which represents an annual average growth rate of approximately 1.82 percent. According to data contained in the Oregon Aviation System Plan5 and FAA Terminal Area Forecast6, based aircraft totals at Troutdale fluctuated between 154 and 177 during the 1990s (see Figure 1-11, Chapter One). It appears that the airport has experienced a modest surge in based aircraft numbers over the last several years, probably related to the availability of T-hangars created during the 1995-1999 period, with the resultant 193 aircraft now found. It is likely that the growth has been gradual since 1990, but that the FAA records did not reflect accurate counts. The current trend appears to reflect natural growth related to the health of airport-based businesses and the overall ability of the airport to accommodate the needs of aircraft owners. Recent discussions with the companies managing the T-hangars – to determine the number of aircraft at the airport – found there were no vacancies.

A review of historic aircraft operations data for Troutdale Airport dating back to 1976 reveals a series of wide ranging fluctuations. According to available data, Troutdale routinely accommodated between 125,000 and 175,000 operations per year during the 1970s. Aircraft operations at Troutdale dropped by more than 50 percent between 1981 and 1982. Following the sharp decline, operations fluctuated between 38,000 and 67,000 through most of the 1980s. Aircraft operations during the 1990s continued to fluctuate. Just as a sharp decline occurred at Troutdale in the early 1980s, a sharp increase (+73%) in operations occurred between 1980 and 1990. During the early 1990s, operations consistently increased from about 92,000 to the most recent peak of 116,775 in 1996. Following the peak in 1996, aircraft operations once again have fluctuated along a downward trend. However, it appears that airport activity is currently experiencing some positive growth as the number of based aircraft has increased. The most recent complete operations records are from 2001. Flight activity data from 2001 reflects the negative impacts associated with September 11th, which included an extended period of flight restrictions. As a result, 2001 data is not considered representative of current activity levels. Aircraft operations for 2002 are expected to return to the approximate levels experienced in 2000, based on the relaxation of emergency measures implemented in the fall of 2001. **Table 3-3** summarizes Troutdale Airport's activity totals since 1976.

During the period from 1976 through 2001, the average number of aircraft operations per based aircraft has also shifted widely. Airports with higher operations levels/ratios often have substantial amounts of flight training, which contributes to higher aircraft utilization. In other cases, higher levels of itinerant

[5] Oregon Continuous Aviation System Plan, Volume I: Inventory and Forecasts (AirTech, 1997).
[6] Federal Aviation Administration - Terminal Area Forecast Summary (Fiscal Years 2001-2015).

traffic associated with business or commercial activity such as air cargo operators, often push activity ratios higher. The average number of operations per based aircraft at Troutdale was 452 between 1976 and 2001. Over the period between 1988 and 2001, the average ratio increased to 520 operations per based aircraft.

Table 3-3: Summary of Troutdale Airport Activity Levels

Year	Annual Operations	Based Aircraft	Ratio of Operations to Based Aircraft
1976	178,637	230	777
1979	124,502	282	442
1980	111,034	250	444
1981	107,325	266	404
1982	55,378	280	198
1983	58,498	280*	209*
1984	67,751	161	421
1985	56,431	161	351
1986	46,909	280*	168*
1987	43,323	280	155
1988	39,919	150	143
1989	53,083	150	354
1990	91,762	155	592
1991	95,459	154	620
1992	100,035	154	650
1993	111,046	154	721
1994	107,533	154	698
1995	101488	176	577
1996	116,775	176**	664**
1997	94,915	177**	536**
1998	82,724	177**	467**
1999	75,025	177**	424**
2000	76,973	177**	435**
2001	68,927**	177**	395**
2002	68,927*** (est.)	193	357 (est.)
Average	***85,376***	***199***	***453***

Notes:
* Hodges & Shutt 1990 Master Plan reports only 149 based aircraft in 1983 and 154 based aircraft in 1986, and would indicate that the 1987 TAF data is probably too high as well. .

** Number of based aircraft is likely understated, based on fact that new T-hangars were constructed and rented, but no changes in based aircraft were recorded by FAA.

*** Number is tower record and thus does not include flights between 10pm and 6am.

**** The FAA predicts a general decrease of 2.6% in operations at all airports for 2002 (see Table 3-2 above). Through June 2002 the Troutdale tower reports operations are down 2.0% year to date, however it is anticipated that flights during September will exceed those of the prior year and compensate for this reduction. It is noted that Hillsboro Airport is down 19.5% in operations year to date 2002 and PDX is up 9.9% in GA operations year to date 2002.

Period 1976-2002
Range of Annual Operations (High-Low) 178,637 - 39,919
Range of Based Aircraft (High-Low) 282-150
Range of Average Activity Ratios (High-Low) 777-143

Source: FAA TAF (based aircraft and operations), Air Traffic Control Tower Records (operations 2001), Hodges & Shutt (based aircraft 1988), and Aron Faegre & Associates (based aircraft 2002).

Current Activity

Current estimates of based aircraft and aircraft operations are presented in **Table 3-4**.

Table 3-4: Troutdale Airport Current Activity

Annual Aircraft Operations	Operations (2000)	Operations (2001)
Local (T&G)	43,130	36,965
Itinerant	31,835	31,962
Total Operations	74,965	68,927
Total Instrument Operations	1,199	1,484
Based Aircraft	**2002**	
Single Engine	135	
Single Engine (High Performance)	42	
Multi Engine	14	
Business Jet	1	
Helicopter	1	
Total Based Aircraft	**193**	

Source: FAA TAF and Air Traffic Control Tower Records (operations);
Aron Faegre & Associates (based aircraft).

Existing Forecasts of Aviation Activity

A review of other available aviation forecasts was conducted to compare various projections against actual activity. These forecasts are described below.

1990 Portland-Troutdale Airport Master Plan

The 1990 Portland-Troutdale Airport Master Plan projected an increase in based aircraft from 150 to 180 (20 percent) over the 20-year planning period. This forecast translates into an annual average growth rate of 0.87 percent (1989 base year through 2010).

The 1990 master plan projected aircraft operations to increase from 61,000 to 77,000 (+26.2%) by 2010. This forecast translates into an annual average growth rate of 1.17 percent.

Actual growth in based aircraft at the airport since the last master plan was completed has outpaced the forecasts by a considerable margin. The current number of based aircraft (193) at Troutdale even exceeds the 2010 forecast by 13 aircraft. If the current trend continues, Troutdale would have approximately 223 based aircraft by 2010, exceeding the previously-forecast number by 43 aircraft or 24 percent. It is evident that the 1990 master plan forecasts of based aircraft has become obsolete and does not provide a reasonable basis for developing future projections.

The master plan forecasts of aircraft operations for 2000 and 2005 are reasonably close to current traffic levels, although the forecasts did not anticipate the rising traffic levels experienced in the early and mid 1990s (peaking at 116,775 operations) and the sharp decline that followed. Based on recent activity, the forecast for 2010 (77,000 operations) could be exceeded at any time and does not appear to reflect the airport's current growth potential.

1997/2000 Oregon Aviation System Plan

The most recent Oregon Aviation System Plan, 1997 (OASP) forecasts of based aircraft at Troutdale were developed using 1994 base year data. The OASP forecasts were made to 2014 and the 2000 Oregon Aviation Plan (OAP) extended these forecasts to 2018, without any changes in forecast assumptions. Using a 1994 base year estimate of 169 based aircraft for Troutdale, the OASP/OAP forecast the number of based aircraft to increase to 211 by 2014 and 222 by 2018. The OASP/OAP forecasts (1994-2018) represent an increase in based aircraft of 31 percent, which translates into an annual average growth rate of 1.13 percent. These forecasts are useful as a general reference to establish baseline long-term growth rates, however since they have not been revised in eight years, they are not considered current enough for use in developing updated projections.

The OASP/OAP forecasts of aircraft operations at Troutdale projected an increase from 107,461 in 1994 to 184,019 in 2018 (+71.2% over 24 years). This forecast translates into an annual average growth rate of 2.29 percent. As noted above, the OASP/OAP forecasts have not been updated to reflect recent conditions and therefore are not useful for projecting future activity in the master plan.

FAA Terminal Area Forecast Summary (TAF) Fiscal Years 2001-2015

The current FAA Terminal Area Forecast (TAF) for Troutdale uses a base year of 2000 (FAA estimate: 177 based aircraft). The TAF forecasts were prepared prior to September 11, and are subject to revision. However, FAA has provided no date for revision of the TAF. The TAF projects the number of based aircraft to increase from 177 to 227 by 2015. This forecast represents an overall increase of 28 percent, which translates into an annual average growth rate of 1.67 percent. Although the base year data used in the TAF is about 5 percent below actual levels, the growth rate is relatively close to Troutdale's most recent 14-year historic trend.

The TAF forecasts of aircraft operations at Troutdale project an increase from 76,975 in 2000 to 84,412 in 2015 (+9.7%). This forecast translates into an annual average growth rate of 0.62 percent. As noted earlier, the FAA 2001-2015 Terminal Area Forecasts (TAF) projects total airport operations within the Northwest Mountain Region to increase by 17.5 percent by 2015, which is an annual average increase of approximately 1.08 percent.

Updated Aviation Forecasts

Updated forecasts of aviation activity for Troutdale Airport were prepared to reflect local conditions, recent trends and long-term expectations within the general aviation industry. A variety of factors specific to the greater Portland area and Troutdale Airport suggest that future growth prospects will be reasonably strong during the current twenty-year planning period. As noted earlier, it appears that historic changes in activity at Troutdale Airport do not consistently follow changes in the region's economy. Although some decline in airport activity would be expected during an extended economic recession, the historic fluctuations of airport activity during periods of local economic growth suggest that other factors have a more direct effect on airport activity. In light of the continued forecast growth within the greater Portland area, the assumptions used in developing updated aviation forecasts for Troutdale largely reflect airport-specific factors or conditions within the general aviation industry.

Three scenarios were developed to provide a forecast envelope with a broad range of growth potential. Forecasts of based aircraft and operations were generated for each of the scenarios. The based aircraft projections reflect historic trends at the airport, FAA forecasts and other local factors that may affect demand levels. Aircraft utilization ratios (average operations per based aircraft) were then applied to each based aircraft projection to estimate future aircraft operations. A review of historic aircraft utilization conducted for the period between 1976 and 2001 provided an indication of the airport's historical range of aircraft utilization.

Based Aircraft

The forecasts of based aircraft were updated following a review of industry trends, documented activity and other available forecasts. As noted earlier, Troutdale Airport has experienced moderate growth in based aircraft (annual average rate of 1.82%) since the last master plan was completed in 1990. The annual average growth was nearly double the 1990 master plan forecast rate and slightly higher than the FAA's forecast rates (annual average rate of 1.67%) for the airport through 2015. Troutdale's growth in based aircraft has been slightly lower, but comparable to the overall growth of other airports (1.9% annual average growth, when combined) within the Greater Portland Area during the same period. As noted previously, the projected growth of population and employment within the local region is expected to average between 1.5 to 1.7 percent annually. While correlations between airport activity and regional economic data may be limited, strength within the economy should help to fuel the region's overall transportation needs.

Several other factors in the local region have the potential of directly affecting activity at Troutdale Airport. Prime among these are the potential closure of Evergreen Airport and forced reduction of based aircraft at Pearson Airpark. Troutdale Airport could be successful in attracting a portion of these potentially displaced aircraft early in the current planning period. Another potentially significant factor is re-development the former Reynolds Aluminum industrial site adjacent to the airport. Currently, there is plan being formulated to develop the Oregon Science and Technology Park (OSTP) on the site. Although the plans are in the conceptual stage, the 725-acre site has been identified as uniquely prime location to develop a large-scale high technology science and industrial park that could attract a large number of companies with a labor force that could reach 10,000. The site's location immediately adjacent to the north and west sides of Troutdale Airport creates some unique opportunities to develop business aviation facilities that are tailored to serve tenants and visitors to the OSTP.

Based on these factors, three based aircraft projections were developed to reflect the airport's growth potential through the current twenty-year planning period (2002-2022). These forecasts provide a baseline and upper-range projection, with an intermediate projection that represents a reasonable preferred forecast. Updated forecasts of aircraft operations were also developed for each of the projections and are presented later in this chapter.

Baseline Forecast: The baseline forecast utilizes the growth rate for Troutdale Airport reflected in the current FAA Terminal Area Forecast (2001-2015), which is a 1.67 percent annual average rate. This rate will be applied to the 2002 total of based aircraft and projected forward to 2022. This growth rate is slightly lower than Troutdale's current (14-year) trend, but provides what might be called a reasonable baseline projection over the twenty-year planning period. It is based on the FAA's long-term knowledge of airports of this size and location, from a national perspective.

Historic Trend: The actual history of growth at the airport provides another basis for a model to predict the future. We have chosen the past 14 years as a period because it provides the most accurate data available. The data on based aircraft for the intervening years is known to be unreliable (see the footnotes to Table 3-2). The airport's 14-year growth rate for based aircraft (1.82 percent, annual average rate) provides a reasonable basis for projecting future activity that is directly related to documented performance over an extended period. This projection reflects sustained, moderate growth that is slightly higher than previous master plan or FAA forecasts. It appears that growth in based aircraft at Troutdale over the last three years has been running at nearly twice the airport's 14-year average. While this recent trend is expected to moderate back toward the established historic rates for the airport, it does suggest that the airport is capable of generating stronger growth when events are favorable. As noted in Chapter Two, Troutdale Airport is well positioned to be competitive in serving the general aviation users in the Greater Portland area.

Dynamic Growth: In addition to a continuation of the established historic growth trend for the airport, there are two significant factors that may contribute to additional activity at Troutdale Airport. The first is the potential closure of Evergreen Airport and the forced reduction of the number of based aircraft at Pearson Airpark. Evergreen currently accommodates approximately 165 aircraft, which would be displaced if the airport closed. The City of Vancouver, through an agreement with the National Park Service, will cap the number of based aircraft at Pearson at 175. The current number of based aircraft is approximately 198, which will require the relocation of at least 23 aircraft. It is assumed that the majority of these aircraft would relocate to one of the more than 20 airports within the local area, including Troutdale Airport. Although it is difficult to determine precisely how many of the Evergreen/Pearson aircraft may ultimately relocate to Troutdale, a 15 to 20 percent one-time relocation factor provides an aggressive target based on the airport's competitive potential.

The second significant factor that may stimulate activity at Troutdale Airport is the potential development of Oregon Science and Technology Park (OSTP), which could serve a wide range of companies of all sizes. Troutdale Airport has the potential of accommodating increased business and corporate aviation activity. While some of this activity would likely be represented through an increase in itinerant activity, some increase in locally based aircraft could be expected.

A Dynamic Growth forecast assumes a slightly higher annual average growth rate of 2.0 percent (in lieu of 1.82%) and a one-time Evergreen/Pearson aircraft relocation factor of 17.5 percent (33 aircraft) in the 1995 projection. Overall, this results in an annual average growth rate of 2.77 percent over the twenty-year planning period (including the one-time Evergreen/Pearson relocation factor). The dynamic projection assumes that Troutdale will be successful in attracting more business aviation traffic in addition to producing slightly higher growth of existing general aviation activities such as flight training and charter services.

Factors which could implement this more dynamic growth than forecast by the FAA or historic data, include for example the Small Aircraft Transportation System (SATS) program currently being studied as a new use of GA aircraft to help in serving as a public transportation mode for smaller communities around Oregon (see Appendix C-2). Should the SATS vision become real over the next 10 years, Troutdale Airport could become an important element for access to the Portland area. Likewise, the fact that three of the major kit built aircraft manufacturer's are located in the region could result in greater than expected growth in based aircraft or airport activity at Troutdale from this category. Finally, Mt. Hood Community College has begun their flight training program utilizing Eagle Flight Center at Troutdale Airport, and should this program prove successful, it could lead to greater than expected airport operations growth for Troutdale Airport.

Summary – Based Aircraft Forecasts

The three projections of based aircraft described above provide a reasonable range of activity that may be sustained over a twenty year forecast period. **Table 3-5** summarizes the three based aircraft projections. The baseline and historic trend projections provide reasonable mid-range forecasts, while the dynamic projection reflects a more aggressive, but still moderate forecast. Because the historic projection reflects recent documented activity for Troutdale Airport, it is recommended for use as the preferred forecast of based aircraft.

Table 2-2, presented in Chapter Two, illustrates that several Portland region airports over the last fourteen years have experienced annual average growth in based aircraft that far exceed typical expectations. These include Scappoose (9.5% per year); Aurora (4% per year); and McMinnville (5.6% per year). The success of other airports in the local area suggests that the 2.77% level of potential dynamic growth projected for Troutdale is well within a possible range.

Due to the relative uncertainty associated with long-term forecasts, it is recommended that the dynamic projection be used only to define the airport's long-term landside development reserves, but not its immediate facility needs. It is recommended that the Historic Trend Forecast be used for the facility needs of the twenty-year plan. The kinds of facilities that would require additional development reserves under the Dynamic Growth forecast will be considered in the facility requirements analysis of the next chapter.

Table 3-5: Troutdale Based Aircraft Forecasts

Forecast	Annual Average Growth Rate (20 Years)	Base Year (2002)	2005	2010	2015	2022
Baseline Projection	1.67%	193	203	220	239	269
Historic Projection *(Preferred Forecast)*	1.82%	193	204	223	244	277
Dynamic Projection	2.76%	193	238[1]	263	290	333

1. Total includes one-time Evergreen/Pearson aircraft relocation (assumed to be 33 aircraft).

Aircraft Fleet Mix

The 1990 Portland-Troutdale Airport Master Plan provided a breakdown of existing and forecast fleet mix for the airport. The airport's actual fleet mix in 1990 and 2002, and the previously-forecast fleet mix for 2010, is presented in **Table 3-6**. The number and percentage of single-engine aircraft has increased since the 1990 master plan was completed. In addition, both the number and percentages of twin-engine aircraft, business jets, and helicopters declined. It is difficult to determine precisely what conditions have contributed to this change in fleet mix. However, most of the new hangar construction that has occurred at the airport in recent years has been targeted toward single engine aircraft.

The departure of one former operator, Sports Air Travel, which maintained several multi-engine aircraft for its small package freight operation, may have contributed to the overall decline in the number twin-engine aircraft at the airport. In addition, there were twin-engine aircraft being restored at the airport during that time, which may have contributed to the higher multi-engine aircraft counts.

Table 3-6: Historical/Actual Aircraft Fleet Mix

	1990 Master Plan Data/Forecasts				Actual	
Based Aircraft	**1989**	**Percentage**	**Forecast (2010)** [1]	**Percentage**	**2002**	**Percentage**
Single-Engine	118	79%	135	75%	177	92%
Twin-Engine	24	16%	32	18%	14	7%
Business Jet	6	4%	9	5%	1	< 1%
Helicopter	2	1%	4	2%	1	< 1%
Total	**150**	**100%**	**180**	**100%**	**193**	**100%**

1. 1990 Portland-Troutdale Airport Master Plan. Note: Port staff suggests that the 1989 numbers for business jets and helicopters may be incorrect, and are more likely listed in reverse, i.e. they believe now that more likely there were 6 helicopters and 2 business jets.

The updated forecasts of based aircraft fleet mix are presented in **Table 3-7.** Based on the airport's shift toward single-engine aircraft in recent years, the projections developed in the 1990 master plan appear to overestimate the potential for a large-scale shift toward more complex locally based aircraft. However, based on the national trends in aircraft manufacturing and the airport's potential for attracting increased business aviation activity, such as would be associated with development of the OSTP and capacity issues at PDX, it does appear reasonable to assume moderate shift toward more complex aircraft. For this reason, the forecast of based aircraft fleet mix assumes a gradual increase in the percentage of twin-engine aircraft (including turboprops), business jets and helicopters during the current planning period. Single-engine aircraft will continue to represent the largest segment of based aircraft, but the overall percentage is projected to decline slightly.

Table 3-7: Forecast Aircraft Fleet Mix (Preferred Forecast)

	Existing	Forecast			
Based Aircraft	**2002**	**2005**	**2010**	**2015**	**2022**
Single-Engine	177 (92%)	188 (92%)	201 (90%)	215 (88%)	238 (86%)
Twin-Engine	14 (7%)	14 (7%)	17 (7%)	22 (9%)	29 (10%)
Business Jet	1 (<1%)	1 (<1%)	3 (2%)	5 (2%)	7 (3%)
Helicopter	1 (<1%)	1 (<1%)	2 (1%)	2 (1%)	3 (1%)
Total	**193**	**204**	**223**	**244**	**277**

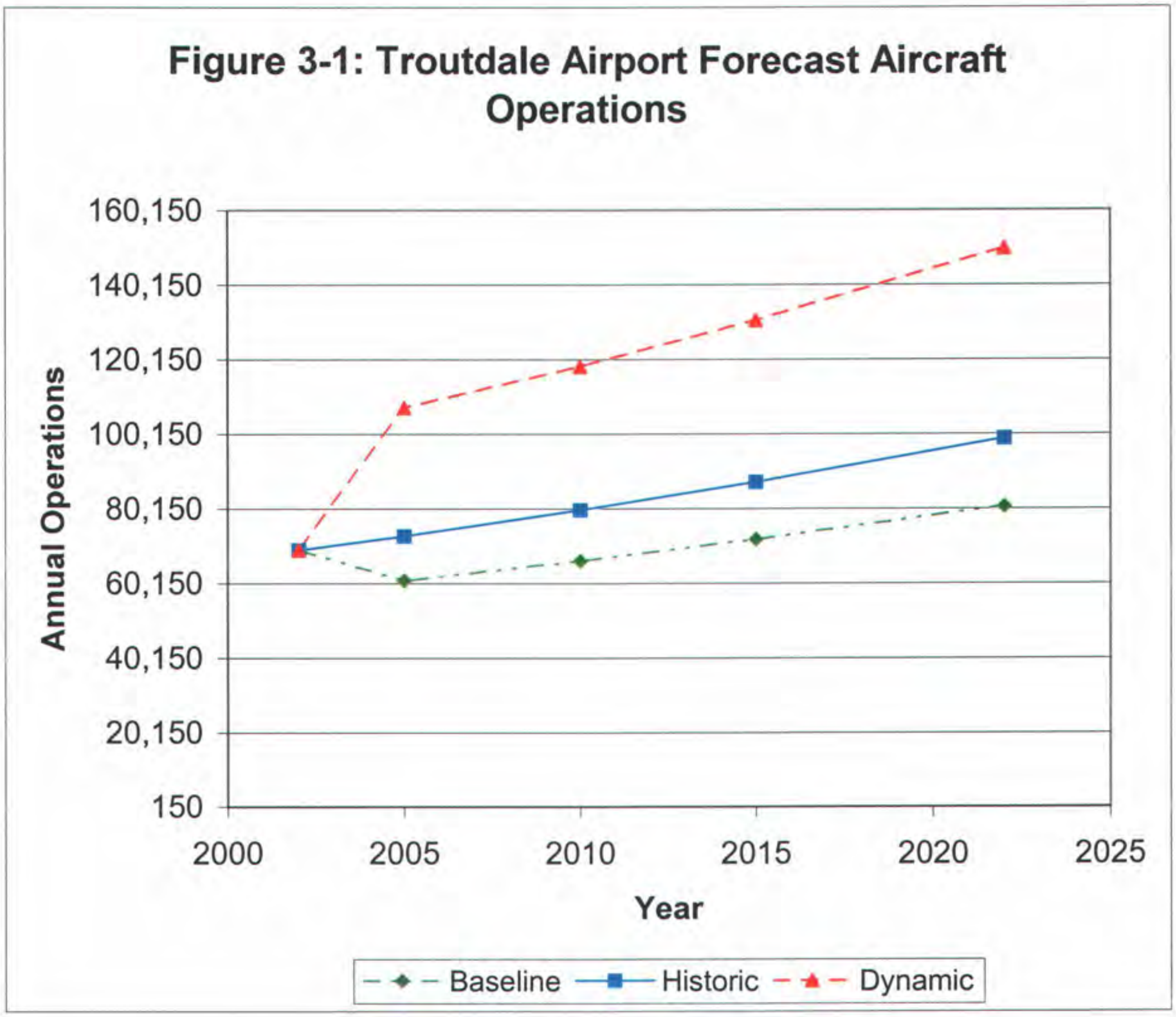
A factor that could affect both the based aircraft fleet mix percentages at Troutdale Airport is the potential relocation of displaced aircraft from Evergreen/Pearson described in the dynamic forecast projection. Most of these aircraft are single-engine and their potential relocation could initially increase the percentage of single-engine aircraft at Troutdale Airport. Thus Table 3-7 assumes that during the next three years the fleet mix will likely remain constant, and that only in the following years will the mix change toward more complex aircraft.

Aircraft Operations

Forecasts of aircraft operations were developed for each of the three based aircraft projections (See **Table 3-8** and **Figure 3-1**). As noted in the based aircraft forecasts, the three projections were developed based on different growth assumptions. For based aircraft forecasts, the growth assumptions are reflected in different average annual growth rates. The forecasts of aircraft operations add a varying aircraft utilization factor to the based aircraft projections to approximate relative increases in overall airport activity.

Table 3-8: Summary of Aircraft Operations Forecasts

	Existing	Forecast				
	2002	**2005**	**2010**	**2015**	**2022**	**Average Annual Growth Rate (2002-2022)**
Baseline Forecast (Activity Ratio: 300 operations per based aircraft)						
Based Aircraft	193	203	219	237	269	1.67%
Annual Operations	68,927 est.	60,600	65,700	71,100	80,700	0.79%
Historic Trend Forecast ***(Preferred Forecast)*** **(Activity Ratio: 357 operations per based aircraft)**						
Based Aircraft	**193**	**204**	**223**	**244**	**277**	**1.82%**
Annual Operations	68,927 est.	72,828	79,611	87,108	98,889	1.82%
Dynamic Forecast (Activity Ratio: 450 operations per based aircraft)						
Based Aircraft	193	238	263	290	333	2.76%
Annual Operations	68,927 est.	107,100	118,350	130,500	149,850	3.40%



As noted earlier, Troutdale has averaged approximately 450 operations per based aircraft in the 26-year period since 1976, although the averages have declined over the last several years. Based on the fluid nature of these historical operations ratios, it is recommended that the updated forecast data in this chapter reflect a range of activity ratios. **Table 3-8** summarizes the activity ratios used for each forecast. The projections result in annual average growth in aircraft operations ranging from 0.79 percent to 3.4 percent through the current 20-year planning period. The Baseline Forecast utilizes an activity ratio of approximately 15% less than 2001 data (rounded to 300 operations per based aircraft), which results in a drop in operations for the 2005 year, followed by growth afterward. The Historic Trend Forecast utilizes the most recent data accurate data of 357 operations per based aircraft. The Dynamic Forecast utilizes the average value of 450 operations per based aircraft, which is believed to be a reasonable number for times of strong economic growth. These three scenarios are intended to provide reasonable models for low, medium, and higher growth futures that the airport may exist within.

Peaking Activity

A summary of current and projected aircraft peaking is provided in **Table 3-9**. A review of air traffic control records and discussions with air traffic controller familiar with Troutdale operations was the primary source for identifying peaking characteristics. The current activity peaking at Troutdale is comparable to other airports its size. The peak month (usually August or July) typically accounts for between 11.5 and 12 percent of annual totals. The recorded peak day total for Troutdale in 2001 was 380 operations (on August 9th) and the peak hour operations were 75 (during the 8-9am period)[7]. A review of historic data indicates that peak day activity typically represents approximately 4.5 to 4.7 percent of peak month traffic. Peak hour activity represents approximately 20 percent of the peak day traffic. There is no indication that the current peaking characteristics will change significantly in the near future. Therefore, current peaking percentages were applied directly to forecast activity to estimate peak activity levels through the planning period.

Table 3-9: Airport Peaking Factors

	Actual	Forecast			
	2002 (Estimated)	2005	2010	2015	2022
Peaking Activity					
Annual Operations	68,927	72,732	79,596	87,108	98,830
Peak Month (11.7% of Annual Ops)	8,064	8,510	9,313	10,192	11,563
Peak Day (4.71% of Peak Month)	380	401	439	480	545
Design Day (Peak Month/31)	260	275	300	329	373
Busy Day (110% of Design Day)	286	302	330	362	410
Peak Hour (19.71% of Peak Day)	75	79	86	95	107

Overview of Airport Activity Segments

A review of historic air traffic data for Troutdale identifies three primary segments of activity: general aviation, commercial/air taxi, and military/government. Historically general aviation activity has accounted for 90 to 95 percent of the airport's total operations. Activity records for commercial and air taxi range from 1 to 5 percent, although significant changes from year to year may indicate some inconsistencies in counting.

[7] Telephone discussion between Troutdale Tower staff Rob Bruders and Aron Faegre on July 11, 2002.

Military and government (USFS Tankers) activity has varied from 1.5 to 2 percent of total operations and typically fluctuates between 1,000 and 2,000 annual operations. According to tower records, most of this activity consists of military local operations. As noted in **Figure 1-4**, in Chapter One, Forest Service tanker operations at Troutdale varying greatly depending on the fire season. Since 1995, the number of tanker operations has ranged from less than ten to just over fifty per year. The tanker operations are normally concentrated in the period from early June through late September. A summary of existing and forecast airport activity is provided in **Table 3-10**, based on the Historic Trend Forecast projections.

Table 3-10: Forecast Summary (using Historic Trend Forecast Projections)

Activity	Actual	Forecast			
	2002	2005	2010	2015	2022
Based Aircraft					
Single Engine	177	188	201	215	238
Multi-Engine	14	14	17	22	29
Business Jet	1	1	3	5	7
Helicopter	1	1	2	2	3
Total	193	204	223	244	277
Annual Aircraft Operations	**2002 (estimated)**				
Local	41,356	43,094	46,166	49,434	54,356
Itinerant	27,571	29,638	33,430	37,674	44,473
Total	68,927	72,732	79,596	87,108	98,830
Activity by Type	**2002 (estimated)**				
General Aviation	65,481	69,095	75,616	82,752	93,888
Air Taxi/ Commercial	1,446	1,637	1,980	2,355	2,941
Government	2,000	2,000	2,000	2,000	2,000
Total	68,927	72,732	79,596	87,108	98,830
Design Aircraft Operations (Business Jet)	689	1,055	1,751	2,570	3,953
Instrument Operations	1,484	1,604	1,824	2,072	2,471

For the purposes of forecasting, the air traffic distribution is not expected to experience significant change. General aviation activity is projected at 95 percent; the percentage of military/government activity is shown as staying relatively constant at 2,000 operations per year. The percentage of commercial/air taxi activity is projected to increase (to approximately 3.4 percent by 2022) reflecting an increase in business aviation activity.

According to air traffic control tower data, local operations currently account for about 60 percent of total operations. These operations occur in the local traffic pattern and airport environment and typically involve flight training. Itinerant operations accounted for approximately 40 percent of annual operations in 1999, 43% in 2000, and 46% in 2001. Based on recent increases in flight training at Troutdale it is anticipated that 2002 will have approximately 40% of annual operations as itinerant operations. In future years, due to an anticipated increase in the level of business-related activity at Troutdale, itinerant operations are projected to increase from 40 percent to approximately 45 percent by 2022. Thus, local operations are projected to gradually decline from 60 percent to approximately 55 percent by 2022.

The projected design aircraft for Troutdale Airport is expected to be a small or medium business jet. Based on the forecast of locally based aircraft fleet mix and anticipated increase in transient business jet activity, projections of annual operations by the design aircraft type were developed. This activity is currently estimated to account for approximately 1 percent of annual operations and is projected to increase to at least 4 percent by the end of the planning period.

Instrument operations at Troutdale have also fluctuated in the past, ranging from around 1,000 operations to more than 5,000 operations per year. As noted in earlier discussions, the existing nondirectional beacon instrument approach may constrain instrument operations at the airport. Instrument operations are projected to increase from the 2001 level of 1,484 operations (2.15 percent) to approximately 2.5 percent of annual operations by 2022. The development of a more efficient instrument approach could increase this activity further. It is reasonable to expect that the advances in avionics, paired with the expected improvements to ground equipment, should over time make IFR operations more accessible to Troutdale.

Summary

Troutdale Airport has shown many peaks and valleys for both based aircraft and their operations during the past 25 years. When an airport has this kind of "yo-yoing" of data it is important to look at all of the forces impacting the airport to try to determine a reasonable projection for the future.

The population base appears to be stable and showing a projected modest growth over the next twenty years, based on Metro forecasts. The economic base of the four cities area has been hit by recent declines in employment and has struggled with the closure of some high-tech facilities. However, as of July 18, 2002 good news has been released that the high-tech facilities are expected to reopen in the next year. Most importantly, local and regional interest in redeveloping the 725 acre Alcoa/Reynolds property (adjacent to the airport) is very high. The local conditions thus appear to be strong for continued growth of based aircraft and operations at the airport – both for recreational as well as business uses.

The airport itself has several FBO's with excellent training, maintenance, and associated facilities. The hangars appear to be at virtually 100% occupancy. Thus, the airport businesses appear to be healthy, indicating a good basis for growth.

The past fourteen years of activity at the airport show – on average – that the airport is capable of sustained modest growth in based aircraft. Knowing that up to 188 aircraft based in Clark County to the north will need new homes, some of which are likely to be attractable to Troutdale Airport, should facilities be available to receive them. Finally, the FAA projections are for growth to continue at Troutdale Airport with rates that are comparable to what has occurred during the past fourteen years.

Given these strong underlying conditions—yet moderating them with the current uncertainties in the overall US economic strengths resulting in part from the actions of September 11th, 2001 – it is recommended that the preferred forecast utilize the Historic Trend Forecast projects. This forecast of aviation activity represents modest to moderate increases in aviation activity during the current twenty year planning period. This forecast projects growth in based aircraft that is comparable to the most recent 14-year trend, though with the local economic development activities currently underway, there is some expectation that these growth rates will be exceeded. Especially as local economic development efforts are successful, it is expected that the fleet mix will increase more strongly in the business class aircraft category. And with the growth of local business activity it is expected that itinerant operations serving these businesses will also increase. For the business use to be substantial and strong, an improvement in the instrument approach capabilities of the airport is assumed, and that there is increase in instrument operations to accompany this capability.

CHAPTER FOUR

Airport Facility Requirements

INTRODUCTION

To plan for the future needs of Troutdale Airport, it is necessary to translate forecast aviation demand--including type and volume--into specified types and quantities of facilities that can adequately serve the identified demand. This chapter uses the results of the inventory and forecast analyses, as well as established planning criteria, to determine the airside and landside facility requirements through the twenty-year planning period. A review of airfield capacity is included to identify any potential capacity-related issues that may occur over the next twenty years. Airside facilities include runways, taxiways, navigational aids and lighting systems. Landside facilities include hangars, fixed base operator (FBO), specialized aviation service operators (SASO), and terminal facilities, aircraft parking apron, air tanker loading areas, aircraft fueling, automobile parking, utilities and surface access.

The objective of this effort is to identify the adequacy or inadequacy of existing airport facilities and outline what new facilities may be needed to accommodate forecast demands. Having established facility requirements, alternatives for providing these facilities will be evaluated in **Chapter Five** to determine the most cost effective and efficient means for implementation.

OVERVIEW

For perspective in the planning process, a review of the old 1990 Portland-Troutdale Airport Master Plan (Hodges & Shutt) will help us understand the key planning issues addressed twelve years ago. That plan found that the principle need for a variety of facility improvements at Troutdale Airport, included:

- Long-term relocation of all airport facilities to the north side of the airport;

- Overlay runway pavement and reduce width, including new shoulder grading and modifications to marking and lighting;
- Overlay north taxiway pavement;
- Slurry seal exit taxiways and northside apron;
- Construct additional exit taxiway;
- Construct Air Guard helipad;
- Construct northside taxilanes and T-hangars;
- Widen exit taxiway fillets; and
- Construct new midfield taxilane, with access road and fencing modifications.

Actual facility improvements made since the last master plan have included:

- 5 T-Hangar buildings (61 hangar spaces) added to the north side of the airport;
- No change to the runway width;
- Reconstruct north taxiway and north apron;
- Reconstruct and name Taxiway C;
- New high speed exit taxiway A3 and standard exit taxiway B3;
- New AWOS;
- New fuel facility; and
- New security fencing for the entire airport.

Five new T-Hangars were constructed between 1990 and 2000 by the same company, and reflect considerable private investment at the airport. Other tenant improvements have been made in recent years, including the recent improvements to the Premier Aircraft maintenance facilities on the north side of the runway.

A detailed Airport Layout Plan (ALP) drawing was prepared as part of the 1990 master plan, however no approach or airspace drawings were created as part of that planning work. The only change to property ownership since 1990 was the sale of an adjacent 12 acre parcel industrial property north of Sundial Road owned by the Port of Portland to a private developer. Otherwise, there have been no changes to the airport property line during the period since the 1990 master plan. A detailed review of the ALP finds that various of the airfield facilities meet differing aircraft design groups as defined by the FAA. This lack of consistency is probably due to the wide range of aircraft types using the airport -- especially the fire tanker aircraft. A review of the facility dimensions depicted on the 1990 ALP was conducted to identify the design category most consistent with the previous planning (see **Table 4-1**.).

The 1990 master plan reflects facility planning based on B-II aircraft (i.e., those with approach speeds less than 121 knots and wingspans shorter than 79 feet). It was recognized that the United States Forest Service (USFS) used tanker aircraft larger than B-II, however since the Forest Service operations were typically only 50 operations per year (much less than the FAA standard of 500 operations per year for defining the design aircraft), the larger Forest Service aircraft were not used as the design aircraft. The existing pavement strength of 19,000 pounds single wheel was also recommended as the "future" pavement strength. All future airfield facilities and airspace surfaces in the 1990 ALP were based on these assumptions.

Table 4-1: Existing Conditions Assessment of Corresponding Design Categories

Item	Airplane Design Group	Notes
Runway Safety Area	*As depicted on ALP:* B-III (NLT ¾ mile visibility) or B-I & B-II (LT ¾ mile visibility)	Non Standard Length Beyond Rwy 25 (meets B-II standard - NLT ¾ mile visibility)
Runway Object Free Area	*As depicted on ALP:* B-IV (NLT ¾ mile visibility) or B-III (NLT ¾ mile visibility)	Non Standard Length Beyond Rwy 25 (meets B-II standard - NLT ¾ mile visibility)
Runway Obstacle Free Zone	Large Aircraft (Per FAR Part 77)	Non Standard Clearance (Taxiway Bravo)
Taxiway Safety Area	Alpha: ADG II Bravo: ADG II	Dimensions only (surface condition/gradient TBD). Limited by frontage road on Alpha and APL on Bravo.
Taxiway Object Free Area	Alpha: ADG II Bravo: ADG I	Limited by distance to aircraft parking.
Building Restriction Line	*As depicted on ALP:* North: B-III (NLT ¾ mile visibility) Or C/D-II South: Same	Four buildings located inside south BRL; Two buildings located inside north BRL.
Aircraft Parking Line	*As depicted on ALP:* North: B-II (NLT ¾ mile visibility) South: B-I (NLT ¾ mile visibility)	-
Runway Protection Zones	*As depicted on ALP:* Rwy 25: A&B Aircraft Visual & NLT 1 mile visibility Rwy 7: C&D Aircraft Visual & NLT 1 mile visibility	-
Runway-Parallel Taxiway Separation	Alpha: B-II Bravo: B-I (small aircraft exclusively)	-
Runway Width	B-IV (NLT or LT ¾ mile visibility) or C/D-IV or even C/D-III[1]	-
Taxiway Width	ADG III	-

Notes: NLT and LT is "not lower than and lower than" visibility minimums for the runway approach. Dimensions as depicted on 1990 Airport Layout Plan (Hodges & Shutt) or as currently in place (existing facilities).

The National Oceanic and Atmospheric Administrations "Airport Obstruction Chart for Portland-Troutdale Airport" OC649 (February 1985) was included in the report for depiction of airspace needs for Runway 7/25.

[1] AC 150/5300, Table 3-2, Footnote 2.

The OC chart depicted airspace surfaces that were consistent with "larger than utility" runways with nonprecision instrument approach capabilities for Runway 7 and visual approaches for Runway 25. A supplemental nonprecision instrument approach surface was also depicted for Runway 25. The master plan identified General Utility II runway standards, which was compatible with the variety of general aviation aircraft operating at the airport, the geometric configuration of the runway-taxiway system within the overall airport site, and the overall capabilities of the airfield facilities.

The 2000 Oregon Aviation Plan (Dye/Century West) created a new system of categorizing Oregon's public use airports. Five airport categories were defined based on the primary functional roles of airports. The airport categories range from commercial service airport such as PDX (Category 1) to small remote airports such as Cascade Locks State (Category 5). Troutdale Airport is categorized as a Business or High Activity General Aviation Airport (Category 2). Business or High Activity General Aviation airports are unique in that they accommodate a significant amount of business aviation activity, including turbine aircraft. Other nearby Category 2 airports include Hillsboro, Aurora, and Scappoose. Business/High Activity GA airports are an important part of Oregon's aviation system, primarily serving the needs of business and general aviation users within a local area. The airports typically have airfield facilities, lighting, and navigational aids needed to accommodate a wide range of business aircraft weighing 12,500 pounds and above.

Troutdale Airport (along with Hillsboro Airport) is identified by the FAA as a general aviation reliever to PDX, which provides substantial airside and landside capacity benefits to PDX by enabling it to focus primarily on commercial aviation facility needs. It is significant to note that the number of GA based aircraft at PDX has declined over the past 20 years, while these reliever airports (and many other local airports) have continuously grown in numbers of based aircraft.

FACTORS USED IN SELECTING APPROPRIATE AIRPORT DESIGN STANDARDS

The selection of design standards for airfield facilities is based primarily upon the characteristics of the aircraft that are expected to use the airport. From a physical planning perspective, the most critical characteristics are the approach speed and wingspan of the selected design aircraft. Aircraft operating weight is also an important planning criterion for airports. For general aviation airports, the FAA distinguishes between large and small aircraft at a weight of 12,500 pounds. Aircraft weighing 12,500 pounds or less (maximum certificated takeoff weight) are categorized as "small aircraft." Aircraft weighing more than 12,500 pounds are categorized as "large aircraft." As noted earlier, Troutdale routinely accommodates aircraft weighing more than 12,500 pounds (the Forest Service aircraft particularly), although the majority of aircraft based at the airport are small airplanes. As an airport that accommodates a wide range of business aviation activity, it is appropriate to plan airside facilities based on large airplane criteria.

Federal Aviation Administration (FAA) **Advisory Circular (AC) 150/5300-13 (Change 7, dated 10/01/02), Airport Design**, serves as the primary reference in planning airfield facilities. **Federal Aviation Regulations (FAR) Part 77, Objects Affecting Navigable Airspace**, defines airport imaginary surfaces which are established to protect the airspace immediately surrounding a runway.

FAA **Advisory Circular 150/5300-13** groups aircraft into five categories based upon their approach speed. Categories A and B include small propeller aircraft, business jet and turboprop aircraft, and some larger aircraft with approach speeds of less than 121 knots. Categories C, D, and E consist of the remaining business jets, turboprops and larger aircraft generally associated with commercial, firefighting and military use; these aircraft have approach speeds of 121 knots or more. The advisory circular also establishes six aircraft design groups, based on the physical size (wingspan) of the aircraft. The classifications range from Airplane Design Group (ADG) I, for aircraft with wingspans of less than 49 feet, to ADG VI for the largest commercial and military aircraft. A summary of typical aircraft, including business and air tanker aircraft, and their respective design categories is presented in **Table 4-2.**

Based on established FAA planning criteria, the ***design aircraft*** represents the most demanding aircraft type with at least 500 itinerant operations per year. The airport reference code (ARC) reflects the combination of aircraft approach speed and design group for the design aircraft. As noted in the previous chapter, the existing design aircraft defined for Troutdale Airport is a small/medium business jet, which is included in Aircraft Approach Category B and Airplane Design Group II (ARC: B-II).

Air Tanker Activity

As noted in the previous chapter, Troutdale Airport routinely accommodates large aircraft activity associated with the U.S. Forest Service (USFS) Troutdale Tanker Base. According to data provided by the USFS, a wide variety of aircraft, most of which are included in Airplane Design Groups III and IV, are operated by government agencies and contractors during fire season[2]. It is recognized that the current and forecast volume of air tanker flights does not meet the conventional FAA activity-based criteria for use as design aircraft (e.g., a minimum of 500 annual itinerant operations). However, the air tankers do represent the most physically demanding aircraft using the airport on a regular basis, particularly for wingspan-derived clearances.

Maintaining the USFS fire response capabilities at the Troutdale Airport Tanker Base is a significant part of the region's fire response strategy, particularly for areas within the Mt. Hood National Forest. Originally, many of the basic existing airfield facilities at Troutdale Airport (especially the runway and taxiway Alpha) were constructed and maintained to accommodate larger military type aircraft[3]. Although wingtip clearances

[2] A copy of the Forest Service list of fire tankers that should be expected to use Troutdale Airport, and the detailed characteristics of those aircraft are provided in *Appendix D-1: US Forest Service Fire Tanker Data.*

[3] A copy of the Civil Aeronautics Administration design standards for airports in the 1940's (as shown in *Data Book for Civil Engineers -- Design*, by Elwyn Seele, Wiley & Sons, 1945) are attached in *Appendix D-2: CAA Design*

on taxiway Alpha no longer accommodate them, many of these same military aircraft are today in use as fire tankers with the Forest Service, which supplements the Troutdale's primary role as a general aviation airport. Currently these fire tankers use taxiway Bravo to meet the wingtip clearance needs. Maintaining or improving existing airport facilities which serve this diversity of aircraft type, may be critical in preserving current fire response capabilities.

Based on the existing airfield configuration, the historic investment in USFS facilities at the airport, and the regional significance of the fire response activity, it is reasonable for facility planning at Troutdale Airport to continue to reflect the unique combination of facility needs. Addressing the corresponding costs associated with maintaining the existing level of capabilities—beyond traditional FAA-based planning criteria--may require a cooperative approach involving the Port, FAA, USFS, and perhaps other involved agencies.

Business Jet Activity

Another factor that should be considered in the evaluation of long-term facility needs is a trend within business aviation toward larger and faster aircraft. As noted in the previous chapter, business jets are among the fastest growing segments of general aviation manufacturing and the number of new business jets included in Airplane Approach Category C is increasing at a significant rate. Examples of Approach Category C business jets are included in **Table 4-2**. Many general aviation airports with substantial business aviation activity are finding that higher performance business jet operations are increasing as the aircraft fleet evolves. The physical planning characteristics of Approach Category C&D aircraft are considerably more demanding than A&B for any corresponding design group.

While the future design aircraft for Troutdale Airport is currently anticipated to be a B-II aircraft, it is reasonable to expect that activity from Category C business aircraft may increase during the current twenty-year planning period. It is difficult to predict to what degree the ongoing changes in the business aircraft fleet may affect operations at Troutdale Airport. However, if the existing "large aircraft" clearances and dimensions that exceed B-II requirements are maintained, the airport will effectively create long-term development reserves that will also meet many of the C-II standards, should that need occur in the future.

Recommended Design Standards to be Used

The design aircraft for Troutdale Airport, based on standard FAA planning criteria, is a small/medium business jet included in Aircraft Design Group II and Approach Category B. Airport reference code B-II (ARC B-II) is appropriate for Runway 7/25 based on conventional FAA planning criteria.

Standards circa 1940's. Troutdale Airport was most likely designed as a Class III airport, which was intended to accommodate DC-2, DC-3, DC-4, DC-6, and Lockheed Constellation size aircraft.

Table 4-2: Typical Aircraft & Design Categories

Aircraft	Design Group	Approach Category	Max Wheel Load psi	Maximum Gross Takeoff Weight (lbs)
Cessna 182	A	I		3,110
Beechcraft Bonanza A36	A	I		3,650
Aerospatiale TBM 700	A	I		6,579
Beechcraft Baron 58	B	I		5,500
Piper Aerostar 602P	B	I		6,000
Cessna 402	B	I		6,300
Cessna Citation CJ1	B	I		10,600
Beech King Air B100	B	I		11,800
Cessna Citation I	B	I		11,850
Piper Malibu	A	II		4,300
Cessna Caravan 1	A	II		8,000
Pilatus PC-12	A	II		9,920
Beech King Air B200	B	II		12,500
Cessna Citation II	B	II		13,300
Beech King Air 350	B	II		15,000
Cessna Citation Bravo	B	II		15,000
Cessna Citation Excel	B	II		20,000
Bombardier Learjet 31A	C	I		17,000
Grumman S-2 Tracker *	B	II	102*	27,000*
Bombardier Learjet 45	C	I		20,500
Gulfstream 100	C	II		24,650
Beechcraft Hawker 800XP	C	II		28,000
Cessna Citation Sovereign	C	II		30,250
Gulfstream 200	C	II		34,450
Cessna Citation X	C	II		36,100
Bombardier Challenger 300	C	II		37,500
Bombardier Challenger 600	C	II		41,250
Gulfstream 300	C	II		66,000
Douglas DC-4 *	B	III	78*	71,200*
Consolidated PB4Y-2 Privateer *	B	III	93*	60,000*
Douglas DC-6 *	B	III	92*	92,200*
Douglas DC-7 *	B	III*	111*	116,900*
Lockheed SP-2H *	C	III	92*	67,500*
Lockheed P3A Orion *	C	III	89*	105,500*
Lockheed P2V Neptune *	C	III	109*	80,000*
Boeing KC97 *	C	IV	117*	155,000*
Lockheed L100-30 (C130 Hercules) *	C	IV	70*	120,000*

Source: AC 150/5300-13, change 6; aircraft manufacturer data. * Aircraft dimensional data and operating weights provided by USFS Fire & Aviation Management office; aircraft as modified for fire service, see Appendix D-1. Note: as of October 2002 USFS is temporarily operating all tanker aircraft at only 80% of gross weights shown, during a period of analysis to determine causes of several tanker aircraft accidents which occurred during the 2002 summer.

However, based on the existing configuration and/or dimensions of many airfield facilities at Troutdale (runway width, taxiway width, etc.), it is evident that the airport is also able to accommodate aircraft of significantly larger design group (wingspan). Because the Port has selectively maintained the "larger" facilities required to accommodate air tanker activity, the airport is not burdened with expansive facilities that are unused throughout most of the year. Based on the factors described above, it is recommended that this historic approach be continued as long as the participating agencies relying on the "larger" facilities contribute to the additional costs[4] associated with maintaining the facilities.

For planning purposes, where facilities currently exceed B-II design standards, it is proposed that the existing dimensions/clearances be maintained. By maintaining existing dimensions, clearances and development setbacks whenever possible, the airport will preserve existing air tanker operations while also protecting for potential expansion and/or a future upgrade in higher performance design aircraft.

The existing airfield conditions (dimensions) and the recommended FAA design standards (B-II) are presented in **Table 4-3** on the following page. Design standards for typical high performance business jets (C-II), and air tanker aircraft (B-III) are also presented for comparison. The airport's current/potential ability to meet the various design standards is summarized in **Table 4-4** on the following page. As indicated in the table, there are many existing runway-taxiway dimensions that would be unable to meet C-II or B-III standards without major reconfiguration of the whole airport. The majority of B-II dimensional standards that are not currently met are related to the nonstandard separation between the runway and the south (Bravo) parallel taxiway. Aside from the Bravo parallel taxiway separation, Troutdale Airport currently meets or exceeds B-II design standards.

CONSIDERATION OF AIRSPACE AND INSTRUMENT APPROACH CAPABILITIES

As noted earlier, the 1990 Airport Master Plan did not include an updated airspace plan. However, the National Oceanic and Atmospheric Administrations "Airport Obstruction Chart for Portland-Troutdale Airport" OC649 (February 1985) depicts airspace surfaces consistent with "larger than utility" runways with nonprecision instrument approach capabilities. Based on the airport surrounding terrain, Troutdale is not suited for a traditional precision instrument approach, such as an instrument landing system (ILS). However, future "precision" instrument approaches such as the planned GLS[5] will likely provide much improved opportunities for Troutdale Airport. There are no design standards for these next generation instrument approaches. Current indications are that these planned enhancements in instrument approach procedures will be based on existing nonprecision instrument airspace planning criteria.

[4] The Forest Service may have funds available for runway and taxiway improvements that specifically benefit their use. See Appendix A-4, Joint Planning Conference Project Meeting Minutes, Item 20.
[5] See Chapter 1, page 27 for discussion of the GLS under the Instrument Approach Issues section.

Table 4-3: TTD Airport Design Standards Summary (in feet)

Design Standard	Existing Conditions	Aircraft Design Groups: ADG II[1] A&B Aircraft (e.g. Citation II)	ADG II[1] C&D Aircraft (e.g. Gulfstream 200)	ADG III[1] A&B Aircraft (e.g. DC-6 air tanker)
Runway Length[2]	5,399	3,530/5,280[2]	5,280/5,500[3]	5,280/5,500[3]
Runway Width	150	75	100	100
Runway Shoulder Width	10	10	10	20
Runway Safety Area Width	300	150	500	300
Runway Safety Area Length (Beyond Runway End)	800 (Rwy 7) 400 (Rwy 25)	300	1,000	600
Obstacle-Free Zone	400	400	400	400
Object Free Area Width	800	500	800	800
Object Free Area Length (Beyond Runway End)	1,000 (Rwy 7) 400 (Rwy 25)	300	1,000	600
Primary Surface Width[1]	500	500	500	500
Primary Surface Length (Beyond Runway End)	200	200	200	200
Runway Protection Zone Length[1]	1,700 (Rwy 7) 1,000 (Rwy 25)	1,000	1,700	1,000
Runway Protection Zone Inner Width[1]	500	500	500	500
Runway Protection Zone Outer Width[1]	1,010 (Rwy 7) 700 (Rwy 25)	700	1,010	700
Runway Centerline to:				
Parallel Taxiway Centerline	275/200 (A/B)	240	300	300
Aircraft Parking Area[4]	341/250 (N/S)	305.5	365.5	400
Building Restriction Line[5]	400 (N/S)	376	393	393
Taxiway Width	50	35	35	50
Taxiway Shoulder Width	10	10	10	20
Taxiway Safety Area Width	79 (est.)	79	79	118
Taxiway Object Free Area Width	131/100 (A/B)	131	131	186
Taxiway Centerline to Fixed/Movable Object	65.5/50 (A/B)	65.5	65.5	93

Notes:

1. Larger than utility runways (Per FAR Part 77); all other dimensions reflect visual or nonprecision runways with not lower than 3/4-statute mile approach visibility minimums (per AC 150/5300-13, Change 7). RPZ dimensions based on visual and not lower than 1-mile approach visibility minimums.
2. Runway length required to accommodate 100 percent of General Aviation Fleet 12,500 pounds or less / 75 percent of large airplanes of 60,000 pounds or less at 60 percent useful load. 81 degrees F, 5-foot change in runway centerline elevation, per FAA standards.
3. Runway length required to accommodate 75 and 100 percent of large airplanes of 60,000 pounds or less at 60 percent useful load. 81 degrees F, 5-foot change in runway centerline elevation per FAA standards. (Note: USFS staff state that existing Troutdale runway length is in practice acceptable for all of their tanker aircraft[6]).
4. Minimum distance per AC 150/5300-13 required to protect runway object free area, parallel taxiway object free area and a 10-foot aircraft tail height at the APL without penetrating the runway transitional surface.
5. Minimum distance per AC 150/5300-13 required to protect runway object free area, parallel taxiway object free area and an 18-foot structure at the BRL without penetrating the runway transitional surface.

[6] Telephone discussion between Aron Faegre and Bob Ihrke, Troutdale Tanker Base Manager (USFS), September 23, 2002.

Table 4-4: Runway 7/25 Compliance with FAA Design Standards

Item	Airplane Design Group II[1] A & B Aircraft	Airplane Design Group II[2] C & D Aircraft	Airplane Design Group III[1] A & B Aircraft
Runway Safety Area	Yes	No[3]	No[4]
Runway Object Free Area	Yes	No[5]	No[6]
Runway Obstacle Free Zone	No[23]	No[23]	No[23]
Taxiway Safety Area	Yes[7]	No[8]	No[9]
Taxiway Object Free Area	No[10]	No[11]	No[11]
Building Restriction Line	No[12]	No[13]	No[14]
Aircraft Parking Line	No[15]	No[16]	No[16]
Runway Protection Zones	No[17]	No[17]	No[17]
Runway-Parallel Taxiway Separation	No[18]	No[19]	No[19]
Runway Width	Yes	Yes	Yes
Runway Length	Yes[20]	Yes[21]	No[22]
Taxiway Width	Yes	Yes	Yes

Notes:

1. Runway design standards for approach category A&B visual runways and runways with not lower than ¾-statute mile approach visibility minimums.
2. Runway design standards for approach category C&D runways.
3. South parallel taxiway (Bravo) located within RSA (taxiing aircraft); extended RSA beyond Rwy 25 is 400 feet less than 1,000-foot standard.
4. Extended RSA beyond Rwy 25 is 200 feet less than 600-foot standard.
5. Extended OFA beyond Rwy 25 is 200 feet less than 1,000-foot standard; aircraft parking areas located within OFA on both sides of runway.
6. Extended OFA beyond Rwy 25 is 200 feet less than 600-foot standard; aircraft parking areas located within OFA on both sides of runway.
7. Bravo parallel taxiway has adequate safety area, although runway-separation is non-standard.
8. Bravo parallel taxiway has non-standard runway separation and aircraft tiedowns located within potential "standard" TSA.
9. Aircraft tiedowns located within Bravo parallel taxiway safety area and runway separation is non-standard.
10. Aircraft tiedowns located within Bravo parallel taxiway object free area and runway separation is non-standard on Bravo taxiway.
11. Aircraft tiedowns located within Alpha and Bravo parallel taxiway object free area and runway separations are non-standard.
12. Two T-hangars and former Premier building located near SE end of runway penetrate transitional surface. Taxiway Bravo does not meet standard runway separation; the above-referenced buildings would penetrate relocated Bravo taxiway object free area.
13. Two T-hangars and former Premier building located near SE end of runway penetrate transitional surface. Hangars/buildings located within standard ADG II (C/D) object free area on current Alpha and Bravo taxiway locations, which also do not meet the runway-taxiway separation.
14. Two T-hangars and former Premier building located near SE end of runway penetrate transitional surface. Hangars/buildings located within standard ADG III (A/B) object free area on current Alpha and Bravo taxiway locations, which also do not meet the runway-taxiway separation.
15. Bravo parallel taxiway has non-standard runway separation; aircraft parking located within potential "standard" taxiway object free area.
16. Alpha and Bravo parallel taxiways have non-standard separation; aircraft parking located within potential "standard" taxiway object free area.
17. Roads located within Runway 7 and 25 protection zones.
18. Alpha parallel taxiway exceeds B-II minimum (NLT ¾ mi.); Bravo parallel taxiway 40 feet less than standard runway separation (240 feet).
19. Alpha and Bravo parallel taxiways have less than standard 300-foot runway separation.
20. Per FAA Runway Length Model – length needed to accommodate 100% of the general aviation fleet under 12,500 pounds and 75% of large airplanes (less than 60,000#) at 60% useful load.
21. Per FAA Runway Length Model – length needed to accommodate 75% of large airplanes (less than 60,000#) at 60% useful load.
22. Per FAA Runway Length Model – length needed to accommodate 100 % of large airplanes (less than 60,000#) at 60% useful load; existing length generally adequate for large air tankers, according to USFS.
23. Bravo Parallel Taxiway located within OFZ.

It is expected that a vertical descent component (glideslope) may be added to nonprecision global positioning system (GPS) approaches in the future. Based on current airspace planning criteria, it may be feasible to add vertical guidance along an existing inbound approach course. While this type of enhancement would not generally allow an aircraft to descend to a lower altitude (until a new nonprecision approach can be designed), the addition of a vertical guidance component is thought to provide additional safety benefits by providing a stabilized flight path and constant rate of descent for aircraft rather than the traditional step-down procedures—assuming that adequate terrain clearance can be provided without creating an excessively steep approach path.

The airspace surrounding Troutdale Airport is relatively complex and directly affects instrument approach procedures and capabilities at the airport. The close proximity of PDX also directly affects instrument procedures at Troutdale. Airport users at Troutdale have requested an improved instrument approach procedure to supplement the existing NDB and GPS overlay approach. While surrounding terrain will likely be a major factor in determining potential approach minima, it will not be possible for the FAA to develop a new procedure for Troutdale without also considering potential impacts on other airports, particularly PDX. However, based on the radar coverage available in the local area and the overall physical relationship among airports, it appears that improvements in Troutdale instrument approach procedures could be made without significantly compromising the airspace capacity of PDX.

The airport users have provided comments and concerns which clearly identify the need for an improved instrument approach to Troutdale Airport. Since a traditional ILS is not possible, it is recommended that this issue be re-examined annually by the Port with the FAA. As soon as the new generation of instrument approach options become available, creation of a new approach for Troutdale Airport should be initiated. In recognition of these future opportunities it is recommended that clearances at both ends of the runway be designed for potential instrument approaches, and thus maintain 34 to 1 clearance of objects along the approach slopes.

DETAILED ANALYSIS OF AIRPORT DESIGN STANDARDS

The airport design standards and airspace planning recommended for Troutdale Airport are based on the following assumptions:

1. *Airport design standards are based on Airport Reference Code (ARC: B-II) for visual runways and runways with not lower than ¾ statute mile approach visibility minimums. Runway protection zones (RPZ) based on the approach visibility standard "visual and not lower than 1-mile" for aircraft approach categories A and B (Per FAA Advisory Circular 150/5300-13, change 7).*
2. *FAR Part 77 airspace planning criteria based on "larger than utility runways" with non-precision instrument approaches.*
3. *All references to the "standards" are based on these approach visibility assumptions, unless otherwise noted.*

4. *Existing clearances and setbacks that exceed ADG II will be retained unless otherwise noted.*

RUNWAY SAFETY AREA (RSA)

The FAA defines runway safety area (RSA) as "A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway." Runway safety areas are most commonly used by aircraft that inadvertently leave (or miss) the runway during landing or takeoff.

By FAA design standard, the RSA *"shall be:*

(1) cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations;

(2) drained by grading or storm sewers to prevent water accumulation;

(3) capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft; and

(4) free of objects, except for objects that need to be located in the runway safety area because of their function. Objects higher than 3 inches above grade should be constructed on low impact resistant supports (frangible mounted structures) of the lowest practical height with the frangible point no higher than 3 inches. Other objects such as manholes, should be constructed at grade. In no case should their height exceed 3 inches."

The recommended transverse grade for the lateral RSA ranges between 1½ and 5 percent from runway shoulder edges. The recommended longitudinal grade for the first 200 feet of extended RSA beyond the runway end is 0 to 3 percent. The remainder of the RSA must remain below the runway approach surface slope. The maximum negative grade is 5 percent. Limits on longitudinal grade changes are plus or minus 2 percent per 100 feet within the RSA.

The RSA along the sides and beyond the ends of Runway 7/25 has been cleared and graded and meets B-II dimensional standards. The RSA is free of physical obstructions and within grade standards. The paved 400- by 150-foot blast pad located at the end of Runway 25 is located within the extended runway safety area. The 1990 ALP depicts a 300-foot wide RSA that extends 600 feet beyond Runway 7 and 400 feet beyond Runway 25, which is free of obstructions within the dimensional boundary.

All runway edge lighting, threshold lights, and directional signs located within the RSA should be mounted on frangible supports. Any future lighting located within the RSA will also need to meet the FAA frangibility standard. The parallel taxiway exits for Runway 7/25 have aircraft hold lines located outside the RSA. The

RSA should be regularly cleared (grass, brush, etc.) and periodically graded and/or compacted to maintain FAA standards.

RUNWAY OBJECT FREE AREA (OFA)

Runway object free areas (OFA) are two dimensional surfaces intended to be clear of ground objects protruding above the runway safety area edge elevation that could interfere with aircraft flight. The FAA defines the OFA clearing standard:

"The OFA clearing standard requires clearing the OFA of above ground objects protruding above the runway safety area edge elevation. Except where precluded by other clearing standards, it is acceptable to place objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes and to taxi and hold aircraft in the OFA. Objects non-essential for air navigation or aircraft ground maneuvering purposes are not to be placed in the OFA. This includes parked airplanes and agricultural operations."

The Runway 7/25 OFA meets the ADG II dimensional standards and is free of physical obstructions. The 1990 ALP depicts an 800-foot wide OFA that extends 1,000 feet beyond Runway 7 and 400 feet beyond Runway 25; portions of the outer boundary of the larger OFA are irregular due to the location of adjacent roads.

OBSTACLE FREE ZONE (OFZ)

The OFZ is a plane of clear airspace extending upward to a height of 150 feet above runway elevation, which coincides with the FAR Part 77 horizontal surface elevation. The FAA defines the following clearing standard for the OFZ:

"The OFZ clearing standard precludes taxiing and parked airplanes and object penetrations, except for frangible visual NAVAIDs that need to located in the OFZ because of their function."

The OFZ may include the Runway OFZ, the Inner-approach OFZ (for runways with approach lighting systems), and the Inner-transitional OFZ (for runways with lower than ¾-statute mile approach visibility minimums. For Troutdale Airport, only the Runway OFZ is required based on runway configuration and instrument approach capabilities. The FAA defines the Runway OFZ as:

"The runway OFZ is a defined volume of airspace centered above the runway centerline. The runway OFZ is the airspace above a surface whose elevation at any point is the same as the elevation of the nearest point on the runway centerline. The runway OFZ extends 200 feet beyond each end of the runway."

The FAA recommended OFZ width for Runway 7/25 is 400 feet based on runways serving large airplanes. Runway lights, VASI, REILS, and directional signage, which have locations fixed by function, must meet the FAA frangibility[7] standard.

The south parallel taxiway (Bravo) is located 200 feet from runway centerline, which places the inner half of the taxiway and taxiing aircraft within the OFZ. The aircraft hold lines located on Bravo exit taxiways are located 160 feet from runway centerline, which is also within the OFZ. The aircraft hold lines on most of the Alpha exit taxiways are located 200 feet from runway centerline, which places holding aircraft outside the OFZ.

RUNWAY PROTECTION ZONES (RPZ)

The FAA provides the following definition for runway protection zones (RPZ):

"The RPZ's function is to enhance the protection of people and property on the ground. This is achieved through airport owner control over RPZs. Such control includes clearing RPZ areas (and maintaining them clear) of incompatible objects and activities. Control is preferably exercised through the acquisition of property interest in the RPZ. The RPZ is trapezoidal in shape and centered about the extended runway centerline. The RPZ begins 200 feet beyond the end of the area useable for takeoff or landing."

The standard RPZ dimensions for runways used by Category A & B aircraft with visual and not lower than 1-mile approach visibility minimums is 500 feet (inner width) by 700 feet (outer width) by 1,000 feet long.

The 1990 ALP depicts the Runway 25 RPZ based on A&B dimension, although the dimensions of the Runway 7 RPZ is 500 feet by 1,010 by 1,700 which is consistent with Category C & D aircraft with visual and not lower than 1-mile approach visibility minimums. The RPZ dimensions for Runway 7 appear to be reflected in the property boundaries west of NE Marine Drive and NE Sundial; retaining the existing RPZ will protect the runway from incompatible land uses. The avigation easement beyond the east side of the Sandy River provides clearances for a distance of up to 1,700 feet from the runway 25 end, which indicates some availability of a Category C & D RPZ for that end as well. As noted earlier, retaining larger clearances at Troutdale is recommended where possible to preserve existing large aircraft capabilities with an additional margin of safety.

RPZs containing buildings, roadways, or other items do not fully comply with FAA standards. A review of recent aerial photography for Troutdale Airport identified portions of NE Marine Drive and NE Sundial Road

[7] A "frangible" object is one which "retains its structural integrity and stiffness up to a designated maximum load, but on impact from a greater load, breaks, distorts, or yields in such a manner as to present the minimum hazard to aircraft." AC 150/5300, p. 2.

within the RPZ for Runway 7. A section of NE Graham Road, a levee, and a pedestrian walking path along the west bank of the Sandy River, crosses through the Runway 25 RPZ. It is recognized that realigning major surface roads located within the RPZs may not be highly feasible. However, where possible, the Port should discourage development or activities within the RPZs that are inconsistent with FAA standards. Eliminating public access to the raised portion of the levee located within the Runway 25 RPZ should be considered.

RUNWAY-PARALLEL TAXIWAY SEPARATION

The north parallel taxiway (Alpha) is located 275 feet from runway centerline and exceeds the B-II design standard of 240 feet. The 275 feet separation is from the 1940's Civil Aeronautics Administration (CAA) required runway-taxiway separation for Class III airports. The south parallel taxiway (Bravo) is located 200 feet from runway centerline and does not meet the B-II design standard of 240 feet. As noted earlier, Taxiway Bravo is used by large air tanker aircraft due to the limited wingtip clearance available on Taxiway Alpha compared to Bravo. Retaining adequate clearances in future taxiway configurations is a critical factor in accommodating air tanker aircraft at the airport. However, it is proposed that wingtip clearance for the fire tankers (and potentially larger business class aircraft that may occasionally use the airport in the future) be provided on only one of the parallel taxiways, as a practical matter, to maximize available airport space for the smaller more numerous other aircraft users.

TAXIWAY SAFETY AREA

Both parallel taxiways for Runway 7/25 are 50 feet wide with 10 foot shoulders, which requires only an additional 4.5 feet on either side of the taxiway to meet the ADG II 79-foot standard. The safety areas for Alpha and Bravo taxiways appear to be free of obstructions and meet the ADG II safety area dimensional standard. Adjacent aircraft parking areas, frontage roads, and hangars are located outside the taxiway safety area. However, the runway separation for the Bravo parallel taxiway does not meet B-II standards; relocating the taxiway to meet B-II standards may also require relocation of aircraft parking spaces or hangars located within the future taxiway safety area. The taxiway safety areas should be regularly cleared and periodically graded and/or compacted to maintain FAA standards.

TAXIWAY OBJECT FREE AREA

The object free area for north parallel taxiway (Alpha) does not meet the ADG II standard with the north aircraft parking line (APL) located 39.5 feet from taxiway centerline which coincides with the taxiway safety area instead of the Taxiway Object Free Area (TOFA). This modification to standard was approved by the FAA in order to allow aircraft maneuvering space on the hangar complex (north) ramp. The south parallel taxiway (Bravo) does not meet the ADG II taxiway OFA standard; the south aircraft parking line (APL) is located 50 feet from taxiway centerline. Aircraft hold lines should be located on all taxilanes or taxiways that connect to the parallel taxiways to protect the taxiway OFA (minimum of 65.5 feet from taxiway centerline). As with the taxiway safety area noted previously, the potential relocation of parallel taxiway Bravo to meet ADG II runway separation standards will bring several existing buildings into the taxiway OFA which would require them also to be relocated. Since relocation of buildings is a costly proposition, it will be important to clearly consider the various options for continuing support of the Forest Service use.

It is noted that the large air tanker aircraft are required to use Taxiway Bravo for ground movement because of inadequate wingtip clearance (to parked aircraft) on Taxiway Alpha. If Taxiway Bravo is relocated to address runway clearance requirements, it will be important to maintain sufficient clearance for large wingspan aircraft taxiing on the relocated Bravo by exceeding ADG II standards.

BUILDING RESTRICTION LINE (BRL)

A building restriction line (BRL) identifies the areas on an airport that are suitable for construction of buildings. Most commonly the BRL shows the distance from the runway beyond which a building of a given height must be placed in order to not become an obstruction to the Part77 airspace requirements. In other cases the BRL shows the distance required from a taxiway, navigational device, or other airport item. The 1990 Airport Layout Plan (ALP) depicts 400-foot (from runway centerline) building restriction lines (BRL) on both sides of Runway 7/25. This dimension meets the B-II requirements, based on standard taxiway clearances, and will accommodate a structure with a roof height of approximately 21 feet. Structures with higher roof elevations should be located further from the runway to prevent penetrations to the runway transitional surface. Any existing structures that penetrate the transitional surfaces should be marked by obstruction lights. At present there are no known penetrations of this surface.

The 1990 ALP depicts four buildings on the south side of the runway that are inside partially or completely inside the 400-foot BRL (three T-hangars; the former Premier Aircraft Engine building; and a pump house). Two hangars located on the north side of the runway are partially inside the 400-foot BRL. However, none of these buildings were identified as obstructions to airspace surfaces on the 1985 Airport Obstruction Chart survey. The heights of the buildings located within the BRL should be reviewed to verify potential obstruction and lighting requirements. The BRL on the plan created by the present study will identify what the controlling factor which governs -- such as building height -- so that it's significance can be fully understood and used during the next 10 to 20 years of development.

AIRCRAFT PARKING LINE (APL)

The aircraft parking line (APL) identifies the areas on an airport that are suitable for construction of aircraft parking areas. Most commonly the APL shows the distance from the runway beyond which an aircraft can be parked, per FAA standards of Tables 2-1 and 2-2. In other cases the APL shows the distance required from a taxiway, navigational device, or other airport item as identified in Tables 2-3. The 1990 Airport Layout Plan

(ALP) depicts aircraft parking lines (APL) on both sides of Runway 7/25, based on clearances from the adjacent parallel taxiways. The north APL is located 341 feet from runway centerline, which provides 66 feet of clearance between taxiway centerline and parked aircraft. This dimension meets the B-II standard for the existing taxiway. However, any potential upgrade in approach visibility minima or design group would require additional parallel taxiway separation, and therefore would require a relocation of the north APL.

The south APL is located 250 feet from runway centerline, which provides 50 feet of clearance between taxiway centerline and parked aircraft. This dimension does not meet the B-II standard for the existing taxiway clearance nor does it provide adequate obstruction clearance for the runway transitional surface, which begins a 7:1 outward slope 250 feet from runway centerline. In addition, Taxiway Bravo does not meet the standard runway separation. The south APL would need to be located a minimum of 305.5 feet from runway centerline to meet B-II standard.

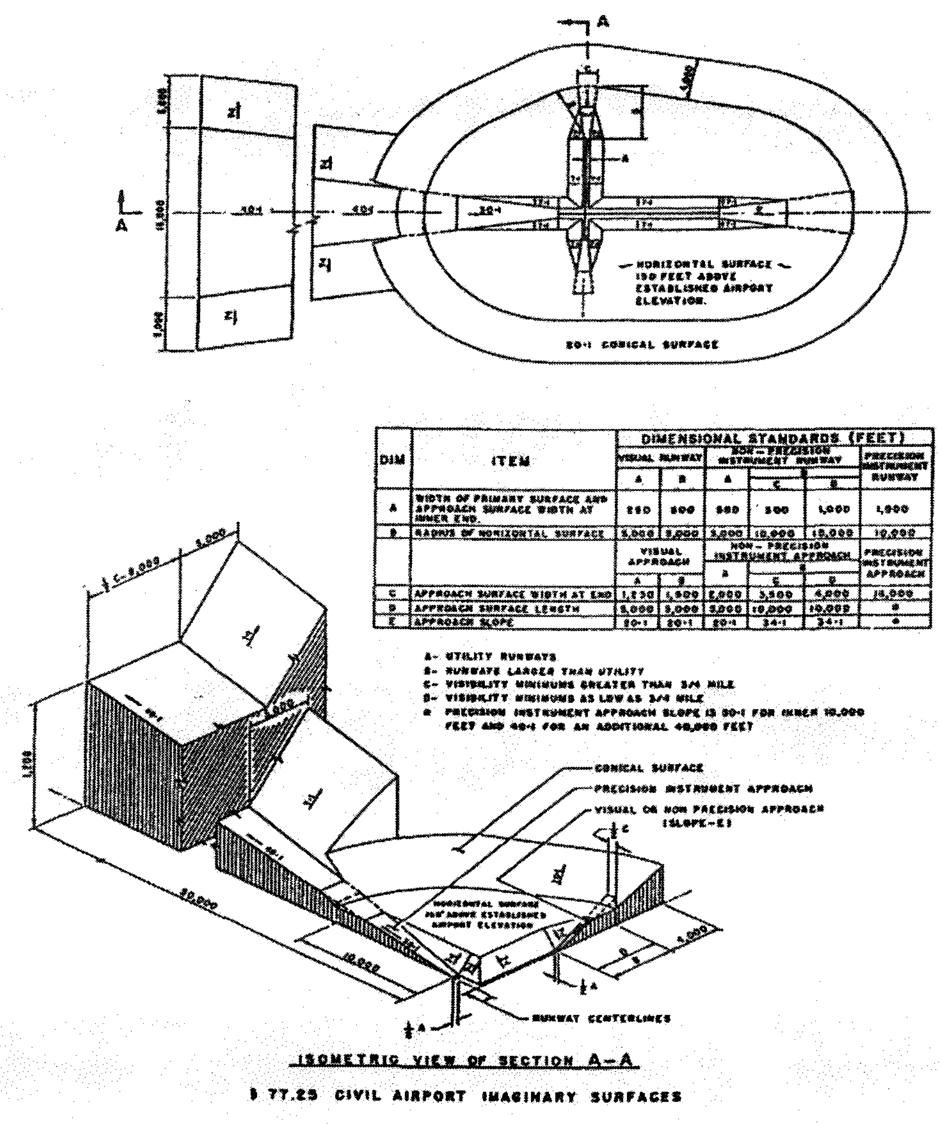
Future aircraft parking areas that may be developed in the vicinity of the runways should be compatible with runway/taxiway design and airspace clearances. The tails of parked aircraft should not penetrate the runway transitional surface. Tail heights of 8 to 10 feet or less are typical of most light aircraft, although business aircraft often have tail heights ranging from 10 to 25 feet. The recommended APL will identify the minimum recommended separations for light aircraft. In addition, specific designated parking areas for larger aircraft will be shown on the ALP which are located such that they provide tail height clearances typical of the larger business class aircraft which may occasionally use Troutdale Airport.

FAR PART 77 SURFACES

Airspace planning for U.S. airports is defined by Federal Air Regulations (FAR) Part 77 – Objects Affecting Navigable Airspace. FAR Part 77 defines imaginary surfaces (airspace) to be protected surrounding airports. **Figure 4-1** on the following page illustrates plan and isometric views of the Part 77 surfaces. The main goal of FAR Part 77 is to set standards to define "obstructions to air navigation." All existing objects which penetrate these surfaces are considered obstructions. Where possible, future buildings, antennas, elevated roadways, and other such objects constructed in the vicinity of an airport, are generally to be located below these surfaces. The Part 77 surfaces are broken down into five components: horizontal surface, conical surface, primary surface, approach surface, and transitional surface. Each are discussed below.

Airspace planning reflects the classification and instrument approach capabilities of each runway end. As noted earlier, Runway 7/25 routinely accommodates aircraft weighing more than 12,500 pounds and has a nonprecision instrument approach with a circle-to-land procedure to the airport environment. The airport Obstruction Chart (OC) attached to the 1990 airport master plan identified the following airspace surfaces for Troutdale Airport (see **Table 4-5**) and serves as the airport's primary reference for existing airspace planning.

FIGURE 4-1: Part 77 Diagram



DIM	ITEM	DIMENSIONAL STANDARDS (FEET)					
		VISUAL RUNWAY		NON-PRECISION INSTRUMENT RUNWAY			PRECISION INSTRUMENT RUNWAY
		A	B	A	B		
					C	D	
A	WIDTH OF PRIMARY SURFACE AND APPROACH SURFACE WIDTH AT INNER END.	250	500	500	500	1,000	1,000
B	RADIUS OF HORIZONTAL SURFACE	5,000	5,000	5,000	10,000	10,000	10,000
		VISUAL APPROACH		NON-PRECISION INSTRUMENT APPROACH			PRECISION INSTRUMENT APPROACH
		A	B	A	B		
					C	D	
C	APPROACH SURFACE WIDTH AT END	1,250	1,500	2,000	3,500	4,000	16,000
D	APPROACH SURFACE LENGTH	5,000	5,000	5,000	10,000	10,000	*
E	APPROACH SLOPE	20:1	20:1	20:1	34:1	34:1	*

A- UTILITY RUNWAYS
B- RUNWAYS LARGER THAN UTILITY
C- VISIBILITY MINIMUMS GREATER THAN 3/4 MILE
D- VISIBILITY MINIMUMS AS LOW AS 3/4 MILE
* PRECISION INSTRUMENT APPROACH SLOPE IS 50:1 FOR INNER 10,000 FEET AND 40:1 FOR AN ADDITIONAL 40,000 FEET

DESIGNED BY: DM	CHECKED BY:	CENTURY WEST ENGINEERING CORPORATION 825 NE Multnomah Suite 425 Portland, Oregon 97232 503-231-6078 phone * 503-231-6482 fax	DATE:
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Table 4-5: FAR Part 77 Airspace Surfaces
(as depicted on 1985 Airport Obstruction Chart)

Item	**Runway 7** *Larger than Utility (Non-Precision)*	**Runway 25** *Larger than Utility (Visual, with Non-Precision Supplemental Surfaces)*
Width of Primary Surface	500 feet	500 feet
Radius of Horizontal Surface	10,000 feet	10,000 feet
Approach Surface Width at End	3,500 feet	1,500 feet
Approach Surface Length	10,000 feet	5,000 feet
Approach Slope	34:1	20:1 w/ supplemental 34:1

Based on the existing and planned runway configuration and utilization, larger than utility – nonprecision airspace surfaces are recommended for Runway 7/25. For airspace planning purposes, approach surfaces consistent with future straight-in instrument approaches (larger than utility runways, visibility minimums greater than ¾ mile) should be depicted on the updated airspace plan drawing and protected through airport overlay zoning. The City of Troutdale has provided this zoning, however other jurisdictions in the vicinity have not. The existing obstructions to the Runway 25 approach (road and levee) may make upgrading the approach surface from visual to nonprecision difficult without displacement of the runway threshold to provide adequate obstruction clearance. Options of lowering the elevation of the road and levee (or removable barrier within the approach) are also potentially available options. Alternatively these obstructions (the levee is lighted) may be found acceptable since this close in portion of the approach is always accomplished under visual conditions.

Instrument approach visibility minimums cannot generally be reduced below 1-mile without the addition of an approach lighting system. A reduction in approach visibility minimums to ¾ mile would require a widening of the runway primary surface to 1,000 feet, which would significantly reduce the airport's developable land area along the runway. The addition of a medium intensity approach light (MALS) or omni directional approach lighting system (ODALS) may allow the current 1 ¼ to 3 mile approach visibility minima to be reduced to as low as 1 mile before triggering the significantly increased development setbacks associated with more precise approaches. **Table 4-6** summarizes the standard airspace dimensions recommended for Troutdale Airport.

Table 4-6: FAR Part 77 Airspace Surfaces
(Recommended to be depicted on 2002 Airspace Plan)

Item	**Runway 7/25** *Larger than Utility* *(Non-Precision)*
FAR Part 77 Designation	C(NP)[1]
Width of Primary Surface	500 feet
Radius of Horizontal Surface	10,000 feet
Approach Surface Width at End	3,500 feet
Approach Surface Length	10,000 feet
Approach Slope	34:1

1. Larger than utility runways; visibility minimums greater than ¾ mile.

HORIZONTAL SURFACE

The horizontal surface is a flat plane of airspace located 150 feet above runway elevation with its boundaries defined by either a 5,000 or 10,000 foot radii (depending on whether visual or instrument approaches exist) that extend from each runway end. It is intended to provide a generally clear area in the vicinity of the airport, to provide a basic safety for aircraft as long as they remain at least 150 feet above the runway elevation. The outer points of the radii for each runway are connected to form an oval, which is defined as the horizontal surface. For Troutdale Airport, the outer boundary of the horizontal surface is based on 10,000 foot radii, which is the standard for larger than utility runways.

Large areas of terrain penetration are located within southern half of the horizontal surface (above elevation 189' feet mean sea level) for Troutdale Airport. Most of the terrain located in this area is forested and an additional 80 feet is added to represent the approximate elevations of the mature trees. The north section of the horizontal surface has numerous towers and smoke stacks identified in the area between the runway and the Columbia River; the OC indicates that these obstructions are lighted.

CONICAL SURFACE

The conical surface is an outer band of airspace, which abuts the horizontal surface. It extends the horizontal surface for additional safety, while letting the safe height increase as distance from the airport increases. The conical surface begins at the elevation of the horizontal surface and extends outward 4,000 feet at a slope of 20:1. The top elevation of the conical surface is 200 feet above the horizontal surface and 350 feet above airport elevation. Large areas of terrain/trees penetrate the conical surface south of the airport at elevations above 189-389 feet msl.

APPROACH SURFACES

Runway approach surfaces provide lower protected airspace, free of obstructions, along the path which aircraft follow when approaching or departing the runway. The approach surfaces extend outward and upward from each end of the primary surface, along the extended runway centerline. As noted earlier, the dimensions and slope of approach surfaces are determined by the type of aircraft intended to use the runway and most demanding approach existing or planned for the runway.

The OC identifies several obstructions (primarily trees) to the approach surfaces for Runways 7 and 25. The Port recently removed several trees located in the runway approach surface of Runway 25. The trees depicted on the OC will be compared with the Port's recent obstruction surveying and removal plan to determine whether any of the previously identified obstructions remain.

The levee located near the east end of the runway is depicted on the OC as an obstruction to the supplemental (34:1) approach surface. The levee is marked with several obstruction lights and does not penetrate the 20:1 approach surface. The obstruction lights have an elevation of 49 feet listed on the OC. NE Graham Road crosses the Runway 25 approach surface approximately 450 feet from the end of the runway (250 feet into the approach surface) and has an elevation of 53 feet listed (including a 15-foot vehicle height). Vehicles traveling on the roadway penetrate both the 20:1 approach surface (+2.5 feet above runway end elevation) and 34:1 approach surface (+7.6 feet above runway end elevation). The 1990 ALP contains a note "Road penetrates approach surface, but does not require a displaced threshold." The ALP indicates that the unobstructed approach slope for Runway 25 is 14:1. It is not immediately evident why a displaced threshold was not required to address the vehicle obstruction. The OC also identifies an area of tree penetration (106 feet msl) approximately 2,000 feet from the end of Runway 25 that penetrates the supplemental 34:1 approach surface. The 1990 ALP indicates that unobstructed approach surface for Runway 7 is 50:1, although two trees (104 and 112 feet msl) were identified on the 1985 OC, which will also be compared with more recent Port obstruction surveying and removal plans.

PRIMARY SURFACE

The primary surface is a rectangular plane of airspace, which rests on the runway (at centerline elevation) and extends 200 feet beyond the runway end. One might think of the primary surface as if it were a large open grassy area, with the runway down its centerline. The primary surface should be free of any penetrations, except items with locations fixed by function (i.e., VASI, runway or taxiway edge lights, etc.). The primary surface end connects to the inner portion of the runway approach surface.

The primary surface for Runway 7/25 is based on the existing larger than utility runway designation and the nonprecision instrument approach capabilities. The primary surface is level and free of obstructions.

TRANSITIONAL SURFACE

The transitional surface is located along the sides of the primary surface, represented by a plane of airspace that rises perpendicularly at a slope of 7 to 1, until reaching an elevation 150 feet above runway elevation. It provides safe, obstruction-free airspace between the primary surface (at runway elevation) at a low angle up to the horizontal surface (150 feet above the runway elevation). This surface should be free of obstructions (i.e., parked aircraft, structures, trees, etc.).

The OC identifies several penetrations to the transitional surface on both sides of Runway 7/25. Noted obstructions on the north side of the runway include antennae mounted on buildings, airport beacon mounted on the control tower, hangars, and trees. The noted obstructions on the south side include several trees, a pole, and antennae mounted on a building. As noted earlier, the Port has removed several trees since the OC was last updated; data from the Port's obstruction surveying and removal plan will be compared to the OC.

As noted earlier, the south aircraft parking line (APL) is located 250 feet from runway centerline, which would result in any aircraft parked along the APL penetrating the transitional surface. The south APL should be relocated to provide adequate clearance of aircraft tail heights beneath the transitional surface.

AIRSIDE REQUIREMENTS

Airside facilities are those directly related to the arrival and departure and movement of aircraft:

- **Runway**
- **Taxiways**
- **Airfield Instrumentation and Lighting**

RUNWAY

The adequacy of the existing runway system at Troutdale Airport was analyzed from a number of perspectives including runway orientation, airfield capacity, runway length, and pavement strength.

Runway Orientation

The orientation of runways for takeoff and landing operations is primarily a function of wind velocity and direction, combined with the ability of aircraft to operate under adverse wind conditions. When landing and taking off, aircraft are able to maneuver on a runway as long as the wind component perpendicular to the aircraft's direction of travel (defined as crosswind) is not excessive. For runway planning and design, a crosswind component is considered excessive at 12 miles per hour for smaller aircraft (gross takeoff weight

12,500 pounds or less) and 15 miles per hour for larger aircraft. As the crosswind angle narrows, an aircraft can tolerate increasingly higher wind speeds. When winds are closely aligned with a runway, aircraft can take off or land in very high wind conditions. A detailed description of typical wind conditions at Troutdale Airport is provided in Chapter 1, in the Climate discussion section. A copy of the wind rose will be placed on the ALP airport drawing.

The runway (7/25) at Troutdale Airport is oriented in an east-west direction and is generally in line with prevailing winds. FAA planning standards indicate that an airport should be planned with the capability to operate under allowable wind conditions at least 95 percent of the time. The 1990 Airport Layout Plan includes a wind rose that indicates 97.9 percent coverage (all weather) at 12 miles per hour. Coverage at 15 miles per hour is approximately 99 percent. Based on existing crosswind coverage, Runway 7/25 meets the FAA standard for wind coverage.

Runway Length

Runway 7/25 has a published length of 5,399 feet (U.S. Government Airport/Facility Directory). Runway length requirements are based primarily upon airport elevation, mean maximum daily temperature of the hottest month, runway gradient, and the critical aircraft type expected to use the runway.

The 1990 master plan indicated that the existing runway length was adequate to accommodate the range of general aviation, business aviation, military and fire related aircraft activity forecast to use the airport. The airport layout plan lists declared distances (reduced) for Runway 7 of 5,220 feet for landing distance available and accelerated stop distances. It appears that the declared distances may be specific to large aircraft because both the existing runway safety area and object free area located beyond the end of Runway 25 meet B-II design standards. The use of reduced declared distances is not necessary to meet B-II design standards on Runway 7/25.

Based on local conditions and the methodology outlined in **AC 150/5325-4A**, the FAA-recommended runway lengths are defined for the large and small aircraft fleet. A summary of FAA-recommended runway lengths for a variety of aircraft types and load configurations is presented in **Table 4-7**. The runway length requirements for several business aircraft are also included for comparison.

As noted in **Table 4-7**, the existing runway length is adequate to accommodate 100 percent of small aircraft (under 12,500 pounds) and a high percentage of large aircraft at moderate useful loads. According to the USFS, the air tankers that regularly operate at Troutdale Airport are not generally limited by existing runway length. Most of these aircraft operate well below their maximum certified gross takeoff weights with "contracted weights" based on typical fuel and load requirements associated with the mission.

Table 4-7: FAA-Recommended Runway Lengths (From FAA Computer Model)

Runway Length Parameters for Troutdale Airport

- *Airport Elevation: 39 feet MSL*
- *Mean Max Temperature in Hottest Month: 82 F*
- *Maximum Difference in Runway Centerline Elevation: 11 feet*
- *Existing Runway Length: 5,399 feet*

Small Airplanes with less than 10 seats	
75 percent of these airplanes	*2,430 feet*
95 percent of these airplanes	*2,990 feet*
100 percent of these airplanes	*3,540 feet*
Small airplanes with 10 or more seats	*4,130 feet*
Large Airplanes of 60,000 pounds or less	
75 percent of these airplanes at 60 percent useful load	*5,290 feet*
75 percent of these airplanes at 90 percent useful load	*7,000 feet*
100 percent of these airplanes at 60 percent useful load	*5,500 feet*
100 percent of these airplanes at 90 percent useful load	*7,710 feet*
Airplanes of more than 60,000 pounds	*5,030 feet*
Selected Business Aircraft Types	
Beechcraft King Air B200	*3,600 feet*
Cessna Citation II (6-9 passengers; 2 crew. MGTW 14,100#)	*4,580 feet*[1]
Cessna Citation Excel (7-8 passengers; 2 crew. MGTW 20,000#)	*4,060 feet*[1]
Cessna Citation Sovereign (9-12 passengers; 2 crew. MGTW 30,000#)	*4,202 feet*[1]
Cessna Citation X (8-12 passengers; 2 crew. MGTW 36,100#)	*5,480 feet*[1]
Learjet 45 (9 passengers; 2 crew. MGTW 20,500#)	*4,350 feet*[2]
Bombardier Challenger 300 (8-15 passengers; 2 crew. MGTW 37,500#)	*4,950 feet*[2]
Gulfstream 300 (11-14 passengers; 2 crew. MGTW 72,000#)	*5,100 feet*[2]

1. *Maximum gross takeoff weight, FAR Part 25 Takeoff (distance to clear 35 feet above runway), zero wind, sea level 86 degrees F; Sovereign runway length based on 99 degrees F.*
2. *Gulfstream, Lear, and Challenger based on maximum gross takeoff weight, FAR Part 25 Takeoff (distance to clear 35 feet above runway), zero wind, sea level, ISA. Higher temperatures require additional runway length or reduction in takeoff weight.*

A review of business jet runway requirements indicates that the existing runway length and low field elevation allow the majority of small, medium and larger business jets to operate at or near maximum gross weight in most conditions. Aircraft runway length requirements increase significantly when outside air temperatures increase. Conversely, an increase in wind, lower air temperature, reduced operating weight of the aircraft, or a combination of these factors can significantly reduce the runway length requirements for any aircraft.

Runway Capacity

In the late 1970's the airport records indicate that as many as 178,637 operations in one year have occurred. The existing runway capacity was estimated in the 1990 ALP Plan to be approximately 120,000 annual operations (page 57), and with the additional exit taxiways to allow aircraft to leave the runway more quickly, a runway capacity of 125,000 to 150,000, without significant delays. During the intervening years since 1990 one additional high speed exit taxiway has been added to the airport. Thus, given maximum forecast operations numbers of 98,889 for the preferred forecast, and 149,850 under the "dynamic forecast", the runway will have adequate capacity within the 20-year planning period.

Runway Width

The width of Runway 7/25 is 150 feet, which exceeds both the ADG II and III standard (for aircraft less than 150,000 pounds). This width was established in the 1940's to meet the CAA criteria for Class III airports (see Appendix D-2) which were expected to accommodate aircraft such as the DC-6 and the Constellation. The 1990 master plan recommended reducing runway width to 100 feet, which is standard for ADG III. The B-II standard for runway width is 75 feet. A reduction of runway width to 100 feet would meet the B-III standards and accommodate the majority of air tanker aircraft. However, coordination with the USFS is recommended to ensure that any proposed runway changes are compatible with air tanker operations. If retaining existing runway width is deemed essential to current flight operations, the Port and USFS may need to identify potential funding sources to supplement FAA funds, which may be limited to a 75 or 100-foot width. This issue will need to be resolved by the time the next runway rehabilitation project is to be accomplished. An important companion issue to runway width is the location of runway lights. If the runway width is reduced, this will require removal of the old lighting system, and installation of new lights at the edge of the reduced width runway.

AIRFIELD PAVEMENT

The existing condition of airfield pavements was summarized in the inventory chapter. The airfield pavements will require regular maintenance and repair as they age (including areas of crack sealing, slurry seal, fog seal, and deep asphalt concrete patching). Based on the age of most existing pavement sections, rehabilitation projects will be needed within the current twenty year planning period. Taxiway Alpha and the north apron were rehabilitated in 1992 with a 2-inch asphalt overlay. The Port's pavement maintenance program prioritizes projects at each of their airports based on pavement condition ratings. The projects are undertaken as funds become available. For long-term capital improvement programming, the Port's 5-year maintenance program will be reflected in the master plan Chapter 7 Financial Management and Development Program, with all remaining airfield pavements shown for rehabilitation later in the planning period.

The current Airport/Facility Directory, published by NOAA, lists the pavement strength of Runway 7/25 at 19,000 lbs. (single wheel landing gear design). As noted earlier, the newer (western) section of the runway has a rating of 30,000 pounds single wheel. Increasing pavement strength to 30,000 pounds single wheel is recommended for the runway and the parallel taxiway system.

Timely maintenance of airfield pavements will extend their service life and therefore reduce the life cycle costs for the airport. Standard life-cycle pavement maintenance and rehabilitation items are listed in **Table 4-8.** Actual results will vary depending on local weather conditions, pavement design and the type and volume of traffic.

Table 4-8: Airfield Pavement Maintenance Schedules

Pavement Maintenance	Approximate Life Expectancy
Pavement Overlays	15 to 20 years
Slurry Seal or Fog Seal	5 to 8 years
Crackfilling	2 to 3 years

TAXIWAYS

Taxiways are constructed primarily to facilitate aircraft movement to and from the runway system. Some taxiways are necessary simply to provide access between airside and landside facilities, while other taxiways become necessary as activity increases and more efficient use of the airfield is needed. Runway 7/25 is served by two full-length parallel taxiways, each with numerous exit taxiways. Aside from the runway separation deficiency previously identified for Taxiway Bravo, the parallel taxiway system, particularly the number and location of exit taxiways, is excellent. The 1990 airport layout plan recommended the addition of three high speed angled exit taxiways (at A4, A6, and B6). Taxiway A3 was reconstructed as a high speed taxiway as part of the rehabilitation of the Alpha parallel taxiway in 1992 and is currently the only high speed exit taxiway available. Converting one or more additional 90-degree angle exit taxiways to high speed exits would be recommended if increased air traffic activity created significant delays for operating aircraft.

Aircraft run-up areas are located on parallel taxiway Alpha at the east end of the runway and on parallel taxiway Bravo at the west end of the runway. Local pilots and controllers have indicated that aircraft holding areas are needed on both parallel taxiways at both ends of the runway. The Port is currently in the process of reconfiguring the aircraft holding area adjacent to Runway 25 threshold on parallel taxiway Alpha. Approximately 50 feet of the inner portion of the paved holding area is being remarked as closed due to the need to meet FAA runway clearance requirements. The reconfiguration reduces the total area available for aircraft holding and may constrain aircraft movement along the portion of the parallel taxiway leading to the FBO located at the east end of the taxiway.

Additional taxiways may be required to serve new or expanded landside development areas on the airport. ADG II design standards would be recommended to serve most general aviation or business aviation facilities. Taxiways or taxilanes intended to serve smaller aircraft located in T-hangars would be based on ADG I standards unless larger aircraft taxiing also needed to be accommodated.

The parallel taxiways meet the ADG III standard for width (50 feet). The larger air tanker aircraft are currently limited to using Taxiway Bravo due to inadequate wingtip clearance from parked aircraft on Taxiway Alpha. Retaining the existing 50-foot width should be considered as part of the relocation of Taxiway Bravo to meet runway separation standards. Taxiway Alpha could be reduced to the ADG II standard (35 feet) based on current aircraft use, although the cost of replacing or reconfiguring the taxiway edge lighting should be factored into the decision.

Hold lines for taxiway Bravo are unable to be provided at the correct distance from the runway, since the runway-taxiway separation distance is less than required. This problem is complicated by the fact that the sign identifying the location of the hold line must be outside of the taxiway safety area.

AIRFIELD INSTRUMENTATION AND LIGHTING

Runway 7/25 has medium-intensity runway edge lighting (MIRL), the standard for general aviation runways. The runway lights appear to be in good condition. However, if the runway width is narrowed from the current 150 feet, it would be necessary to relocate the edge lights. Depending on the age and condition of the lights at that time, it may be necessary to replace the light system.

Runways 7 and 25 are equipped with visual approach slope indicators (VASI). These are owned and maintained by the FAA, not the Port of Portland. VASIs provide visual guidance to pilots by projecting colored light beams outward and upward along the approach path for a runway. Pilots are able to adjust their approach path upward or downward based on the visual cues provided by the VASI. Precision Approach Path Indicators (PAPI) are now the standard for visual guidance systems. The existing VASIs will in all likelihood be replaced by the FAA at the end of their useful life with PAPIs. The useful life of an outdoor electrical component can vary greatly, although twenty years is a reasonable planning estimate. However, unless the system begins to experience reliability problems, or becomes too costly to maintain (replacement parts, bulbs, etc.) it is likely to continue functioning well into the current planning period.

The runway is also equipped with runway end identifier lights (REIL). REILs consist of two sequenced strobes that provide rapid and positive identification of the approach end of the runway. REILs improve utilization of the runway during nighttime and poor visibility condition and are generally recommended for instrument runways without approach lights.

Runway 7/25 is not equipped with an approach light system. Adding an approach light system, in conjunction with future improved instrument approaches to a particular runway, can in some cases benefit approach minimums. The omni-directional approach light system (ODALS) is often used when space limitations or cost prevents installation of other systems such as a medium intensity approach light system (MALS). The ODALS typically consist of five single fixtures located along the extended runway centerline that extend to a distance of approximately 1,500 feet (compared to 2,400 to 3,000 feet for a MALSR). An ODALS could be installed on Runway 7 within current airport property. Typically, approach light systems are installed and maintained by the FAA, not the airport owner.

The parallel taxiway system has medium intensity taxiway edge lighting (MITL). Other taxiways may be equipped with MITL or reflective edge markers. As with the runway edge lighting, any narrowing of existing taxiways (or the relocation/replacement of Taxiway Bravo) may require replacement of the edge lights.

The lighted airfield directional and informational signs appear to meet current FAA standards.

The aircraft apron and hangar areas have limited overhead flood lighting, including several fixtures mounted on various buildings. The aircraft fueling area also has flood lighting. Flood lighting is recommended for all new operations areas to maintain safety and security.

ON-FIELD WEATHER

The airport has an automated surface observing system (ASOS) located on the field. The ASOS satisfies weather observation requirements for general aviation and commercial operations (i.e. charter flights, medevac, etc.).

LANDSIDE FACILITIES

The purpose of this section is to determine the space requirements during the planning period for the following types of facilities associated with general aviation operations areas at the Troutdale Airport:

- **Hangars**
- **Aircraft Parking and Tiedown Apron**
- **Fixed Base Operator (FBO) and Specialty Aircraft Service Operation (SASO) Facilities**
- **Forest Service Aircraft Facilities**
- **Surface Access, Vehicle Parking, Utilities**
- **Aviation Fuel Storage**
- **Security**

HANGARS

Troutdale Airport currently has twenty hangar buildings containing approximately 300,000 square feet of space. Approximately two-thirds of this space is used for aircraft storage, with the other third used for aircraft FBO maintenance services. It is estimated that 85 percent of based aircraft at Troutdale are stored in hangars[8], with the remainder stored outside on one of the tiedown aprons.

The hangar space dedicated to aircraft storage consists of 154 T-hangar spaces in 15 buildings (approximately 185,000 total square feet) plus space for approximately 11 additional aircraft[9] in 16,900 square feet in conventional hangar space (east half of Hangar 1 -- Building 1260 N Service Rd.). The remaining 98,450 square feet of conventional hangar spaces are primarily used for maintenance (FBO and SASO), with approximately 17,000 square feet of this area currently vacant. Building areas are as follows:

- 1610-20 N Service Rd - 9,600 sf,
- 1500-10 N Service Rd - 7,700 sf,
- 1260 N Service Rd - 16,900 sf,
- 1230 N Service Rd - 23,100 sf,
- 1020 N Service Rd - 9,450 sf,
- 520 N Service Rd - 3,900 sf)
- 1123 NW Graham Rd - 17,000 sf,
- 1023 NW Graham Rd - 3,600 sf ,
- 911 NW Graham Rd - 7,200 sf,

[8] An on-site inspection of the airport on February 26, 2002 counted 42 aircraft on the various aircraft aprons (though some of these may have been itinerant and some may have been out from hangars). Based on ownership and rental lists, it has been determined that a total of 193 aircraft were based at the airport in June of 2002.

[9] Number is based on 1,500 square feet per aircraft in a conventional hangar.

Hangar development must keep pace with the increase in based aircraft. It is assumed that the current percentage relationship of aircraft stored in hangars vs. outdoor tie-downs will be maintained during the planning period. A planning standard of 1,500 square feet per based aircraft stored in hangars was used to estimate gross area requirements, although individual needs may vary. As indicated in the aviation activity forecasts, the number of based aircraft at Troutdale is projected to increase by 84 aircraft (from 193 to 277) during the twenty-year planning period. If 85% of these aircraft are to be stored in hangars, there will be a need for approximately 100,000 square feet of new storage hangar space.

The data in **Table 4-8** suggests that one more 12-unit T-hangar building will be required during the next year. Since there are no vacancies in the existing T-hangars on the airport, the need for more new hangars is self-evident. Over the remainder of the twenty-year period an additional five more 12-unit T-hangar buildings would be expected. At Aurora Airport the construction of approximately 60' by 60' conventional hangars as a means of storage for two to three aircraft has proved to be very popular. This size hangar allows for flexibility in storing twins and/or small jet aircraft, with some availability of associated office or storage space and even toilet facilities. It is recommended that building sites be provided for additional hangars of both the T-hangar and small conventional types.

It is possible that growth in based aircraft could exceed current projections, through high success of development on nearby properties. For this reason, it is recommended that hangar development reserves be established to accommodate potential demand beyond the projected needs. The addition of competitively priced hangar space can significantly alter the development picture of an airport. Because existing market conditions and near-term potential generally drive private hangar investment, it is difficult to predict the depth or sustainability of current development trends. At this point, we recommend that most of the remaining developable portions of the airport be reserved for aviation related uses. The efficient utilization of airport lands will be particularly important as the airport approaches its landside capacity. The location, size, and configuration of the hangar development reserves will be addressed in the alternatives analyses (see Chapter Five).

AIRCRAFT PARKING AND TIEDOWN APRON

It is estimated that 15 percent of locally based aircraft at Troutdale are currently parked in tiedown positions. This percentage is expected to remain relatively steady during the planning period. The airport currently has 161 aircraft tiedown positions in all of the available parking aprons. On average, 29 of these are being used for based aircraft and up to 30 of these are being used for itinerant aircraft on a busy day. As noted in **Table 4-8**, it is estimated that locally based aircraft will require 42 tiedown spaces by the end of the planning period.

FAA **Advisory Circular 150/5300-13** suggests a methodology by which itinerant parking requirements can be determined from knowledge of busy-day operations. At Troutdale Municipal Airport, the number of itinerant spaces was determined to be approximately 40 percent of busy day itinerant operations. The FAA planning criterion of 360 square yards (3,240 square feet) per itinerant aircraft was applied to the number itinerant spaces to determine future itinerant ramp requirements. Locally based aircraft tiedowns are planned at 300 square yards (2,700 square feet) per position. By the end of the twenty-year planning period, itinerant parking requirements are estimated to include 41 light aircraft tiedowns and 4 business aircraft (twin-engine drive through parking) positions.

Based on the forecasts and estimates of aircraft storage needs, the current quantity of aircraft parking (tiedowns) will be adequate to meet demand for local and itinerant parking through the planning period. It is noted that the airside required correction of distance between the south Bravo taxiway and runway, will likely result in the loss of some existing tiedowns in the north aprons. Likewise, changes in the configuration of the existing aircraft north tiedown aprons to accommodate marked business aircraft parking positions will likely result in a slight net loss of light aircraft tiedowns, although it appears that these will not create significant constraints on existing facilities. Finally, it is noted that during periods when PDX is fogged in, the large south terminal apron functions as a parking and transfer area for package delivery "box hauler" aircraft, as well as a parking area for other aircraft unable to reach Portland area airports due to low lying fog. The aircraft parking area requirements are summarized in **Table 3-8.**

FBO AND SASO FACILITIES

A fixed base operator (FBO) is defined by the Port of Portland's Minimum Standards document as an aircraft service and training center that also sells fuel. A specialty aircraft service operator (SASO) is defined by the Port of Portland's Minimum Standards document as an aircraft service or training center that does not sell fuel. There is currently one existing FBO facility and several SASO facilities at Troutdale Airport. The FBO and major SASO's each have adequate space for office, classroom, and hangar operations. FBO and SASO facility requirements are driven primarily by market conditions and the particular needs of the business and its customers. Because future FBO and SASO facility needs are difficult to quantify, and may differ greatly from one operation to another, the best planning approach available is to identify development reserves that could accommodate new or expanded facilities. General areas for expanded operations, maintenance hangar, vehicle parking, and apron should be reserved.

The airport should also be capable of accommodating additional FBO and SASO facilities, should that interest develop. Although it appears unlikely that Troutdale will be able to support more than two FBO's during the current planning period, the airport needs to provide equal access to prospective tenants, without discrimination. The Port of Portland has an airport minimum standards document that establishes the requirements for all airport activities and addresses these types of development issues.

Table 4-8: Apron & Hangar Facility Requirements Summary

Item	Existing Base Year (2002)	2005	2010	2022
Demand				
Based Aircraft	193	204	223	277
Itinerant GA Busy Day Aircraft[1]	29	30	33	41
Existing Facilities				
Light Aircraft Tiedowns (on-airport)	161			
Business Aircraft Parking Spaces	0[2]			
On-Airport Hangar Spaces Dedicated Aircraft Storage (est.) Overall Hangar Area (est.)	165 spaces[3] 200,000 sf[3] 300,000 sf[3]			
Total Apron Area	161 spaces approx 55,000 sy			
Projected Needs				
Itinerant Aircraft Parking (@ 360 sy each + 10%)		30 spaces / 11,880 sy	33 spaces / 13,068 sy	41 spaces / 16,236 sy
Locally-Based Tiedown Needs (@ 300 sy each + 10%)		31 spaces / 10,230 sy	33 spaces / 10,890 sy	42 spaces / 13,860 sy
Business Aircraft Parking[4] (@ 600 sy each)		3 spaces / 1,800 sy	3 spaces / 1,800 sy	4 spaces / 2,400 sy
Total Apron Needs		64 spaces / 23,910 sy	69 spaces / 25,758 sy	87 spaces / 32,496 sy
Gross Hangar Space Requirements[5] (@ 1,250 sf per space)		173 Spaces / 216,250 sf	190 Spaces / 237,500 sf	235 Spaces / 293,750 sf

1. Size transient apron for 50% of "Busy Day" itinerant aircraft, e.g. for 2005 year: # = 50% x 302 operations [Table 3-9 Revised] x 0.5 aircraft per operation x 40% [Itinerant ops vs. Local]. (This method per Thomas Coates, AIP2000 presentation, FAA.)
2. No designated parking spaces exist for larger itinerant aircraft (twin-engine, turboprop, business jet, etc.).
3. Estimate of existing hangar area dedicated for aircraft storage; overall hangar space, including large hangars (maintenance, etc.).
4. Larger business class aircraft parking anticipated due to surrounding industrial park development plans. Allow additional 10% of calculated itinerant spaces.
5. Assumes that 85% of future based aircraft will require hangar space.

FOREST SERVICE AIRCRAFT FACILITIES

The Forest Service aircraft facilities are located at the northeast quadrant of the airport, and are owned by the Forest Service. The Forest Service leases taxiway access to the runway from the Port of Portland. At this time, there are no known additional facilities required for the Forest Service aircraft area. It is noted that fire retardant chemicals are commonly used as part of the Forest Service operations. Environmental concerns with the storage, loading, and/or containment of these chemicals is under the control of the Forest Service, and does not occur on Port of Portland owned portion of the airport.

AGRICULTURAL AIRCRAFT FACILITIES

There are no known agricultural operations occurring at the airport and Troutdale does not have a dedicated agricultural aircraft facility. No agricultural operations are anticipated for Troutdale Airport. However, if agricultural operations were to occur at the airport in the future, a designated AG aircraft parking/loading position with adequate containment would be recommended to reduce site contamination potential. It is noted that most AG operations do not occur at towered airports, so the potential for such development at Troutdale is minimal.

SURFACE ACCESS REQUIREMENTS

Vehicle access to all existing on-airport facilities is provided by the airport access roads, which ring the airport (NW Graham Road, NW Sundial Road, Marine Drive, and N Frontage Road). Access to the airport terminal areas appears to be adequate for the planning period, although ODOT is aware that the 257th/Graham Road intersection with Frontage Road (at the I-5 underpass) may be near capacity at times. However, with the planned development of major industrial properties to the north and west of the airport, and the development community college facilities to the northeast, it is likely that the City of Troutdale will refine or alter these roads[10]. The existing roadways are in good physical condition.

As part of the planning for the major industrial properties to the north and west of the airport, consideration is being given to revising the I-84 exit configuration, to create an interchange further to the west of that that existing today. The intent would be to create more direct access to the north of I-84, without having to go around the airport. Some interest has been expressed in reserving area for a future runway extension at the west end of the airport[11]. Thus, it is desirable to show where a runway extension reserve area would exist, to promote coordinated long term planning for these future I-84 connections.

Approximately 440 vehicle parking spaces are available around the airport in terminal areas for airport users, and these appear to be adequate based on current and future needs. The vehicle parking areas include the following:

- north of Buildings 920 - 1080 on NW Graham Road (with approximately 180 parking spaces),
- north of Building 1500 NW Graham (approximately 30 spaces).
- east of Building 1023 NW Graham Road (10 spaces), and
- south of Administration Building 999 N Frontage Road (with approximately 220 parking spaces).

[10] See "Joint Planning Conference Meeting Minutes", February 28, 2002, Items 5 and 15 (Appendix A-4).
[11] See "Citizen Advisory Committee Meeting Notes", June 27, 2002, Item 3, "I-84 Access for OSTP" and "Runway Length" paragraphs.

These parking areas appear to be adequate for current and near-term demand. However, terminal area vehicle parking reserves should be provided nearby to allow for an expansion or reconfiguration of the FBO facilities or a general increase in vehicle parking demand. Additional vehicle parking should also be provided for where new hangar facilities are to be provided. At some airports, local building codes require vehicle parking be provided as part of hangar construction. However, at other airports, autos are parked inside the hangars once the aircraft is taken out.

Vehicle traffic on the airport consists mostly of light cars and trucks, commercial delivery trucks, and full-size tractor trailer combinations used for bulk delivery of aviation fuel. Since fixed-point fuel storage exists at two locations on the airport, adequate gated surface access must be maintained within the terminal area to those two locations. With recent construction of a new perimeter fence and gate system, the primary vehicle access to the aprons and terminal areas is to be provided at the following locations:

North side of Runway
East of Building 1610 N Service Road - 15' cantilevered gate with gate operator
East of Building 1350 N Service Road (Port Maintenance) - 20' cantilevered gate with gate operator
East of Building 920 N Service Road - 15' cantilevered gate with gate operator
East of Building 472 NW Graham Road - 20' cantilevered gate with gate operator

South side of Runway
North of Building 1023 NW Graham Road - 15' cantilevered gate with gate operator
East of Building 999 N Frontage Road - 15' cantilevered gate with gate operator

These gates appear to provide good access to all parts of the airport and should be adequate throughout the twenty year planning period.

SUPPORT FACILITIES

AVIATION FUEL STORAGE

Aviation gasoline (avgas) and jet fuel are both available at Troutdale Airport. As noted previously in the inventory chapter, the airport currently has two 12,000 gallon tanks for avgas and one 10,000 gallon tank for jet fuel (see Table 1-9).

A review of fuel records for Troutdale (see Figure 1-12) indicates that fuel sales have fluctuated from about 28,000 to 70,000 gallons per month (approximately 500,000 gallons per year) during the period 1986 through 1988 while Skywest was operating at the airport. During the more recent period 1999 through 2001 fuel sales have ranged from 4,000 to 33,000 gallons per month (with averages of 200,000 gallons per year). Based on air traffic operations, this would equate to average fuel sales of approximately 5 gallons sold per aircraft operation between 1996 and 1998, and approximately 2.5 gallons sold per aircraft operation between 1999 and 2001.

Given that fuel facilities at Troutdale have served such diverse levels of aircraft operations, and types of operations, it is reasonable to expect that the current fuel facilities will provide adequate capacity for the modest growth projected for the next twenty years.

AIRCRAFT WASH RACK

A common-use aircraft wash rack was constructed in 2003. The facility is capable of accommodating two aircraft at a time and has adequate containment to capture wash residue.

AIRPORT UTILITIES

The existing utility service on the airport is considered to be adequate for current needs. Further expansion of aircraft facilities west along the north apron will require extensions of the water, electrical, and telephone lines that serve currently serve the north terminal area. Likewise, further expansion of aircraft facilities east or west of the Administration Building adjacent to the south apron will require the same utility extensions.

Electrical and telephone lines (existing and new) should be located underground where possible. Additional development in any of these areas will likely require capacity analysis of the existing storm drainage system, along with possible creation of storage or swale elements to accommodate current water quality requirements.

SECURITY

Aircraft theft and vandalism, and a variety of less serious incursions are not uncommon at general aviation airports. The security measures (fencing, gates, flood lighting, passive access control, etc.) in use at Troutdale are comparable to most small general aviation airports. Ensuring that gates are closed and locked and hangar and aircraft apron areas are adequately lighted are the best measures for minimizing incidents.

The airport is currently completing construction of new six-foot high chain link fence with top bracket and three barbed wires, which will substantially improve security over the previous perimeter fencing and limited fencing around operations areas. New vehicle and pedestrian gates utilize controllers with security access codes. Port staff is currently developing an airport security plan with its foundation being an airport watch program whereby all Troutdale Airport users accept responsibility for reporting unusual activity inside the security fence.

FACILITY REQUIREMENTS SUMMARY

The facility requirements for Troutdale Airport are primarily related to maintaining existing airfield capabilities and improving facilities based on user demands. For the most part, the need for new or expanded facilities, such as aircraft hangars, will be market driven. It appears that the primary facilities needed for the airport during the next five years, will be the creation of additional T-Hangars and/or small sized conventional box hangars (potentially for corporate clients). In facilitating growth of facilities at the airport, the Port of Portland may desire to be a proactive partner with the private sector. The Port's role could range from being the developer of the hangars (as airports such as Madras and Scappoose have done), to putting out an RFP for hangar developers. Unlike some Portland metropolitan area airports, Troutdale Airport is fortunate to have land area and utilities immediately available for such hangar development.

Recognition is given to the uniqueness and importance of the USFS tanker operation based at the airport. While developing the airside facilities in the future, it is recommended that the large aircraft capabilities that exist at the airport today be preserved -- especially the runway width and south taxiway width. Because this conclusion has significant cost implications to the airfield facilities, it is one that ultimately requires strong Forest Service and FAA concurrence if it is to be accomplished.

As a result, Troutdale Airport has the basic facilities capable of accommodating a wide range of user needs. **Table 4-9** summarizes some of the key issues identified during the facility requirements analysis at Troutdale Airport.

The forecasts of aviation activity contained in Chapter Three anticipate moderate growth in activity that will result in comparable facility needs beyond current capabilities. The existing airfield facilities have the ability to accommodate a significant increase in activity, without requiring major facility upgrades or expansion. Improvements in basic facilities such as access roads, utilities, and drainage will enable the remaining developable areas to become more attractive to potential tenants.

The projected twenty-year facility needs are summarized in **Table 4-10**. The next step in the planning process is to analyze alternatives that can accommodate these requirements.

Table 4-9: Major Facility Requirements Issues

Facility	Description
Runway	Existing runway width of 150' exceeds FAA standard of 75' for ADG II airplanes. Recommend keeping 100' or 150' width since airport is the USFS's only Portland area fire tanker facility and serves aircraft as large as C-130A Hercules, an ADG IV airplane. Runway extension reserves should be protected for future options for a 300 to 600-foot runway extension to potentially accommodate larger class business aircraft beyond the planning period. Establish appropriate weight bearing capacity.
Parallel Taxiway Alpha (North)	Existing parallel taxiway separation of 275' exceeds FAA standard of 240' for ADG II airplanes. Future separation could be reduced if additional apron area width is needed. Exit locations appear to be adequate. Need separated run-up areas at each end to improve usability and avoid backups of aircraft. Existing width of 50' exceeds FAA standard of 35' for ADG II airplanes. Consider decreasing to 35', especially if this creates improved ramp space.
Parallel Taxiway Bravo (South)	Existing parallel taxiway separation of 200' does not meet FAA standard of 240' for ADG II. Exit locations appear to be adequate. Need separated run-up areas at each end to improve usability and avoid backups of aircraft. Existing width of 50' exceeds FAA standard of 35' for ADG II airplanes. Recommend retaining at 50' and utilizing TOFA standards for ADG III to preserve USFS operations safety.
Aircraft Parking	The number of aircraft tiedowns exceeds that required during the 20-year planning period. Some aircraft parking reconfiguration may be required to accommodate itinerant business aircraft parking and changes to the taxiway-runway separation distance. Configure to protect smaller aircraft and hangar doors from prop/jet blast.
Aircraft Hangars & Other Airport Buildings	All aircraft storage hangars are filled, indicating that it is an appropriate time to initiate efforts to gain additional storage hangar spaces. Site areas should be designated for both T-hangar and conventional box hangar type construction. The Port of Portland owned Buildings 620, 650, and 680 contain 5 T-hangar units that are quite old and may be beyond their useful life. If more appropriate uses can occur in their site, it is possible that they could be demolished at some time in the future. Hangar development reserves should be provided to accommodate additional demand potential beyond the planning period. Existing FBO maintenance hangar, office and classroom spaces appear to be adequate, though these facilities will require ongoing maintenance and renovation as tenant needs change over time. Some buildings may need to be removed if Taxiway Bravo separation from runway is corrected.
Fuel Storage	AVGAS facilities of 12,000 gallon above ground tank plus 12,000 gallon underground tank, along with Jet Fuel facilities of 10,000 gallon above ground tank, will satisfy the fuel storage needs through the planning period. Maintain reserve area for potential expansion beyond planning period, and/or for future card lock system.
Forest Service Facilities	Existing facilities are adequate.
AG Facilities	None required.
Security	Major new security fencing has just been provided, including gates for controlled access to aircraft operations areas. Apron and hangar flood lighting are adequate.
Vehicle Parking	Designated auto parking areas adjacent to FBO and hangar areas appears to be adequate.
Access Roads	Access roads appear to be adequate.

Table 4-10: Airport Facility Requirements Summary

Item	Short Term	Long Term
Runway	* Pavement Maintenance.[1]	* Confirm runway width requirements. * Pavement Maintenance. * Pavement Overlay (increase WBC to 30,000# SW). * Runway Extension/Reserve.
Taxiway Alpha (North)	* Provide improved aircraft run-up positions at each end of taxiway. * Pavement Maintenance	* Consider relocating to 240' separation from runway. * Consider reducing width from 50' to 35'. * Pavement Maintenance. * Pavement Overlay. * Taxiways to New Development Areas.
Taxiway Bravo (South)	* Provide improved aircraft run-up positions at each end of both taxiways * Pavement Maintenance	* Relocate taxiway to provide correct separation from runway. * Confirm maintaining 50' width. * Pavement Maintenance. * Pavement Overlay. * Taxiways to New Development Areas.
North Tiedown Apron	* Configure to provide itinerant tiedown locations for business class aircraft. * Pavement Maintenance.	* Pavement Maintenance. * Pavement Overlay.
South Tiedown Apron	* Configure to provide itinerant tiedown locations for business class aircraft. * Configure to accommodate occasional box hauler traffic diverted from PDX. * Pavement Maintenance.	* Pavement Maintenance. * Pavement Overlay.
Fueling Area	* Pavement Maintenance.	* Provide reserve area.
Agricultural Facilities	* None.	* Same.
Hangars	* T-hangar and Conventional Hangar Development Areas for small aircraft. * Business Aviation Hangar Development Areas for twins and jets.	* Development Reserves.
Navigational Aids and Lighting	* Development of improved instrument approach with lower ceiling minimums. * Flood Lighting (new hangar areas)	* Runway approach lights (ODALS) * Maintenance.
Airport Buildings	* Maintenance on Port –owned buildings. * Consider promoting development of additional T-hangars.	* Same.
Utilities	* Utility extensions as needed for additional storage hangars or other development.	* Same.
Airport Roadways	* Pavement maintenance	* Access to new development areas.
Security	* Monitor and maintain fencing, apron lighting.	* Same.

1. Vegetation control, crackfill, sealcoat

CHAPTER FIVE
Airport Development

Overview

The evaluation phase of the Airport Master Plan Update project began with preliminary development concepts being considered during review of the Facilities Requirements Chapter at Citizen Advisory Committee Meeting #3 held on November 7, 2002 (see Appendix D-3). Based on the facility requirements analyses, key facility needs were focused into the following categories for development analysis:

- Improved Instrument Approach
- B-II Design Aircraft vs. Existing Fire Tanker C-III Aircraft Needs
- B-II Design Aircraft vs. Future C-II Business Aircraft Needs
- Basic Improvements to Meet Forecast Based Aircraft
- Miscellaneous Airport Improvements

As to the first three items, it was determined that a meeting should be held with FAA staff at the Seattle Office, to review these issues in detail, and determine what approach could develop a consensus for the future development of the airport. For this purpose, a meeting was held at the FAA Offices on December 5, 2002 to review airport layout alternatives and determine the preferred plan for the future (see a memorandum of this meeting in Appendix E-1). As to the last two items, these represented issues previously raised at Citizen Advisory Committee meetings (see meeting minutes in appendices A-4, A-6, A-7, A-8, B-2, C-3, D-3).

The process of identifying and evaluating development options has thus included involvement by citizens on the advisory committee, the local community during open houses, local governmental staff (on the advisory committee), the FAA staff, Oregon Department of Aviation staff (on the advisory committee), along with Port staff.

Following further review of the conceptual options by the Advisory Committee, a preferred alternative containing the desired development components will be established -- based on desired portions of the various options considered -- and it will be depicted on the Airport Layout Plan. In the following sections each of the key facility needs issues will be discussed.

Improved Instrument Approach

Throughout the planning process, the number one improvement requested by pilots has been an improved instrument approach -- especially one with lower minimum altitudes than that which exists. A meeting was held with Vic Zembruski, FAA instrument approach specialist from the FAA Flight Procedures Office, on December 5, 2002 to determine the potential for substantial improvements.

Zembruski noted that FAA staff have in the past done feasibility studies for two different new instrument approaches to Troutdale Airport. One is a VOR-DME approach to Runway 7 which was studied in 1995. It developed probable minimums of 800 MSL using a combination straight segment of 2 to 4NM and a left turn toward Battleground VOR. The second study in 1996 designed a GPS straight-in to Runway 7 with minimums as low as 560 MSL, and a 15 degree offset straight-in to Runway 25 with minimums as low as 1060 MSL. Copies of those studies were provided and are attached to the memo in Appendix E-1.

Zembruski noted that the Runway 25 approach would likely use a 15 degree offset from the runway heading in order to line up better with the Columbia River Gorge and thus provide minimums as low as possible. The standards for the approach can be found in TERPS Section 251. He noted that although the Part 77 approach surfaces should be shown with a 34:1 slope to identify any existing obstructions on the airspace plan, under TERPS criteria a "clean" 20:1 slope must be maintained to keep night minimums for a straight-in approach. Thus, there must be not obstructions in the 20:1 slope, and any obstructions that penetrate the 34:1 approach surface must be marked and lighted, per FAA requirements.

Zembruski believes that all of these approach options are viable and would provide minimums in the range of 600-800-ft. He believes that in the past it was the Port of Portland and Portland approach controllers' fear that this could conceivably reduce capacity at PDX that resulted in no further study of the options. Should the Port be interested in pursuing either of these options further, Zembruski can evaluate them further. He recommended discussing with the Troutdale Control Tower staff whether one or the other would be preferred based on typical weather conditions during IFR conditions.

The tower staff may be able to provide anecdotal information as to the percent of approaches which would come from each direction were those approaches available. However, it may be wise to design both approaches so that the approach from the east can be used whenever possible to avoid conflicts with PDX instrument approaches. Zembruski noted that Pearson Airport's instrument approach is closer to PDX than Troutdale, and that the PDX controllers are able to work those aircraft into the general flow of traffic. Based on comments provided by Troutdale Control Tower staff at a recent planning advisory committee meeting, improvements in radar coverage for the Portland area is expected to significantly improve air traffic management options and may be a factor in improving instrument procedures at TTD.

Following the meeting with FAA staff, a meeting was held with Port of Portland staff involved with operations at PDX, to consider whether these instrument approach options for Troutdale should be further examined. There was general concurrence that they should be examined, and that the next step in pursuing this development option will be to meet with FAA PDX Tower staff, to attempt to gain their input, and hopefully support, for the concept.

Given that there is a good potential for instrument approaches from both runway directions, it was agreed that both ends of the runway should be shown with 34:1 approach surfaces. This alternative will be utilized for the final Airport Layout Drawings and the associated airspace plans.

B-II Design Aircraft vs. Existing Fire Tanker C-III Aircraft Needs

Two alternative airport airfield layout drawings were created for Troutdale Airport. First, a drawing showing the potential layout for the runway, taxiways, and RPZ configurations using B-II standards was created (see Drawing A1 at the end of this section). This option includes a potential option for a 600 ft. runway extension to the west; taxiway options included Alpha (north taxiway) relocated 35 ft. closer to the runway and taxiway Bravo (south taxiway) located 40 ft. south to provide the 240 ft standard separation between runway and taxiway. It proposes that Taxiway Bravo include clearances for Design Group III aircraft, in order to accommodate U.S. Forest Service tanker aircraft. Runway width is shown as being reduced to 100 ft. at the time of next major pavement rehabilitation. It is proposed that taxiway Alpha be 35 ft. wide per B-II standards but that taxiway Bravo be 50 ft. wide to accommodate the larger US Forest Service aircraft.

FAA staff reviewed this option at the December 5, 2002 meeting, and concurred that B-II criteria are appropriate for Troutdale Airport. The FAA will support a 100 ft. width runway in lieu of the 75 ft. width of

B-II standards as long as a written description is included in the Master Plan that clearly explains that the additional width is needed to accommodate US Forest Service Tankers. The FAA questioned the need to retain a 50-ft. width for taxiway Bravo, based on the US Forest Service air tankers utilizing a 35-ft. width taxiway at LaGrande. Further research and coordination between the USFS and the Port will be conducted. Based on FAA comments, it appears that retaining the existing taxiway width or providing any width greater than 35 feet will require funding other than FAA.

B-II Design Aircraft vs. Future C-II Business Aircraft

At the November 7, 2002 Advisory Committee Meeting (and at several other meetings), it was recommended that strong consideration be given to the potential that Troutdale Airport may be an important future business aviation facility for Troutdale and other East County businesses -- especially given the potential for extensive future commercial and industrial development of the adjacent Reynolds Aluminum Site. The reason for examining this potential is because the Advisory Committee believes that there is a high probability that when surrounding industrial lands are further developed, the Troutdale Airport will become a much more business aviation oriented airport, perhaps somewhat along the lines of Hillsboro Airport which serves Intel and other major employers. Were this to happen, it could be expected that Approach Category C aircraft would likely become based at the airport such as are currently based at Hillsboro Airport. To determine the suitability of the Troutdale Airport for business aircraft use, local major business aviation companies were queried as to runway length requirements for the business aircraft they are currently using to serve major corporations. The table below shows the results of this survey:

Troutdale Airport Runway
Business Aircraft Requirements & Limitations[1]
Aron Faegre & Associates
with Century West Engineering
3/1/03

Aircraft	Airport Ref. Code	Takeoff Distance ft (req'd/at MGTOW)	Max Wt lbs (MGTOW)	Takeoff Dist. (req'd at TTD)	Wt Limitation (at TTD)	Percent wt Reduction
G-V	D-II	6,533	90,500	5,400	82,400	91%
G-IVSP	D-II	6,400	74,600	5,400	68,000	91%
G-IV	D-II	5,534	73,200	5,400	70,000	96%
G-III	C-II	5,980	69,700	5,390	66,000	95%
G-IISP	C-II	6,760	64,800	5,310	58,000	90%
Falcon 50	B-II	5,850	40,780	5,250	38,000	93%
Citation X	C-II	6,060	36,100	TBD	TBD	TBD
Hawker 700	C-I	7,100	25,500	5,400	23,000	90%
G-100 (Astra)	TBD	7,100	24,650	5,400	21,500	87%
Westwind	TBD	5,700 (Note 2)	23,500	5,100	21,000	89%
LR-35A	D-I	6,000 (Note 3)	18,300	5,400 (Note 3)	17,200	94%
DA-10 (Falcon 10)	TBD	4,600	17,600	4,600	17,600	100%

Notes:
1) Aircraft performance assumptions: Runway elevation 39 feet; temperature 82 degrees F; no wind.
2) Westwind runway distance calculated at 68 degrees F per second segment climb limited (SSL) aircraft criteria.
3) Lear-35A runway distance calculated based on no thrust reversers installed.
4) Information Sources: G-IVSP, G-III, GIISP, Falcon 50, Hawker 700, G-100, Westwind, LR-35A, and DA-10 provided by Aero Air, Hillsboro, as tabulated by either Simuflite or Flight Safety; Citation X provided by E. Sturm; G-IV and G-V by Nike, Hillsboro.

Based on this analysis it is clear that should Category C business aircraft become key users in the future, the 5,400 foot runway will not provide the capability for maximum gross weight take-off on an 82 degree day (maximum mean daily temperature). However, it is also clear that the 5,400 foot runway is still useful for most of these aircraft on an 82-degree day for approximately 90% of the maximum gross weight, which would appear to be at least a "useful" operation under many scenarios. For example, the take-off may be with less than preferred fuel, or with less passengers than otherwise. Or, a flight may be timed to use better temperatures or more wind, which would reduce the runway length requirement. For example, the Citation X at maximum gross weight requires a 5,200 foot runway on a 59 degree day with no wind. In fact, Troutdale Airport's common wind conditions result in a generally reduced runway length requirement for most aircraft. Thus, the 5,400-foot runway at Troutdale generally is a quite useful length for many business aircraft.

Accommodating larger, faster Category C aircraft (meaning that they approach to land at 121 to 141 knots rather than the 91 to 121 knots of Category B aircraft) results in some significant design challenges. Should a Category C aircraft become the "critical aircraft" (one with 500 or more operations per year) it will require the airport to maintain significantly longer runway safety areas (level ground that could support an aircraft in an emergency under dry conditions) beyond the ends of the runway. Rather than the 300 feet distance for Category B aircraft, the runway safety must extend 1,000 feet beyond each end of the runway for Category C aircraft. Thus, the existing 5,400 foot runway with two existing 300 foot runway safety areas would need to be revised to a 4,000 foot runway with two new 1,000 foot runway safety areas. A 4,000 foot runway becomes only marginally useful for business jets.

A drawing showing the potential layout for the runway, taxiways, and RPZ configurations using C-II standards was created (see Drawing A2 at the end of this section). The drawing shows that even by retaining the existing 5,400-ft. runway length, both ends would need to be relocated 600-ft. to the west in order to meet the C-II Runway Safety Area dimensional standards. This option does not include any potential runway extension. Runway-Taxiway separations increase from 240 to 300-ft. and are shown on the drawing as such[1]. Taxiway options thus relocate Alpha (north taxiway) 25 ft. further from the runway and taxiway Bravo (south taxiway) 100 ft. further south to provide the 300 ft standard separation between runway and taxiway. It proposes that Taxiway Bravo include clearances for Design Group III aircraft, in order to accommodate U.S. Forest Service tanker aircraft. Runway width is shown as being reduced to 100 ft. at the time of next major pavement rehabilitation. It is proposed that taxiway Alpha be 35 ft. wide per B-II standards but that taxiway Bravo be 50 ft. wide to accommodate the larger US Forest Service aircraft.

At the December 5, 2002 meeting with FAA staff, they concurred that it would be desirable to reserve property area in order to accommodate a future conversion to C-II design standards, should that ever be desired. It was noted that the City of Troutdale is currently identifying a future location of a North-South road that would be located just to the west of the airport property. The drawing showing C-II design layout for the airport could be used as a reasonable identification of potential future needs for the airport.

FAA staff noted that 1,000 foot long by 500 foot wide Runway Safety Areas beyond the ends of the runways would be essential once approach category C aircraft are major users of the airport; however, non-standard runway-taxiway separations (for example 240-ft. vs. the required 300-ft.) can often be accommodated by control tower operational procedures. In other words, the control tower can ensure that there are not large wing span aircraft on the taxiway and runway simultaneously, or can even keep the taxiways clear at times when approach category C aircraft are landing or taking off. This has been done at other airports and would be expected to be allowed at Troutdale in the future. The volume of Category C aircraft activity is also expected to be a consideration in addressing operational/design standard options.

1 However, it is unclear whether the land area is sufficient to fully accommodate this width along the west end of taxiway Bravo. More detailed survey information may be required to determine the precise space available.

FAA staff pointed out that the RPZs at each end of the runway can be of different sizes, based on the approach criteria required at each runway end. Following a discussion of the likely needs of the approaches, it was determined that 1700-ft. x 500-ft. x 1010-ft. are probably appropriate for both ends (Approach Category C, visual and not lower than 1-mile).

Under either the B-II or C-II design criteria there are hangars located at the east end of taxiway Bravo that will need to be removed when the taxiway is reconstructed. FAA staff pointed out that if the buildings are privately owned, the FAA will pay their owners the fair market value of the buildings and will assist in relocation costs. However, if the buildings are owned by the airport (Port), the FAA will only pay for the cost to demolish them.

Based on the above analysis, it is proposed that the Troutdale Master Plan Update show reserve areas for the meeting of airfield C-II criteria in the future.

Basic Improvements to Meet Forecast Based Aircraft

Drawing A3 shows the potential future locations for tie-downs, T-hangars, corporate hangars, FBO's, aviation businesses, and non-aviation businesses. The layout continues past Port of Portland overall goals to view properties along Frontage Road as potential non-aviation related revenue development sources for the airport. They have good direct access to the freeway, and as such may have highest value for non-aviation uses. Properties somewhat in from Frontage Road, are proposed to be reserved for aviation-related businesses, since those properties could have direct access to the taxiway and runway. New T-hangars and corporate hangar facilities are proposed for development on the north side of the airport, as they do not require such close access to the freeway.

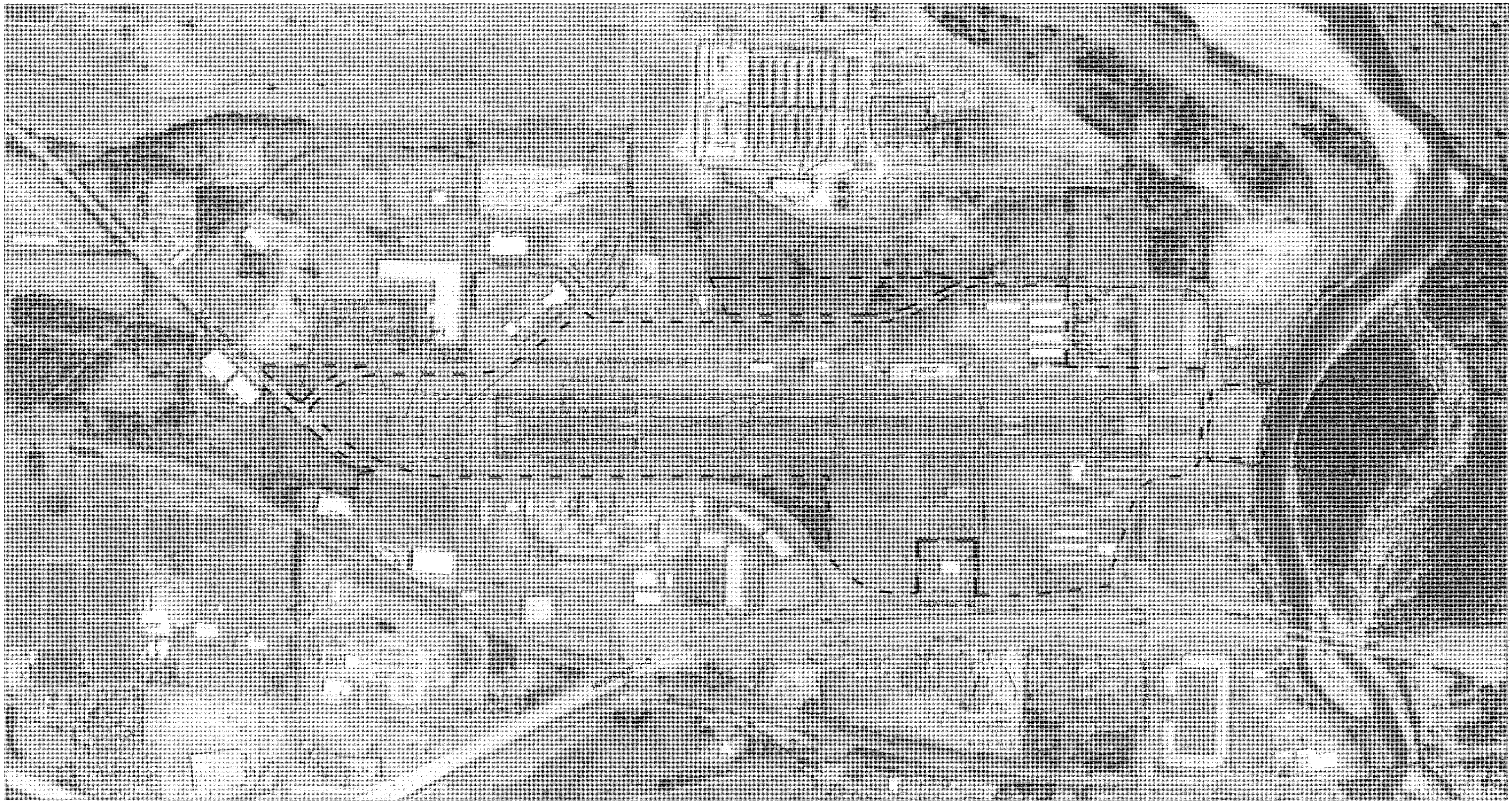
Miscellaneous Airport Improvements

Drawing A3 also shows proposed locations for miscellaneous airport improvements requested during the course of the study. These items are:

- Run-up Pads: Numerous pilots have noted the need for a designated run-up area at each end of both taxiways. On a busy day this is a bottleneck to operations on the airport. There should be space for two aircraft to be performing a run-up and others still able to pass.
- Taxiway Bravo Passing Lane: Numerous pilots noted that Taxiway Bravo would benefit from the installation of a passing lane midway along its 1,800 foot west portion so that aircraft can pass each other.
- Compass Calibration Pad: A compass calibration pad is needed on the airport for swinging of the

magnetic compass in the aircraft, to determine its accuracy. The FAA AC 150/5300-13, Appendix 4, page 112 contains criteria for the location of a compass calibration pad, which includes a recommendation that it be 300 feet from any above or below-ground power and communications cables, and 600 feet from a building. A thorough magnetic survey of the potential site is recommended by the FAA prior to construction.

- Surveyed Bearing to BTG: A surveyed point should be provided on the airport which has a designated bearing to eh Battleground VOR, for use in checking the NAV radios for accuracy.
- Twin and Light Jet Parking Area: A specific area should be established for twin and light jet parking. These should be designed to allow aircraft to power in and power out (drive-through) without directly disturbing smaller nearby aircraft.
- 40-Mile Loop Trail Coordination: The 40-Mile Loop organization is planning to further develop a hiking trail along the west bank of the Sandy River, as part of facility improvements for the Lewis and Clark Bicentennial. A meeting was held with staff from that organization on June 27, 2002 to emphasize the need to avoid construction of "people attractor" elements on the Port property within the Runway Protection Zone area (see Item 3, Citizen Advisory Committee Meeting #1 Notes, Appendix B-2). It is recommended that Port staff maintain coordination with this group to ensure that the trail development include signage warning equestrian riders and pedestrians of the presence of aircraft overhead, and the need to remain on the trail and avoid climbing up on the dike area.
- Potential Property Acquisition: Along the north side of NE Marine Drive, near its junction with Frontage Road, it is proposed that the airport acquire a 5.35 acre triangular area. This area could be useful in the future as an additional access point for the aviation and non-aviation related properties along the south side of the airport. Along the west end of the airport property additional property to the west could be acquired to preserve the potential for an enlarged RPZ under the C-II design criteria.
- Midfield High-speed Exit: Tower staff have noted that as the airport gains more business activity with light jets, it is recommended that a midfield high-speed exit be provided to improve the tower's ability to keep traffic flowing smoothly.
- Building Restriction Line: Establish building restriction line at 460 feet from runway centerline to protect for potential future C-II airfield design criteria. This distance relates to other existing hangars at the north west area of the airport and provides the following clearances: [300 feet Runway to Taxiway Separation, plus 65.5 feet Taxiway Object Free Area, plus 94.5 foot apron in front of hangar]



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KEY:
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RUNWAY-TAXIWAY LAYOUT USING B-II CRITERIA (EXCEPT DG-III TOFA TAXIWAY BRAVO)

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ARON FAEGRE & ASSOCIATES
with
CENTURY WEST ENGINEERING

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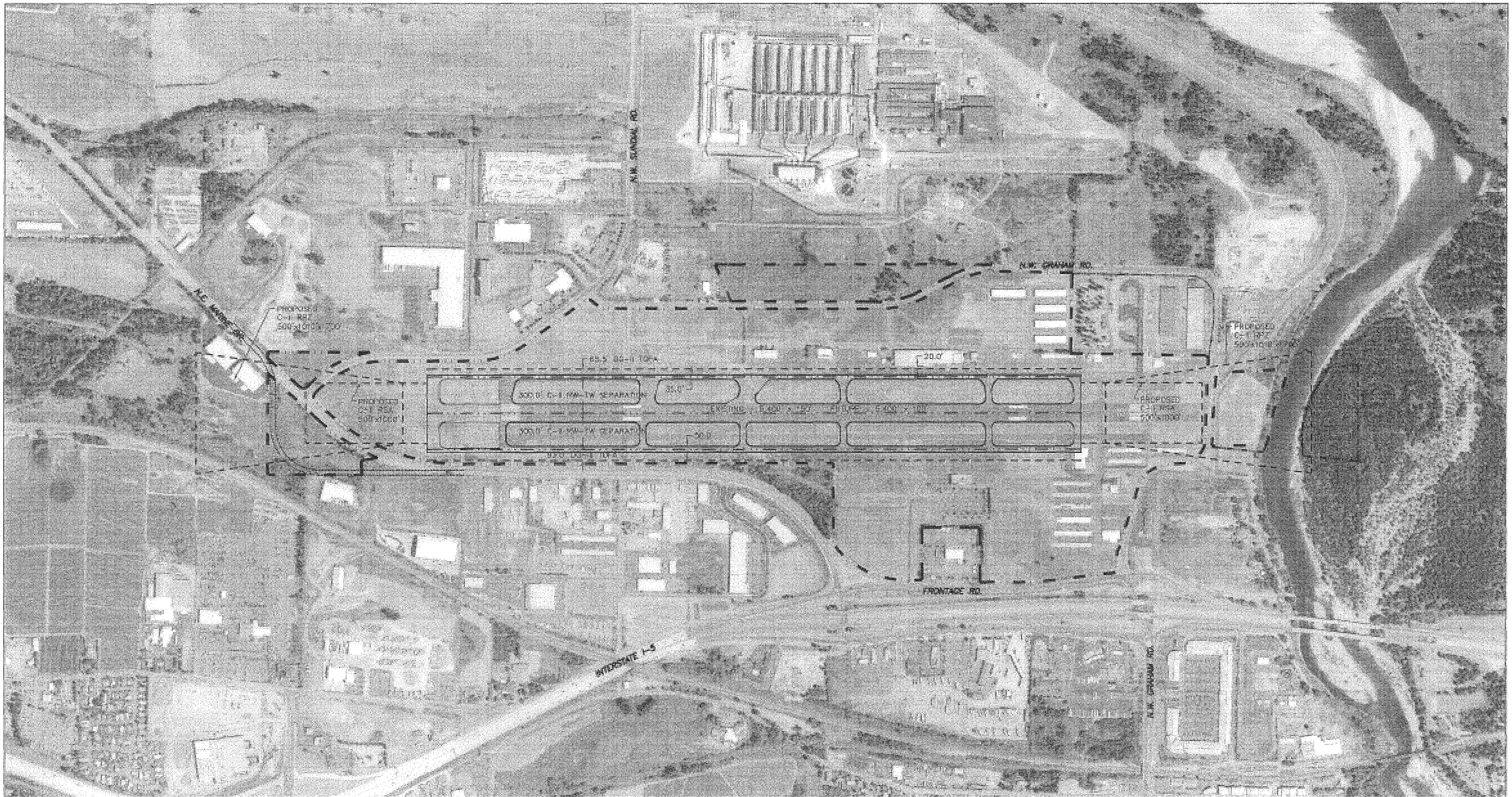
TROUTDALE AIRPORT
AIRPORT LAYOUT PLAN UPDATE

AIRPORT LAYOUT PLAN ALT. I

DRAWING NO. A1

SHEET NO. 1 OF 3



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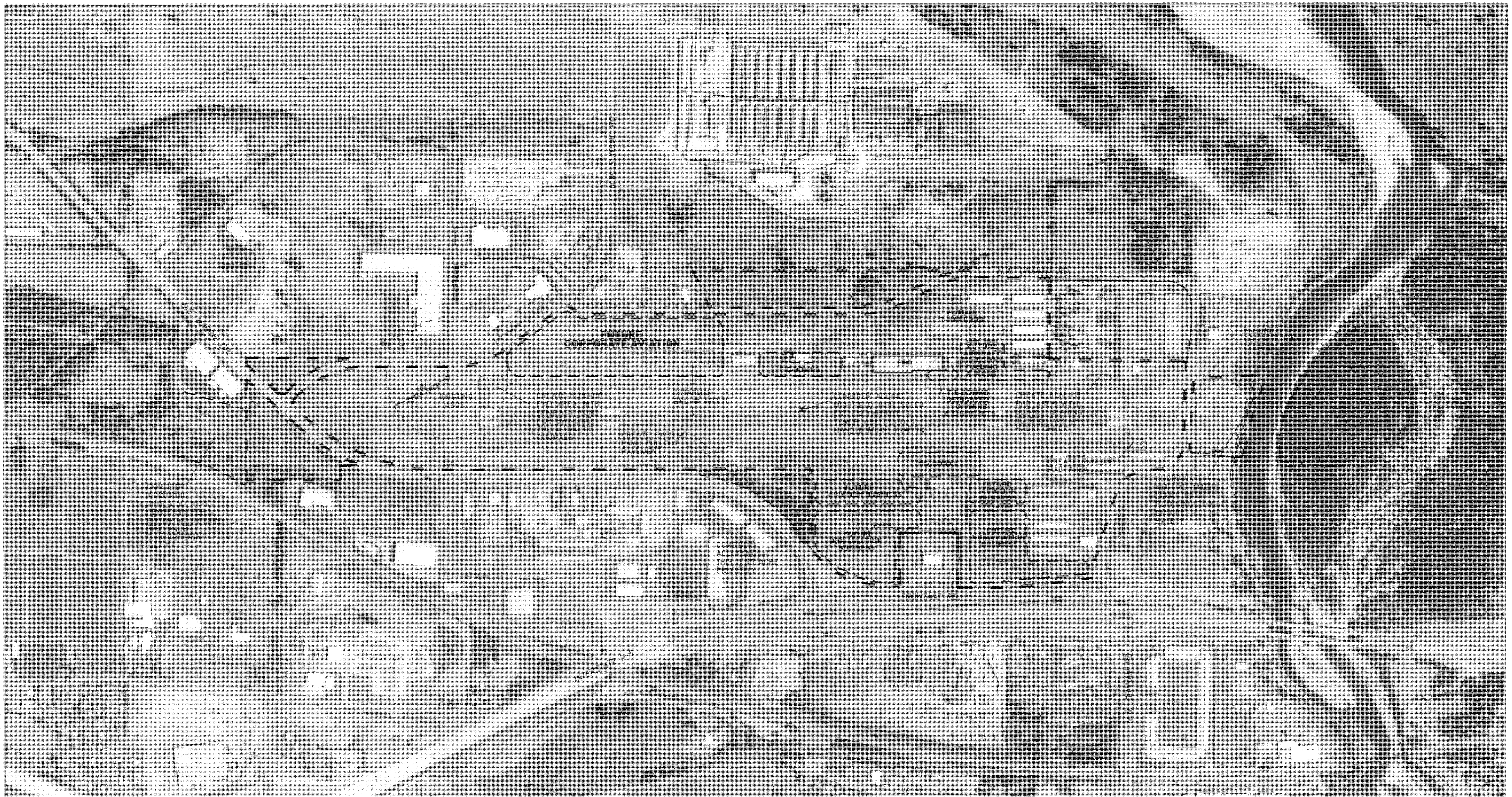
AIRPORT LAYOUT PLAN ALT. 2

DRAWING NO. A2

SHEET NO. 2 OF 3



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KEY:
AIRPORT PROPERTY LINE
DIAGRAMATIC USE AREA

DEVELOPMENT OPTION DIAGRAM

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TROUTDALE AIRPORT
AIRPORT LAYOUT PLAN UPDATE

AIRPORT LAYOUT PLAN ALT.3

DRAWING NO. A3

SHEET NO. 3 OF 3

CHAPTER SIX
Noise Compatibility

Noise Evaluation - Introduction

Noise is sometimes defined as unwanted sound. However, sound is measurable, whereas noise is subjective. The relationship between measurable sound and human irritation is the key to understanding aircraft noise impact. A rating scale has been devised to relate sound to the sensitivity of the human ear. The A-weighted decibel scale (dBA) is measured on a logarithmic or "log" scale, by which is meant that for each increase in sound energy level by a factor of 10, there is a designated increase of 1 dBA. This system of measurement is used because the human ear functions over such an enormous range of sound energy impacts. At a psychological level, there is a rule of thumb that the human ear often "hears" an increase of 10 decibels as equivalent to a "doubling" of sound.

The challenge to evaluating noise impact lies in determining what amount and what kind of sound constitutes noise. The vast majority of people exposed to aircraft noise are not in danger of direct physical harm. However, much research on the effects of noise has led to several generally accepted conclusions:

- The effects of sound are cumulative, therefore, the duration of exposure must be included in any evaluation of noise.
- Noise can interfere with sleep and outdoor activities.
- Noise can disturb communication, TV/radio listening, and relaxation.
- When community noise levels have reached sufficient intensity, a certain percentage of the population is likely to become highly annoyed and object to the noise.

Research has also found that individual responses to noise are difficult to predict[1]. Some people are annoyed by perceptible noise events, while others show little concern over the most disruptive events. However, it is possible to predict the responses of large groups of people – i.e. communities. Consequently, community response, not individual response, has emerged as the prime index of aircraft noise measurement.

[1] Beranek, Leo, *Noise and Vibration Control*, McGraw-Hill, 1971, pages ix-x.

DNL Methodology

On the basis of the findings described above, a methodology has been devised to relate measurable sound from a variety of sources to community response. It has been termed "Day-Night Average Sound Level" (DNL) and has been adopted by the U. S. Environmental Protection Agency (EPA), the Department of Housing and Urban Development (HUD), and the Federal Aviation Administration (FAA) for use in evaluating noise impacts. In a general sense, it is the yearly average of aircraft-created noise for a specific location (i.e., runway), but includes a calculation penalty for each night flight, due to quieter background levels at night and the higher sensitivity to noise while sleeping.

The basic unit in the computation of DNL is the sound exposure level (SEL). An SEL is computed by mathematically summing the dBA level for each second during which a noise event occurs. For example, the noise level of an aircraft might be recorded as it approaches, passes overhead, and then departs. The recorded noise level of each second of the noise event is then added logarithmically to compute the SEL. To provide a penalty for nighttime flights (defined as the hours be between 10 PM and 7 AM), 10 dBA is added to each nighttime dBA measurement, second by second. Due to the mathematics of logarithms, this calculation penalty is equivalent to 10-day flights for each night flight[2].

A DNL level is approximately equal to the average dBA level during a 24-hour period with a weighing for nighttime noise events. The main advantage of DNL is that it provides a common measure for a variety of different noise environments. The same DNL level can describe an area with very few high noise events as well as an area with many low level events.

Noise Modeling and Contour Criteria

DNL levels are typically depicted as contours. Contours are an interpolation of noise levels drawn to connect all points of a constant level that are derived from information processed by the FAA approved computer noise model called the Integrated Noise Model (INM). The current version 6.1 was used for this study. The noise contours appear similar to topographical contours and are superimposed on a map of the airport and its surrounding area. It is this map of noise levels drawn about an airport that is used to predict community response to the noise from aircraft using that airport. DNL mapping is best used for comparative purposes,

[2] Where Leq ("Equivalent Sound Level") is the same measure as DNL without the night penalty incorporated, this can be shown through the mathematical relationship of:

$$Leq_d = 10 \log \left(\frac{N_d \times 10^{(SEL/10)}}{86{,}400} \right) \qquad Leq_n = 10 \log \left(\frac{N_n \times 10^{((SEL+10)/10)}}{86{,}400} \right)$$

If SEL equals the same measured sound exposure level for each computation, and if $N_d = 10$ daytime flights, and $N_n = 1$ night-time flight, then use of a calculator shows that for any SEL value inserted, $Leq_d = Leq_n$.

rather than for providing absolute values. That is, valid comparisons can be made between scenarios as long as consistent assumptions and basic data are used for all calculations. It should be noted that a line drawn on a map by a computer does not imply that a particular noise condition exists on one side of the line and not on the other. These calculations can only be used for comparing average noise impacts, not precisely defining them relative to a specific location at a specific time. Noise contours are typically plotted in 5 DNL increments, starting at 55 DNL.

Noise and Land-Use Compatibility Criteria

Federal regulatory agencies of government have adopted standards and suggested guidelines relating DNL to compatible land uses. Most of the noise and land-use compatibility guidelines strongly support the standard that significant annoyance from aircraft noise levels does not occur outside a 65 DNL noise contour. Federal agencies supporting this standard include the Environmental Protection Agency, Department of Housing and Urban Development, and the Federal Aviation Administration.

Part 150, Airport Noise Compatibility Planning, of the Federal Aviation Regulations, provides guidance for land-use compatibility around airports. Table 6-1 presents these guidelines. Compatibility or non-compatibility of land use is determined by comparing the noise contours with existing and potential land uses. All types of land uses are compatible in areas below 65 DNL. Generally, residential and some public uses are not compatible within the 65-70 DNL, and above. As noted in **Table 6-1,** some degree of noise level reduction (NLR) from outdoor to indoor environments may be required for specific land uses located within higher level noise contours. Land uses such as commercial, manufacturing, some recreational uses, and agriculture are compatible within 65-70 DNL contours.

Table 6-1: Land-Use Compatibility with DNL

Land Use	Yearly Day-Night Average Sound Level (Ldn) In Decibels					
	BelowOver					
	65	65-70	70-75	75-80	80-85	85
Residential						
Residential, other than mobile homes & transient lodgings	Y	N(1)	N(1)	N	N	N
Mobile Home Parks	Y	N	N	N	N	N
Transient Lodgings	Y	N(1)	N(1)	N(1)	N	N
Public Use						
Schools	Y	N(1)	N(1)	N	N	N
Hospitals and Nursing Homes	Y	25	30	N	N	N
Churches, Auditoriums, and Concert Halls	Y	25	30	N	N	N
Governmental Services	Y	Y	25	30	N	N
Transportation	Y	Y	Y(2)	Y(3)	Y(4)	Y(4)
Parking	Y	Y	Y(2)	Y(3)	Y(4)	N

Commercial Use						
Offices, Business and Professional.	Y	Y	25	30	N	N
Wholesale and Retail—Building Materials, Hardware and Farm Equipment	Y	Y	Y(2)	Y(3)	Y(4)	N
Retail Trade--General	Y	Y	25	30	N	N
Utilities	Y	Y	Y(2)	Y(3)	Y(4)	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing General	Y	Y	Y(2)	Y(3)	Y(4)	N
Photographic and Optical	Y	Y	25	30	N	N
Agriculture (except livestock) and Forestry	Y	Y(6)	Y(7)	Y(8)	Y(8)	Y(8)
Livestock Farming and Breeding	Y	Y(6)	Y(7)	N	N	N
Mining and Fishing, Resource Production and Extraction	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor Sports Arenas, Spectator Sports	Y	Y(5)	Y(5)	N	N	N
Outdoor Music Shells, Amphitheaters	Y	N	N	N	N	N
Nature Exhibits and Zoos	Y	Y	N	N	N	N
Amusements, Parks, Resorts and Camps	Y	Y	Y	N	N	N
Golf Courses, Riding Stables and Water Recreation	Y	Y	25	30	N	N

Y (Yes) Land-use and related structures compatible without restrictions.
N (No) Land-use and related structures are not compatible and should be prohibited.
NLR Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into design and construction of the structure.
25, 30 or 35 Land uses and structures generally compatible; measures to achieve NLR or 25, 30, or 35 dB must be incorporated into design and construction of the structure.

NOTES:

1. Where the community determines that residential uses must be allowed, measures to achieve outdoor to indoor Noise Levels Reduction (NLR) of at least 25dB and 30dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB; thus, the reduction requirements are often stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year-round. However, the use of NLR criteria will not eliminate outdoor noise problems.
2. Measures to achieve NLR of 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.
3. Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.
4. Measures to achieve NLR of 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received office areas, noise sensitive areas, or where the normal noise level is low.
5. Land-use compatible, provided special sound reinforcement systems are installed.
6. Residential buildings require an NLR of 25.
7. Residential buildings require an NLR of 30.
8. Residential buildings not permitted.

SOURCE: Federal Aviation Regulations, Part 150, Airport Noise Compatibility Planning, dated January 18, 1985.

Oregon DEQ Standards

When aircraft are in flight, landing, or taking off, they are regulated solely by the FAA since navigable airspace is under federal jurisdiction. However, because aircraft noise occurs at and around airports, it is also a concern to local governments. The State of Oregon Administrative Rules Section OAR 340-35-045 requires that when establishing a new airport or performing airport master planning that a projected noise impact analysis must be prepared and made available to the local land use determination agency.

The state airport noise standards are administered by the Department of Environmental Quality (DEQ), and require that an "airport noise impact boundary" be depicted around an airport. DEQ defines this boundary with an annual average day-night noise level of 55 DNL. This standard is considerably more conservative than the federal standard of 65 DNL and thus promotes a higher level of scrutiny in the land use evaluation of airport development proposals. DEQ reviews submittals to ensure that they are accurate portrayals of the boundary, but does not evaluate whether the noise levels are acceptable for specific land uses within the boundary. Since this project does not involve establishing a new airport, or master planning, there is no requirement to coordinate with Oregon DEQ on airport noise. This was accomplished by having the Troutdale Planning Director on the Master Plan Public Advisory Committee.

Local City and County Standards

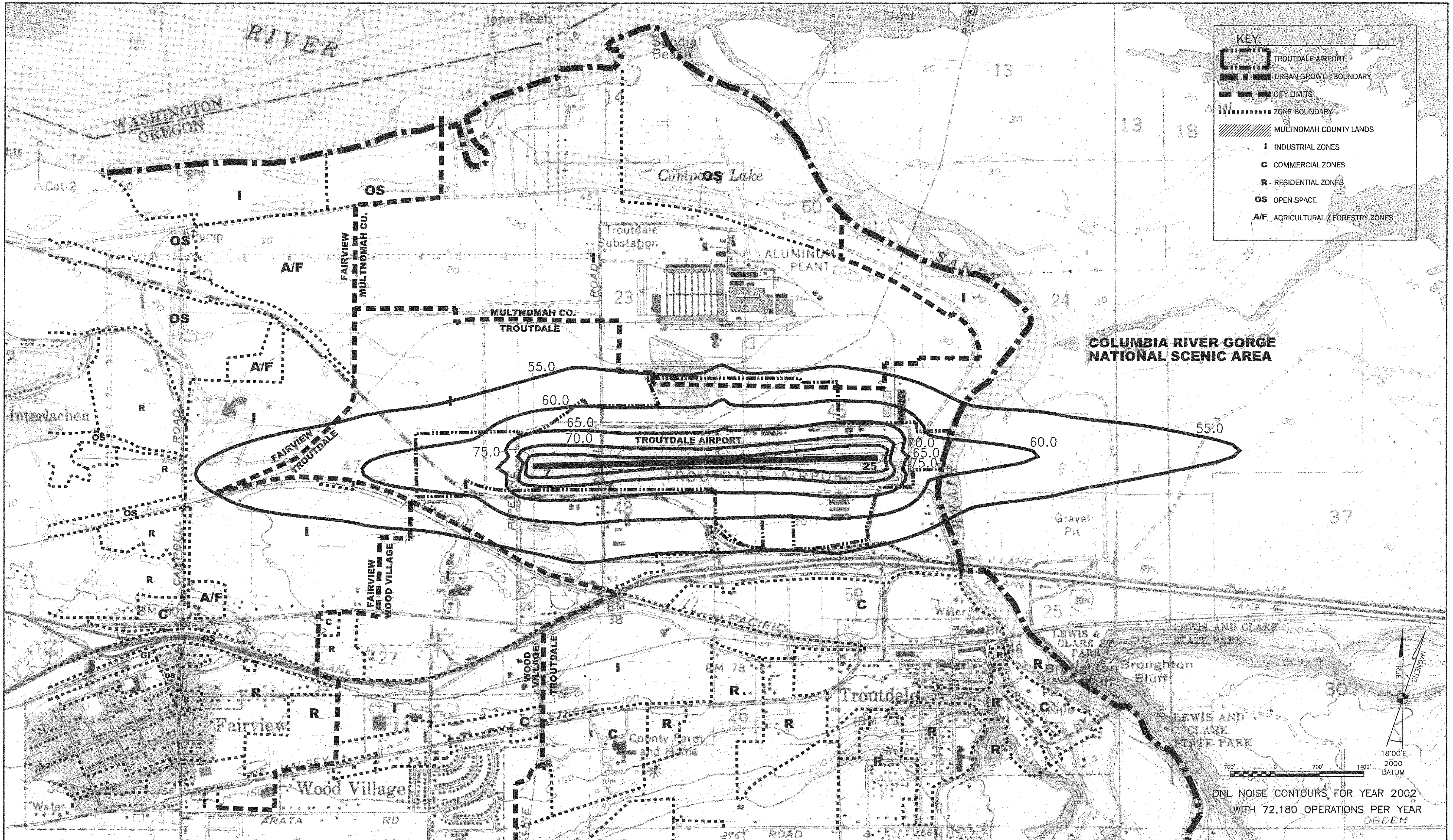
Multnomah County and the City of Troutdale do not have any regulations directly governing aircraft noise. Both entities are precluded by federal law from regulating aircraft noise.

INM Cases Run

The FAA approved INM Model version 6.1 was programmed with 72,180 operations to create the existing noise contours based on the year 2002 number of operations. Flight paths were modeled based on typical usage seen and described by pilots, the tower staff, and the consultants. **Drawing 6-1** shows the results of this case. All noise contours, including the 55 DNL contour, are on properties zoned industrial.

The INM Model was then programmed with 98,889 operations to create the predicted noise contours based on the year 2022 number of operations. Flight paths were again modeled based on typical usage seen and described by pilots, the tower staff, and the consultants. **Drawing 6-2** shows the results of this case. In this case most of the noise contours, including the 55 DNL contour, are on properties zoned industrial. However, at the east end of the airport it is found that the 55 DNL contour begins to include a small area of residential zoned properties. Under federal standards this would not constitute significant impact, however under Oregon DEQ rules, this would constitute an area that might be looked at in more detail.

Drawings 6-1 & 6-2



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PROJECT: TROUTDALE-3

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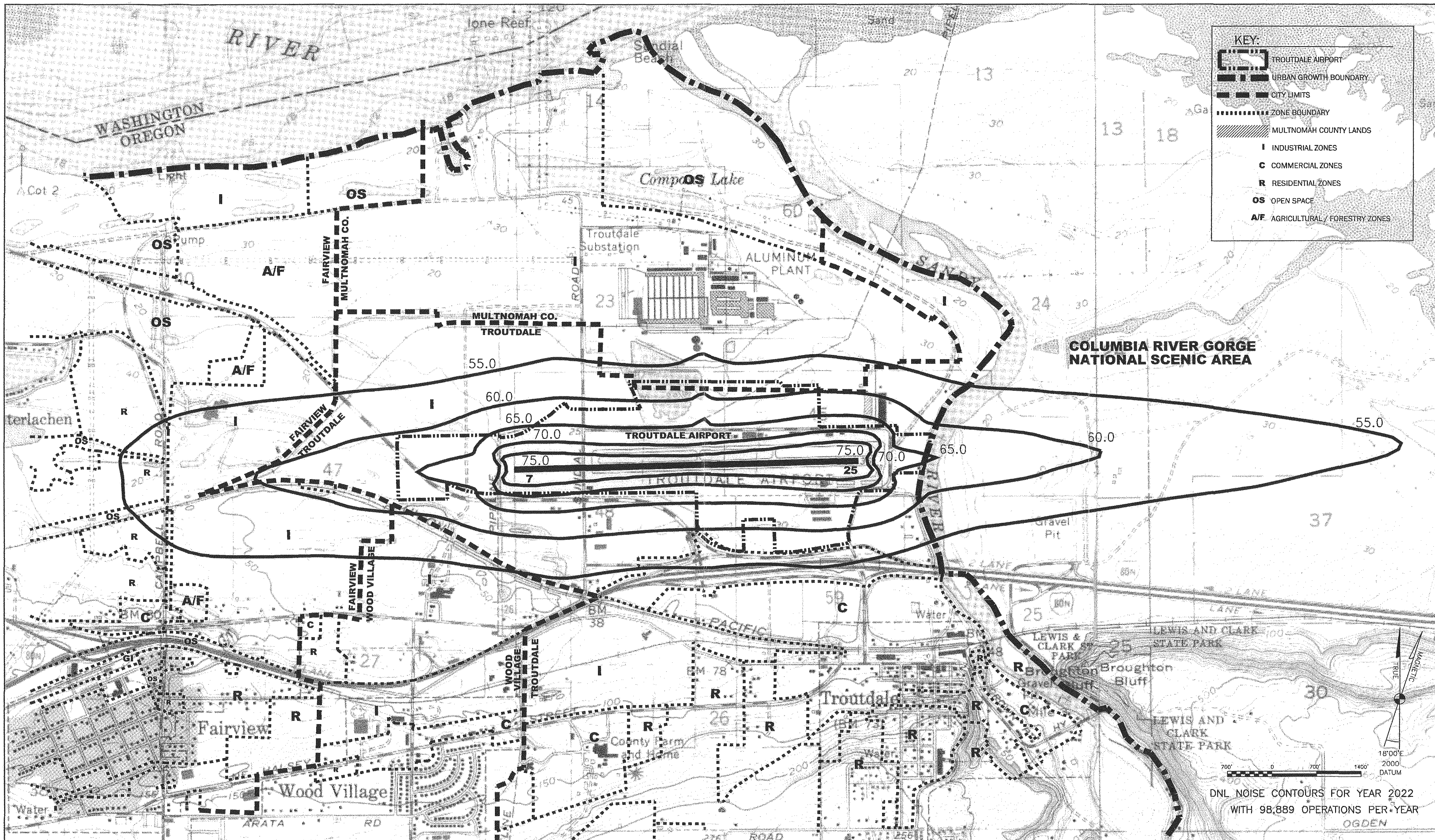
AIRPORT LAYOUT PLAN UPDATE

AIRPORT LAND USE PLAN WITH 2002 NOISE CONTOURS

FIGURE 6-1



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DATE: OCTOBER 17, 2003		PROJECT: TROUTDALE-3	

TROUTDALE AIRPORT
AIRPORT LAYOUT PLAN UPDATE

AIRPORT LAND USE PLAN WITH 2022 NOISE CONTOURS

FIGURE 6–2

Results

The existing and 20 year noise contours indicate that the DNL contours will remain largely on industrial zoned lands. However, at the end of the 20-year period, it would appear that some noise concerns could develop in the residential areas to the west of the airport. To forestall, or eliminate these potential future concerns, consideration could be given to working with pilots and the control tower to develop flight patterns that have aircraft turn north or south somewhat prior to reaching these residential areas.

CHAPTER SEVEN
Financial Management & Development Program

The analyses conducted in the previous chapters have evaluated airport development need based on forecast activity and the associated facility requirements. One of the most important elements of the master planning process is the application of basic economic, financial and management rationale so that the feasibility of the implementation can be assured. The amount of local and outside funding (state, federal, etc.) that will be available during the current twenty-year planning cannot be guaranteed. When overall capital needs exceed available funding in any particular period, projects are generally deferred until funding can be obtained. In this situation, it is particularly important to establish and maintain priorities so that completion of the most essential improvements is assured.

Historically, the primary source of funding for major capital projects at the airport has been federal aviation trust fund monies with local matching funds provided by the Port of Portland. Eligible airport improvements receive up to 90 percent funding by FAA Airport Improvement Program (AIP) funds. The Port has also funded most non-eligible public facility improvements (buildings, vehicle parking, utilities, etc.) at Troutdale Airport. Hangar construction, which is not eligible for FAA funding, has been largely privately funded in recent years.

The Port manages a Pavement Maintenance and Management Program for the four Port-owned airports, which coordinates the project priorities and capital spending for the full range of pavement maintenance projects. The project recommendations and priorities contained in the Port's pavement program were integrated into the master plan's capital improvement program (CIP) to ensure consistency between ongoing maintenance and long-term planning. The maintenance of airfield pavements ranges from very minor items such as crack filling to seal coats and patching. Minor pavement maintenance items such as crackfilling and isolated repairs are not included in the capital improvement program, but are undertaken by the Port on a regular basis.

AIRPORT DEVELOPMENT SCHEDULE AND COST ESTIMATES

The analyses presented in Chapter Five described the airport's overall development needs for the next twenty years. Estimates of project costs were developed for each project based on 2003 dollars. A 30 percent contingency overhead for engineering, administration, and unforeseen circumstances has been included in the estimated component and total costs. In future years, as the plan is carried out, these cost estimates can continue to assist management by adjusting the 2003-based figures for subsequent inflation. This may be accomplished by converting the interim change in the United States Consumer Price Index (USCPI) into a multiplier ratio through the following formula:

$$\frac{X}{I} = Y$$

Where:

X = USCPI in any given future year
Y = Change Ratio
I = Current Index (USCPI)

USCPI
184.6 @ August 2003 (1982-1984 = 100)

Multiplying the change ratio (Y) times any 2003-based cost figures presented in this study will yield the adjusted dollar amounts appropriate in any future year evaluation.

The following sections outline the recommended development program and detailed funding distribution assumptions. The scheduling has been prepared according to the facility requirements assessment and recommended facility improvements contained in the preferred development alternative. The projected staging of development projects is based upon anticipated needs and investment priorities. Actual activity levels may vary from projected levels; therefore, the staging of development in this section should be viewed as a general guide. When activity does vary from projected levels, implementation of development projects should occur when demand warrants, rather than according to the estimated staging presented in this chapter. In addition to major development projects, the airport will require regular facility maintenance expenditures.

Due to the conceptual nature of a master plan, implementation of recommended capital projects will occur following further refinement of design and cost estimates through architectural or engineering analyses. Capital costs presented in this chapter should be viewed only as estimates, subject to subsequent refinement. Nevertheless, these estimates are considered accurate for performing the feasibility analysis in this chapter.

A summary of development costs during the twenty-year capital improvement plan is presented in **Table 7-1**. The twenty-year CIP is divided between short-term and long-term projects, which are listed in **Table 7-2**.

The tables provide a listing of all major capital projects included in the twenty-year CIP, including each project's eligibility for FAA funding. The FAA will not participate in projects such vehicle parking, hangar development, building renovations, utilities, or non-aviation developments.

The Short Term phase of the capital improvement program includes the highest priority projects to be conducted during the first five years. The CIP lists projects for each individual year within the short term period. Intermediate Term projects are expected to occur beyond the next five years, and Long Term projects are expected to occur beyond the next ten years. However, changes in demand or other conditions could accelerate or slow demand for some improvements within these projected timelines. As with most airports, pavement related improvements represent the largest portion of CIP needs at Troutdale during the current planning period:

- *Preserve/Resurface Existing Airfield Pavement* 21%
- *New or Reconstructed Airfield Pavement* 40%
- *NAVAIDS, Lighting, Marking* 6%
- *Roads and Vehicle Parking* 12%
- *Building Related Items* 8%
- *Other Items (storm drainage, wetland mitigation, etc.)* 13%

Total 100%

Table 7-1: Summary of Development Costs

Short Term (2004-2008)	$5,287,633
Intermediate Term (2009-2013)	$6,935,767
Long Term (2004-2022)	$5,571,237
Total Development Costs	**$17,794,637**

Table 7-2
20-Year Capital Improvement Program
Troutdale Airport

Short Term Projects (Years 1-5)

Project	Qty.	Unit	Unit $	Total Cost	FAA Eligible	Port
2004						
Crack Seal & Slurry Seal Rwy 7/25 North Apron & T/W A	1	LS	$240,000	$240,000	$216,000	$24,000
Sandy River Delta Tree Maintenance	1	LS	$300,000	$300,000	$270,000	$30,000
Subtotal 2004			$540,000	$540,000	$486,000	$54,000
2005						
Overlay Taxiway Alpha Exit A8 (4" AC)	1	LS	$64,400	$64,400	$57,960	$6,440
Crack Seal and Slurry Seal Taxiway B & Exits	1	LS	$80,000	$80,000	$72,000	$8,000
Subtotal 2005			$144,400	$144,400	$129,960	$14,440
2006						
Airport Signage Project	1	LS	$70,000	$70,000	$63,000	$7,000
SE Industrial/Commercial Site Develop/Wetland Mit.	1	LS	$1,000,000	$1,000,000	$0	$1,000,000
Crack Seal & Slurry Seal South Apron (atermt01)	1	LS	$90,000	$90,000	$81,000	$9,000
Overlay Taxiway Alpha between A2 and A3 Exits(4" AC)	1	LS	$479,010	$479,010	$431,109	$47,901
Mill & Overlay North Apron (2")(an02)	1	LS	$50,400	$50,400	$45,360	$5,040
Subtotal 2006			$1,689,410	$1,689,410	$620,469	$1,068,941
2007						
Airfield Storm Drain Upgrade	1	LS	$760,000	$760,000	$684,000	$76,000
Mill & Overlay SE HangarTaxiways(2") (hang01tc,01,02,03,03a,03b,11&12 exc. tenant areas)	1	LS	$155,000	$155,000	$139,500	$15,500
Mill & Overlay N Access Rd. (4") (c-w sec.,rdtow01-05)	1	LS	$250,000	$250,000	$225,000	$25,000
Reconstruct NW Vehicle Pkg. (5")(N of Cascade,pan01)	1	LS	$57,400	$57,400	$0	$57,400
Subtotal 2007			$1,222,400	$1,222,400	$1,048,500	$173,900
2008			$0	$0	$0	$0
Rehabilitate S. Terminal Access Rds (4")(E-W rdent02 & N-S rdent01)	1	LS	$80,000	$80,000	$72,000	$8,000
Mill & Overlay SE HangarTaxiways(2") (hang04a,04b,05,07 &09)	1	LS	$291,200	$291,200	$262,080	$29,120
Reconstruct SE Access Rd & Auto Pkg.(4")(Gorge Winds, rdhang01 &phang01)	1	LS	$100,000	$100,000	$90,000	$10,000
Subtotal 2008			$471,200	$471,200	$424,080	$47,120
Subtotal Short Term Projects (Years 1-5)				***$4,067,410***	***$2,709,009***	***$1,358,401***
30% Engineering & Contingency				*$1,220,223*	*$812,703*	*$407,520*
Total Short Term Projects (Years 1-5)				***$5,287,633***	***$3,521,712***	***$1,765,921***

Intermediate Term Projects (Years 6-10)

Project	Qty.	Unit	Unit $	Total Cost	FAA Eligible	Port
Overlay North Vehicle Pkg Lot (both sections) (4" AC)	1	LS	$238,000	$238,000	$0	$238,000
Mill & Overlay N T-Hngr Taxiways (2" AC)	1	LS	$215,600	$215,600	$194,040	$21,560
Overlay South Terminal Vehicle Parking Lot (4" AC)	1	LS	$385,000	$385,000	$0	$385,000
Reconstruct Runway 7/25, Exits & Drainage Sys.	1	LS	$2,500,000	$2,500,000	$2,250,000	$250,000
Relocate South Parallel Taxiway (Bravo) (5,400x50') w/ Eight Exit Txy. Extensions; Demo old pavement	32,450	SY	$30	$973,500	$876,150	$97,350
Medium Intensity Taxiway Lights (MITL) - New Txy Bravo	5,400	LF	$40	$216,000	$194,400	$21,600
Demo Existing Hangars (for Txy Bravo Reloc.)	38,000	SF	$2.75	$104,500	$94,050	$10,450
High Speed Exit Taxiway w/ lighting	3,000	SY	$30	$106,000	$95,400	$10,600
Slurry Seal North Apron (Western & Cascade)	7,639	SY	$2.25	$17,188	$15,469	$1,719
Slurry Seal North Apron (ATCT to Western AC)	10,000	SY	$2.25	$22,500	$20,250	$2,250
Slurry Seal Premier Bldg. Apron (bldg front to Alpha)	7,111	SY	$2.25	$16,000	$14,400	$1,600
Slurry Seal NE Apron (Right Approach)	5,833	SY	$2.25	$13,124	$11,812	$1,312
Slurry Seal Premier/Fuel Area Apron	10,556	SY	$2.25	$23,751	$21,376	$2,375
Slurry Seal Gorge Winds Apron	1,000	SY	$2.25	$2,250	$2,025	$225
Slurry Seal South Apron	24,756	SY	$2.25	$55,701	$50,131	$5,570
Slurry Seal South Parallel Taxiway (Bravo)	37,622	SY	$2.25	$84,650	$76,185	$8,465
Slurry Seal South (former Premier) Apron	2,067	SY	$2.25	$4,651	$4,186	$465

Slurry Seal SE Apron (Eagle Air)	4,333	SY	$2.25	$9,749	$8,774	$975
Slurry Seal North Parallel Taxiway (Alpha) & Hold Areas	45,241	SY	$2.25	$101,792	$91,613	$10,179
Medium Intensity Runway Lights (MIRL) - New	5,400	LF	$40	$216,000	$194,400	$21,600
Slurry Seal North T-Hangar Taxiways	13,000	SY	$2.25	$29,250	$26,325	$2,925
Subtotal Intermediate Term Projects (Years 6-10)				***$5,335,206***	***$4,240,985***	***$1,094,221***
30% Engineering & Contingency				*$1,600,562*	*$1,272,295*	*$328,266*
Total Intermediate Term Projects (Years 6-10)				***$6,935,767***	***$5,513,280***	***$1,422,487***

Long Term Projects (Years 11-20)

Project	Qty.	Unit	Unit $	Total Cost	FAA Eligible	Port
Airport Building Maintenance Projects	1	LS	$979,600	$979,600	$0	$979,600
Overlay SE Access Rd (E of Main Apron) (4" AC)	1	LS	$103,298	$103,298	$92,968	$10,330
Overlay N. Access Rd (4") (east section,rdtow01-05)	1	LS	$300,000	$300,000	$270,000	$30,000
Overlay SE Hangar Main Taxiway (Mill & 2"AC)	5,000	SY	$16	$80,000	$72,000	$8,000
Overlay North Apron (ATCT to Western AC) (3" AC)	10,000	SY	$16	$160,000	$144,000	$16,000
Overlay Premier Bldg. Apron (bldg front to Alpha) (3"AC)	7,111	SY	$16	$113,776	$102,398	$11,378
Overlay Premier/Fuel Area Apron (3" AC)	10,556	SY	$16	$168,896	$152,006	$16,890
Overlay NE Apron (Emerald to W. End of Old Hng) (2" AC)	10,667	SY	$12	$128,004	$115,204	$12,800
Overlay Gorge Winds Apron (2" AC)	1,000	SY	$12	$12,000	$10,800	$1,200
High Speed Exit Taxiway w/ lighting	3,000	SY	$30	$106,000	$95,400	$10,600
North Access Road Extension	1,500	LF	$55	$82,500	$74,250	$8,250
South Access Road Extension	1,000	LF	$55	$55,000	$49,500	$5,500
North Corporate AC Apron (new)	6,667	SY	$29	$193,333	$174,000	$19,333
North T-Hangar Taxilanes (new)	5,000	SY	$29	$145,000	$130,500	$14,500
Northwest Corporate Hangar Apron	10,000	SY	$29	$290,000	$261,000	$29,000
PAPI (replace existing VASI)	2	ea	$60,000	$120,000	$108,000	$12,000
Compass Rose Marking/Calibration	1	LS	$10,000	$10,000	$9,000	$1,000
Slurry Seal North Apron (Western & Cascade)	7,639	SY	$2.25	$17,188	$15,469	$1,719
Slurry Seal North Apron (ATCT to Western AC)	10,000	SY	$2.25	$22,500	$20,250	$2,250
Slurry Seal Premier Bldg. Apron (bldg front to Alpha)	7,111	SY	$2.25	$16,000	$14,400	$1,600
Slurry Seal NE Apron (Right Approach)	5,833	SY	$2.25	$13,124	$11,812	$1,312
Slurry Seal Premier/Fuel Area Apron	10,556	SY	$2.25	$23,751	$21,376	$2,375
Slurry Seal Gorge Winds Apron	1,000	SY	$2.25	$2,250	$2,025	$225
Slurry Seal South Apron	24,756	SY	$2.25	$55,701	$50,131	$5,570
Slurry Seal SE Apron (Eagle Air)	4,333	SY	$2.25	$9,749	$8,774	$975
Slurry Seal South Parallel Taxiway (Bravo)	37,622	SY	$2.25	$84,650	$76,185	$8,465
Slurry Seal North Parallel Taxiway (Alpha) & Hold Areas	45,241	SY	$2.25	$101,792	$91,613	$10,179
Slurry Seal Rwy 7/25; repaint markings	90,000	SY	$3.00	$280,000	$252,000	$28,000
Medium Intensity Taxiway Lights (MITL) - Replacement for North Parallel Taxiway (Alpha)	5,400	LF	$40	$216,000	$194,400	$21,600
Slurry Seal North Apron (Western & Cascade)	7,639	SY	$2.25	$17,188	$15,469	$1,719
Slurry Seal North Apron (ATCT to Western AC)	10,000	SY	$2.25	$22,500	$20,250	$2,250
Slurry Seal Premier Bldg. Apron (bldg front to Alpha)	7,111	SY	$2.25	$16,000	$14,400	$1,600
Slurry Seal NE Apron (Right Approach)	5,833	SY	$2.25	$13,124	$11,812	$1,312
Slurry Seal Premier/Fuel Area Apron	10,556	SY	$2.25	$23,751	$21,376	$2,375
Slurry Seal Gorge Winds Apron	1,000	SY	$2.25	$2,250	$2,025	$225
Slurry Seal South Apron	24,756	SY	$2.25	$55,701	$50,131	$5,570
Slurry Seal SE Apron (Eagle Air)	4,333	SY	$2.25	$9,749	$8,774	$975
Slurry Seal South Parallel Taxiway (Bravo)	37,622	SY	$2.25	$84,650	$76,185	$8,465
Slurry Seal North Parallel Taxiway (Alpha) & Hold Areas	45,241	SY	$2.25	$101,792	$91,613	$10,179
Slurry Seal North Corporate AC Apron (new)	6,667	SY	$2.25	$15,000	$13,500	$1,500
Slurry Seal North T-Hangar Taxilanes (new)	5,000	SY	$2.25	$11,250	$10,125	$1,125
Slurry Seal Northwest Corporate Hangar Apron	10,000	SY	$2.25	$22,500	$20,250	$2,250
Subtotal Long Term Projects (Years 11-20)				***$4,285,567***	***$2,975,370***	***$330,597***
30% Engineering & Contingency				*$1,285,670*	*$892,611*	*$99,179*
Total Long Term Projects (Years 11-20)				***$5,571,237***	***$3,867,981***	***$429,776***

CIP Summary				Total Cost*	FAA Eligible	Port
Total Short Term Projects (0-5 years)				**$5,287,633**	**$3,521,712**	**$1,765,921**
Total Long Term Projects (6-11 years)				**$6,935,767**	**$5,513,280**	**$1,422,487**
Total Long Term Projects (12-20 years)				**$5,571,237**	**$3,867,981**	**$429,776**
Total				**$17,794,637**	**$12,902,973**	**$3,618,184**

* Includes 30% Engineering and Contingency (2003 dollars)

Short Term Projects (1-5 Years)

Pavement maintenance and rehabilitation projects represent a significant portion of the short term projects at Troutdale. Crack fill and slurry seal projects are scheduled for the runway, Taxiway Alpha (north parallel) and south apron. Overlay or other pavement rehabilitation projects are planned for sections of Taxiway Alpha, sections of the north apron, and several hangar taxilanes in the southeast section of the airport. Taxiway Bravo (south parallel), will undertake slurry seals during the interim, and not a rehabilitation, since it is planned for relocation within 10 years (FAA standard for funding). The Port will also be conducting several pavement rehabilitation projects for airport access roads and vehicle parking areas on both the north and south sides of the airport. An airport signage plan project is included.

Two other large projects planned within the short term period include upgrades to the existing stormwater drainage system and site development work for a future industrial/commercial site in the southeast section of the airport. It is anticipated that the site development project will also include a wetland mitigation component, although the specific mitigation strategies will be determined through separate study and design.

Intermediate Term Projects (6-10 years)

The intermediate term of the CIP continues with numerous pavement maintenance and rehabilitation projects, including slurry seals for most aprons, both parallel taxiways and several hangar taxiway/taxilanes. Pavement overlay projects are planned for the north and south terminal area vehicle parking lots during this period.

Two major airfield pavement projects are planned for this period that will involve reconstruction or new construction. Runway 7/25 will require reconstruction (overlay) and may also be narrowed at that time to 100 feet. At the time the runway is narrowed, the medium intensity runway edge lighting (MIRL) system is planned for replacement and the existing stormwater drainage system (based on the existing 150-foot wide runway) will need to be modified. The existing nonprecision instrument runway markings will also be replaced and the existing exit taxiways connecting on either side of the runway will need to be modified to reflect the change in runway width.

In a separate project, Taxiway Bravo will be relocated approximately 40 feet south to meet FAA runway separation standards (the existing taxiway will be removed). Several existing hangars located near the southeast end of the airport (nearest the parallel taxiway) will need to be removed/relocated to accommodate the new Taxiway Bravo and the required clear area for use by larger air tanker aircraft. The Taxiway Bravo and hangar removal project is currently planned toward the end of the intermediate term (8-10 years) based on existing building leases and the condition of the taxiway. The existing medium intensity taxiway lighting (MITL) system is planned for replacement as part of the taxiway relocation project. An additional high speed exit is planned for Runway 7/25. A decision about the best location and direction for the exit will be made as part of the pre-design phase based on traffic needs at the time the project is completed.

Long Term Projects (11-20 Years)

The majority of long-term projects at Troutdale involve pavement preservation, resurfacing, reconstruction or new construction. This includes periodic slurry seals for all airfield pavements on approximately a five-year cycle. Asphalt overlays will be required for several aircraft aprons located on both sides of the runway. Projected new construction includes additional corporate apron areas and hangar taxilanes on the north side of the runway. These timing of these facilities will be heavily affected by market conditions and overall demand for additional space on the airport. A second additional high speed exit is planned as a long-term project. Some of the projects identified toward the end of the long-term period will likely be developed beyond the 20-year planning period, as future demand for facility improvements may change. In addition, the projects identified early in the long-term period may be undertaken sooner if funding is available or the demand for specific projects increases.

The Port has identified several building maintenance projects for existing buildings that are not currently eligible for FAA funding. Long term lighting improvements include replacement of the existing MITL on Taxiway Alpha and the replacement of existing VASI units with new-generation precision approach path indicators (PAPI).

Long term roadway improvements are planned in conjunction with expansion of aviation facilities on the airfield; overlays are planned for existing airport access roads (north and southeast sections of airport).

Financing Of Development Program

Federal Grants

A primary source of potential funding identified in this plan is the Federal Airport Improvement Program (AIP). As proposed, approximately 72 percent of the airport's 20-year CIP will be eligible for federal funding. Funds from this program are derived from the Aviation Trust Fund, which is the depository for all federal aviation taxes collected on such items as airline tickets, aviation fuel, lubricants, tires, aircraft registrations, and other aviation-related fees. These funds are distributed under appropriations set by Congress to all airports in the United States that have certified eligibility. The funds are distributed through grants administered by the Federal Aviation Administration (FAA).

Under current guidelines, the airport sponsor receives 90 percent participation on eligible projects. According to FAA guidelines, the Port of Portland is eligible under the Airport Improvement Program (AIP) to receive general aviation entitlement and discretionary grants.

Under current congressional funding authorization, airports like Troutdale are eligible to receive up to $150,000 per year to use on eligible airport improvement projects. The future availability of the GA non-primary entitlement funding is dependent on congressional reauthorization and may change during the planning period. However, based on current legislation, these grants have become a very significant source of FAA funding for general aviation airports. Airports may combine up to three years of GA entitlement funding for projects. Discretionary grants are also used for larger projects that require additional funding.

The limitations of AIP funding will dictate in large part, the actual schedule for completing airport improvement projects through the planning period. Based on the competition for dollars at general aviation airports, it is unlikely that AIP grant monies will be available every year. As a result, some projects may be occasionally deferred until adequate funding can be obtained.

State Funding

The State of Oregon Department of Aviation operates a program to assist airport sponsors with pavement maintenance and associated improvements (crack filling, repair, sealcoats, etc.), which have not traditionally been eligible for FAA funding. The Port of Portland does not currently participate in the ODA pavement maintenance program; however, the Port has worked with closely with FAA in developing a pilot program which addresses funding for airport pavement maintenance at general aviation airports.

Financing the Local Share of Capital Improvements

Several airport improvement projects identified in the master plan are not eligible for federal funding. Revenues generated at the airport through land leases, fuel sales, hangar rentals, etc., are used to support the airport maintenance and operations and the capital improvement program. The Port of Portland is responsible for coordinating the financial management for its three general aviation airports in addition to PDX. Within this system, the maintenance, operating and capital budgets for each individual airport are managed to address the most critical needs and to reflect the limitations of funding.

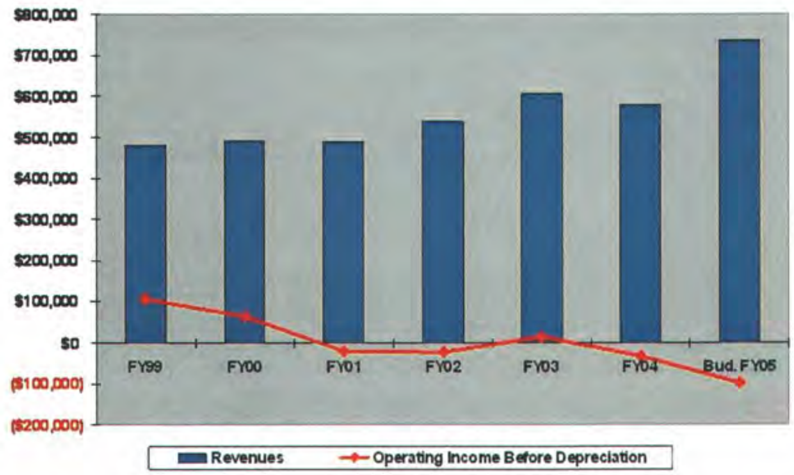
Private funding for aircraft hangar construction, business-related facilities and other tenant items has, and is expected to continue being a significant part of the overall financial investment required during the planning period at Troutdale Airport.

Operational Cash Flow Analysis

The finances of a publicly operated general aviation airport like Troutdale are remarkably complex[1]. Sources of operating revenue include land leases to fixed-base operators, hangar rentals, fuel flowage and landing fees and non aviation land leases (often for agricultural, industrial, or commercial uses). Calls upon this revenue are equally diverse: staff to manage and maintain airport facilities, creation of new facilities to improve capacity or safety and on-going maintenance of the extensive pavements that are the heart of every airport. The sources of airport revenue generated at the airport itself are seldom enough to fully cover these operating costs. Airport Improvement Program (AIP) grants from the FAA and Port cost center (aviation) income have been crucial to updating the infrastructure at TTD.

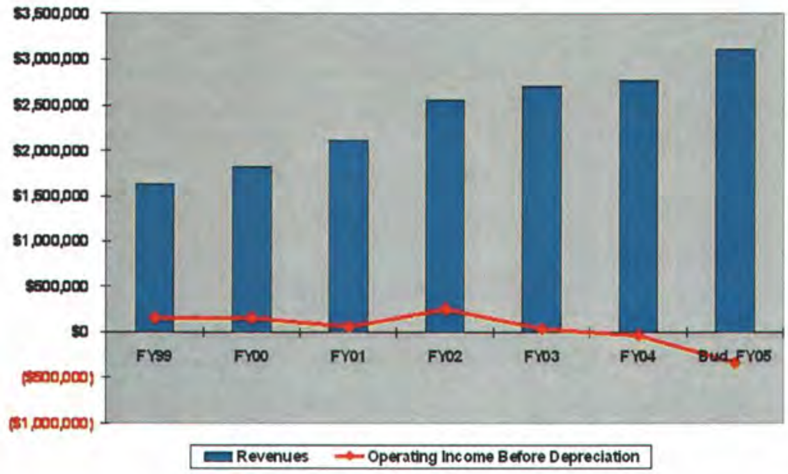
Over the past six years, Troutdale airport (TTD) has been able to cover its operating expenses (day-to-day) and a minimal amount of capital. Over the long-term, TTD is expected to continue covering its operating expenses but not contribute significantly to any capital expenses. Including the FY '04-05 budget, TTD is projected to generate only $2,300 (operating income before depreciation) towards capital expenses over the most recent seven year period. The Port's General Aviation (GA) program as a whole is expected to generate $265,000 towards capital over the same time period. The annual financial results are depicted in Exhibits 7-1 and 7-2. Most of GA's operating income comes from the Hillsboro Airport where much higher activity levels and a much more diverse revenue stream exist.

Exhibit 7-1
Troutdale Airport (TTD)
Operating Results



[1] Operational Cash Flow information provided by Port of Portland, August, 2004.

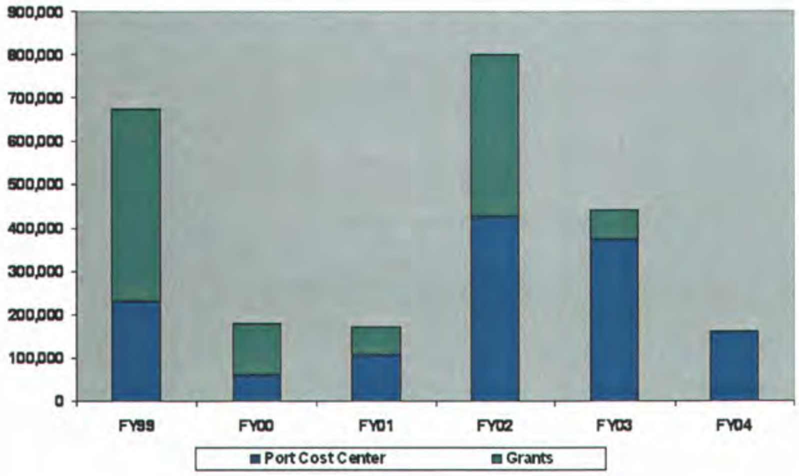
Exhibit 7-2
General Aviation
Operating Results



The Port recently completed a fair market value appraisal of Troutdale airport. TTD ground rental rates were increased to $0.25 psf from $0.22. This is the first increase since 1996 and will generate an additional $7,500 this fiscal year. The rate increase will generate additional dollars as tenants' rent adjustment dates come due. The Port continues to review all airport rates and charges, along with non-airside development, to increase revenues in a fair and prudent way. The capital improvement plan contained in this report includes $2.3M in facilities intended to support new tenant development, both airside and non-airside. However, it is unlikely the Port will invest in the improvements until the market supports a reasonable rate of return for the Port.

Much of the capital funding for the GA airports will continue to come from Federal Grants and the Port cost center. The Port cost center represents the financial conglomeration of several aviation business lines including: Parking, Rental Cars, PDX airside and non-airside, and General Aviation. Approximately $13.0M of the $17.9M twenty year capital plan contained in this report is eligible for grant funding. This does not mean that all the projects listed will receive grant funding, but they could. Exhibit 7-3 shows the previous six years of capital expenses at TTD, broken-down by the funding sources. Deferring major capital projects can have consequences as well. If the Port needs to delay maintenance items, operating expenses could rise in the near term to keep the airport operational.

Exhibit 7-3
Troutdale Airport (TTD)
Capital Spending



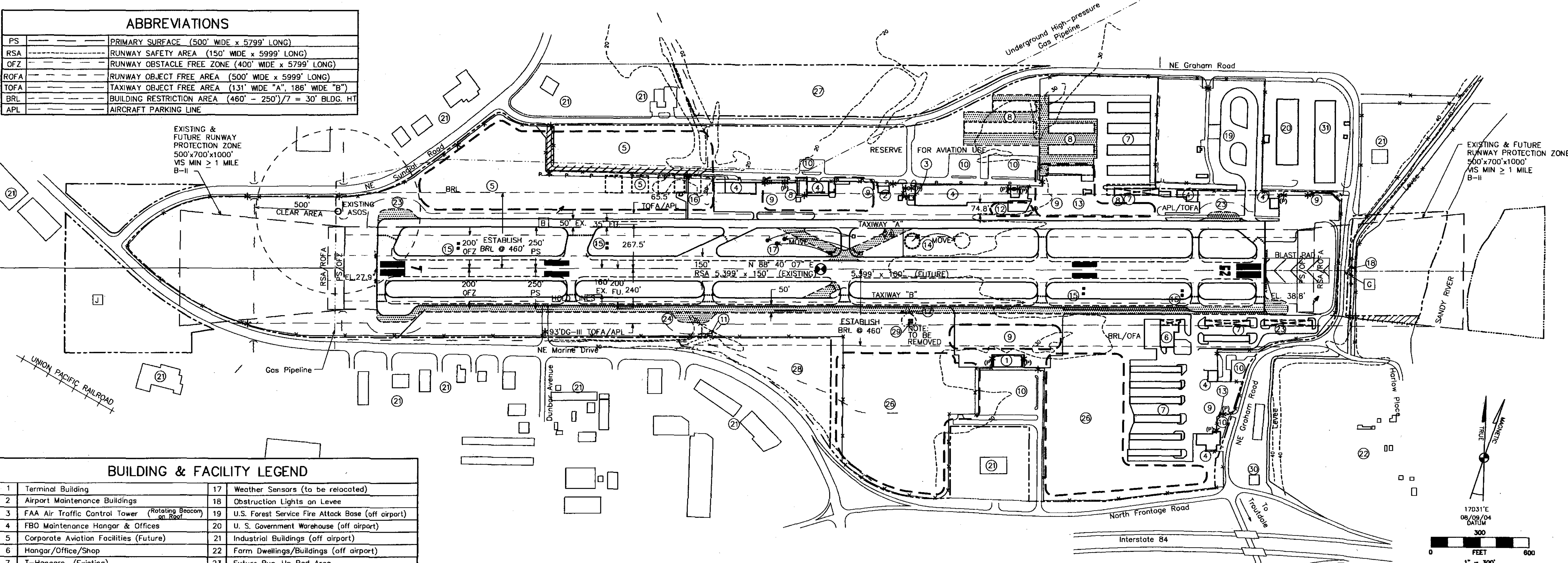
The Port will need to balance the financial demands of all four of its airports and maximize outside funding sources while exercising considerable financial discipline with its own resources.

- Assume operating cash flows are not able to cover any capital dollars.
- The Port has recently completed a land appraisal for TTD which will increase the land rental rates from $0.22 psf to $0.25 psf. The rate had not changed since 1996 and will generate an additional $7,500 in FY05.
- Revenues dipped in FY04 but are expected to grow in FY05. OIBD is expected to be negative, which it has been four out of the last five years.
- Assume operating cash flows will not cover capital expenditures. Assume PCC and Grant funding will be needed for all maintenance projects. Assume $1M in growth projects in the first five years will need to generate a normal return on investment. Also, the $766,000 in growth projects in years 11 – 20 will need to generate similar returns.
- Assume growth in operational expenses covering all categories. Expect expenses to rise with revenues over the long-term.

CHAPTER EIGHT
Airport Layout Plans

The airport layout plans are contained on the following 11" x 17" pages at half size of originals, and include the following sheets:

- Drawing 1a: Airport Layout Plan Drawing 1a
- Drawing 1b: Airport Layout Plan Drawing 1b
- Drawing 2a: FAR Part 77 Airspace Plan Drawing 2a
- Drawing 2b: Runway Surface Approach Plan and Profile Drawing 2b
- Drawing 3: Airport Land Use Plan with 2022 Noise Contours Drawing 3



ABBREVIATIONS

PS		PRIMARY SURFACE (500' WIDE x 5799' LONG)
RSA		RUNWAY SAFETY AREA (150' WIDE x 5999' LONG)
OFZ		RUNWAY OBSTACLE FREE ZONE (400' WIDE x 5799' LONG)
ROFA		RUNWAY OBJECT FREE AREA (500' WIDE x 5999' LONG)
TOFA		TAXIWAY OBJECT FREE AREA (131' WIDE "A", 186' WIDE "B")
BRL		BUILDING RESTRICTION AREA (460' - 250')/7 = 30' BLDG. HT
APL		AIRCRAFT PARKING LINE

BUILDING & FACILITY LEGEND

1	Terminal Building	17	Weather Sensors (to be relocated)
2	Airport Maintenance Buildings	18	Obstruction Lights on Levee
3	FAA Air Traffic Control Tower (Rotating Beacon on Roof)	19	U.S. Forest Service Fire Attack Base (off airport)
4	FBO Maintenance Hangar & Offices	20	U. S. Government Warehouse (off airport)
5	Corporate Aviation Facilities (Future)	21	Industrial Buildings (off airport)
6	Hangar/Office/Shop	22	Farm Dwellings/Buildings (off airport)
7	T-Hangars (Existing)	23	Future Run-Up Pad Area
8	T-Hangars (Future)	24	Future Passing Lane Pullout Area
9	Aircraft Apron (General)	26	Future Development
10	Automobile Parking	27	Not used
11	Sewer Lift Station	28	Property to be Acquired
12	Aircraft Apron (Transient Corporate)	29	Water Pump (Abandoned, to be removed)
13	Fueling Facility/Underground Tanks	30	Hotel & Restaurant (off airport)
14	Segmented Circle (to be relocated)	31	Mt. Hood Community College (off airport)
15	Visual Approach Slope Indicator		
16	Remote Transmitter Receiver		

AIRPORT DATA

		EXISTING	FUTURE
AIRPORT REFERENCE CODE		B-II	Same
AIRPORT SERVICE LEVEL (NPIAS)		Reliever	Same
RUNWAY CLASSIFICATION		General Utility II	Same
DATUM FOR ALL ITEMS		NAD83/NAVD88	Same
AIRPORT REFERENCE POINT [A]	Latitude	45° 32' 57.73" N	Same
	Longitude	122° 24' 04.51" W	Same
AIRPORT ELEVATION (Feet above MSL) [A]		38.8'	Same
MEAN MAX. TEMP. (Hottest month)		82°	Same
TERMINAL NAVIGATIONAL AIDS [D]		NDB	GPS
AIRPORT ACREAGE	Fee Title	251.20±	256.55±
	Easement	7.36±	13.18±
BASED AIRCRAFT SPACES	Tiedowns Used	29	42
	Hangar Spaces	164	235
TRANSIENT AIRCRAFT SPACES (TOTAL)		132 (33 REQUIRED)	95 (45 REQUIRED)

NOTES

[A] Existing coordinate data from National Oceanic and Atmospheric Administration As listed in www.airnav.com web site.

[B] In future, when Taxiway "A" is reconstructed, it will be constructed at 35' width in lieu of existing 50'. However, 267.5' separation from runway will be retained

[C] Source: FAA Airport Master Record (Form 5010).

[D] Existing nonprecision approach is circle-to-land. Future nonprecision GPS approach may include a straight-in, or offset approach, for one or both ends.

[E] Established runway protection zones have been the basis for past property acquisition.

[F] Clear slopes calculated from Airport Obstruction Chart data.

[G] Road (vehicle) penetrates approach surface, is allowed as a modification to standards, see I below.

[H] Complete airport perimeter is fenced.

[I] Deviations from FAA standards:
- Road (vehicle) penetration of Runway 25 approach surface.
- Separation between runway and south parallel taxiway is 40 feet less than B-II standard 240'. (This will be resolved with future Taxiway B project as shown.

[J] See Master Plan text for discussion of potential area roadway changes required should airport in the future change to C-II classification to serve faster corporate aircraft. Larger required safety areas cause runway and RPZ to move further west.

DRAWING LEGEND

	EXISTING	FUTURE
ACTIVE AIRFIELD PAVEMENT		
OTHER PAVEMENT		
PAVEMENT TO BE REMOVED (RUNWAY AND TAXIWAY NOT SHOWN)		
PERIMETER FENCE		
GRAVEL SHOULDER/ROAD		
AIRPORT PROPERTY LINE		
AVIGATION EASEMENT		
OTHER PROPERTY LINES		
BUILDINGS		
BUILDINGS TO BE REMOVED		
VEHICLE GATE ((P) = PEDESTRIAN GATE)	*	⊛
TOPOGRAPHIC CONTOURS	XXX	
WATER COURSE & BRIDGE/CULVERT		
POWER LINE	P P	
AIRFIELD LIGHTS: SINGLE/FLASHING		
WIND CONE		
THRESHOLD LIGHTS (FUTURE W/ REIL)		
ROTATING BEACON		☆
AIRPORT REFERENCE POINT		⊕
HOLD LINE		
PAPI/VASI		

RUNWAY DATA

			RUNWAY 7 - 25 EXISTING	FUTURE
PHYSICAL LENGTH AND WIDTH			5,399' X 150'	5,399' X 100'
EFFECTIVE GRADIENT			0.2%	Same
PAVEMENT STRENGTH (1000#) S/D/DT [C]			19/-/-	19/25/-
PAVEMENT SURFACE			Asphalt	Same
RUNWAY SAFETY AREA (RSA)			5,999' X 150'	Same
OBJECT FREE AREA (OFA)			5,999' X 500'	Same
OBSTACLE FREE ZONE (OFZ)			5,799' X 400'	Same
CRITICAL AIRCRAFT			Citation II	Same
APPROACH TYPE	7		Visual [D]	Same
	25		Visual [D]	Same
APPROACH SLOPE: REQUIRED/CLEAR [E] [F]	7		20:1/50±:1	34:1
	25		20:1/14:1 [G]	34:1
APPROACH AND LANDING AIDS	7		REILS; VASI-3.0°	Same
	25		REILS; VASI-3.0°	Same
RUNWAY END COORDINATES [A]	7	Latitude	45° 32' 57.11" N	Same
		Longitude	122° 24' 42.43" W	Same
	25	Latitude	45° 32' 58.34" N	Same
		Longitude	122° 23' 26.59" W	Same
TDZE	7		32.0'	Same
	25		35.0'	Same
RUNWAY LIGHTING			Medium Intensity	Same
TAXIWAY LIGHTING			Medium Intensity	Same
RUNWAY MARKING			Nonprecision	Same
WIND COVERAGE %			97.9%	Same

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SIGNATURE

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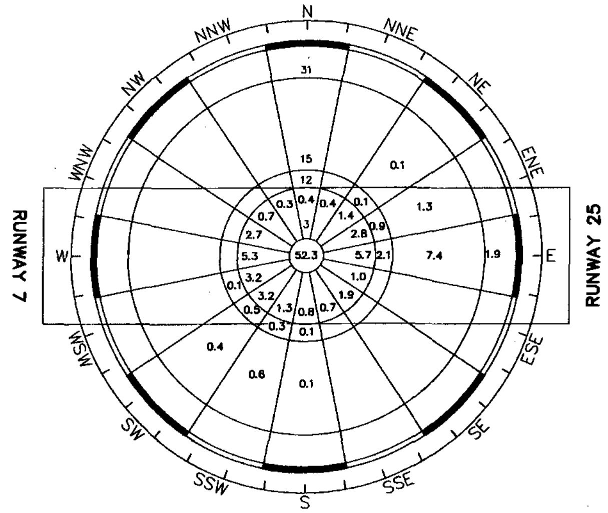
DESIGNED BY:	DRAWN BY:	CHECKED BY:	SCALE:
AF	MB	DM	1" = 300'
DATE: OCTOBER 6, 2004		PROJECT: TROUTDALE-1a	

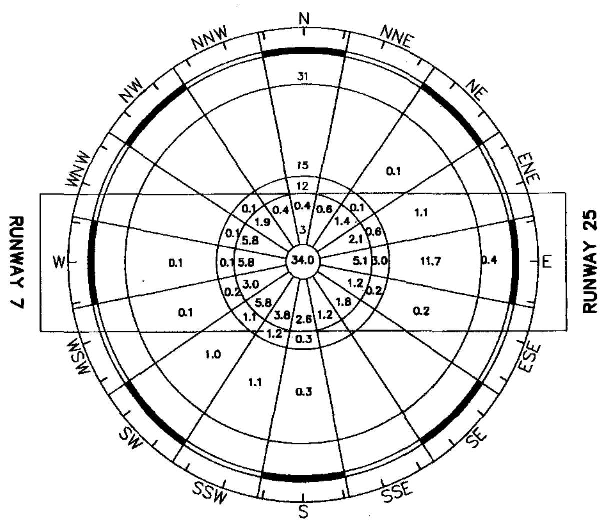
TROUTDALE AIRPORT
AIRPORT LAYOUT PLAN UPDATE

AIRPORT LAYOUT PLAN

DRAWING NO. 1a



LOW VISIBILITY
COVERAGE: RUNWAY 7 – 25 96.6%
CEILING – 1000 FEET AND/OR VISIBILITY – 3 MILES
BUT MORE THAN 200 FEET AND 1/2 MILE

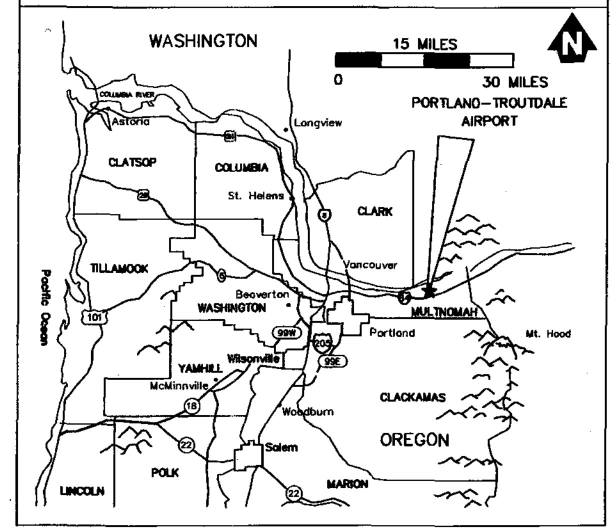


ALL WEATHER
COVERAGE: RUNWAY 7 – 25 97.9%

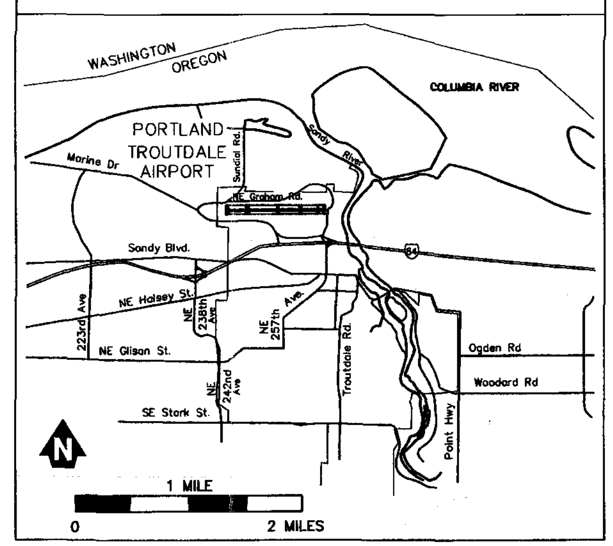
WIND ROSES

LOCATION OF OBSERVATION:
STATION NO. 24242, TROUTDALE, OREGON
PERIOD OF OBSERVATION:
7/49 – 3/51 (24 OBS/DAY) AND 4/51 – 3/53 (6 – 18 OBS/DAY)
*WIND VELOCITIES ARE IN MILES PER HOUR

LOCATION MAP



VICINITY MAP



DECLARED DISTANCES

	RUNWAY 7	RUNWAY 25
DISPLACED THRESHOLD (Approach ends)	0'	0'
STOPWAY (Stop End)	0'	0'
CLEARWAY (Stop ends)	0'	0'
TAKEOFF RUN AVAILABLE (TORA)	5,399'	5,399'
TAKEOFF DISTANCE AVAILABLE (TODA)	5,399'	5,399'
ACCELERATE – STOP DISTANCE AVAILABLE (ASDA)	5,399'	5,399'
LANDING DISTANCE AVAILABLE (LDA)	5,399'	5,399'

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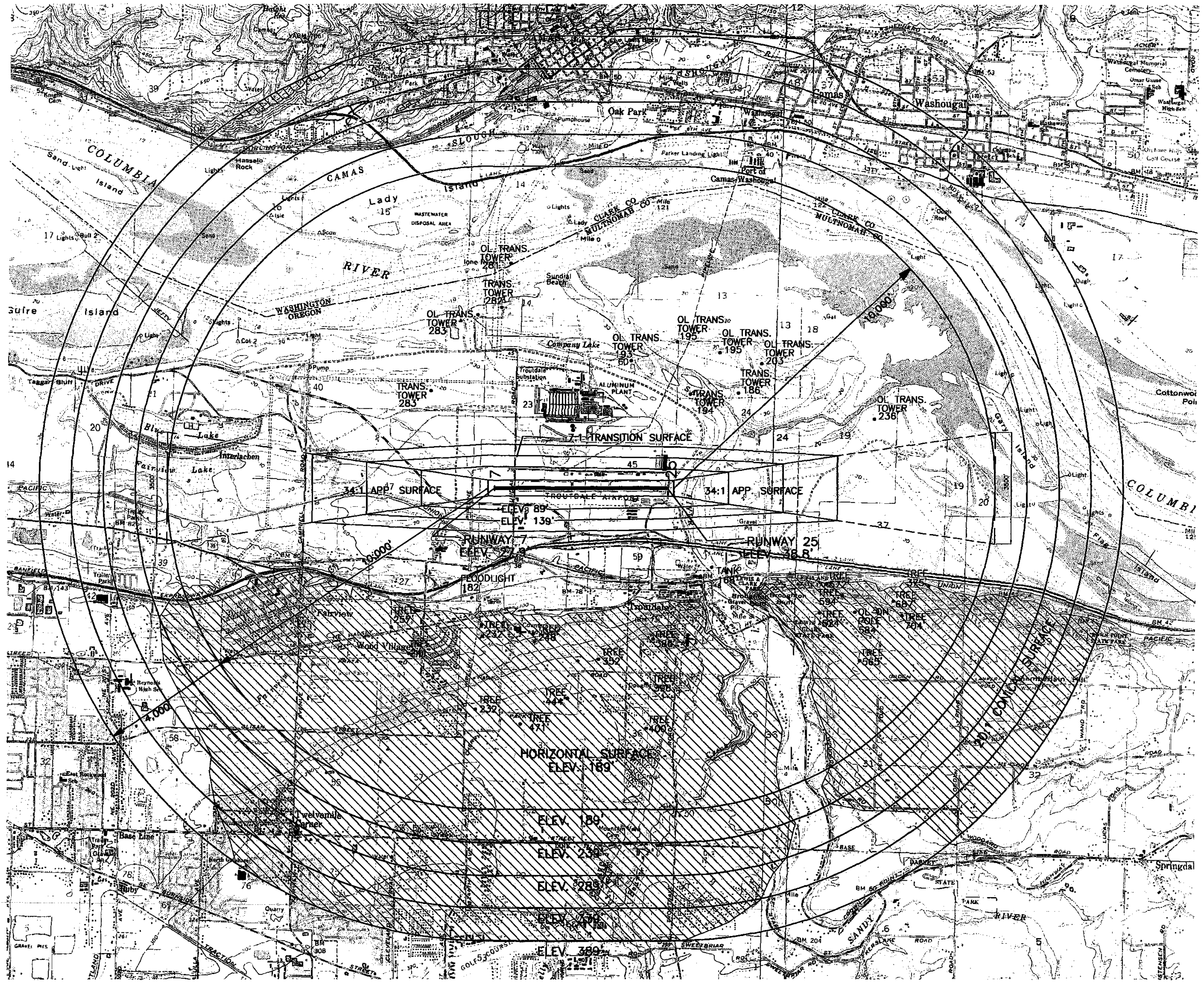
DATE: AUGUST 21, 2003 R | PROJECT: TROUTDALE–1b

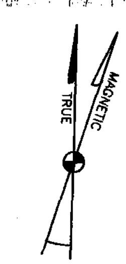
TROUTDALE AIRPORT
AIRPORT LAYOUT PLAN UPDATE

AIRPORT LAYOUT PLAN

DRAWING NO. 1b
SHEET NO. 2 OF 5



2000' 0 2000' 4000'



KEY:

1. TERRAIN OBSTRUCTION CROSS-HATCH IS GROUND ELEVATION FROM USGS TOPO QUAD PLUS 80 FEET FOR TYPICAL LARGE DOUGLAS FIR TREE (OR TELEPHONE POLE).
2. OBSTRUCTION

PLAN NOTES:

1. TR = TRANSITIONAL
   AP = APPROACH
   C = CONICAL
   H = HORIZONTAL
   DIST = DISTANCE FROM RUNWAY END
2. OBSTRUCTIONS NUMBERED 1 THROUGH 20 USE SAME I.D. NUMBERS AS IN CHART OC649.
3. OBSTRUCTION ELEVATIONS ALL OBTAINED FROM CHART OC649.
4. OBSTRUCTIONS UNDER TRANSITIONAL AND INNER APPROACH SURFACES ARE SHOWN ON SHEET 4.

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AF	MB	DM	1" = 2000'
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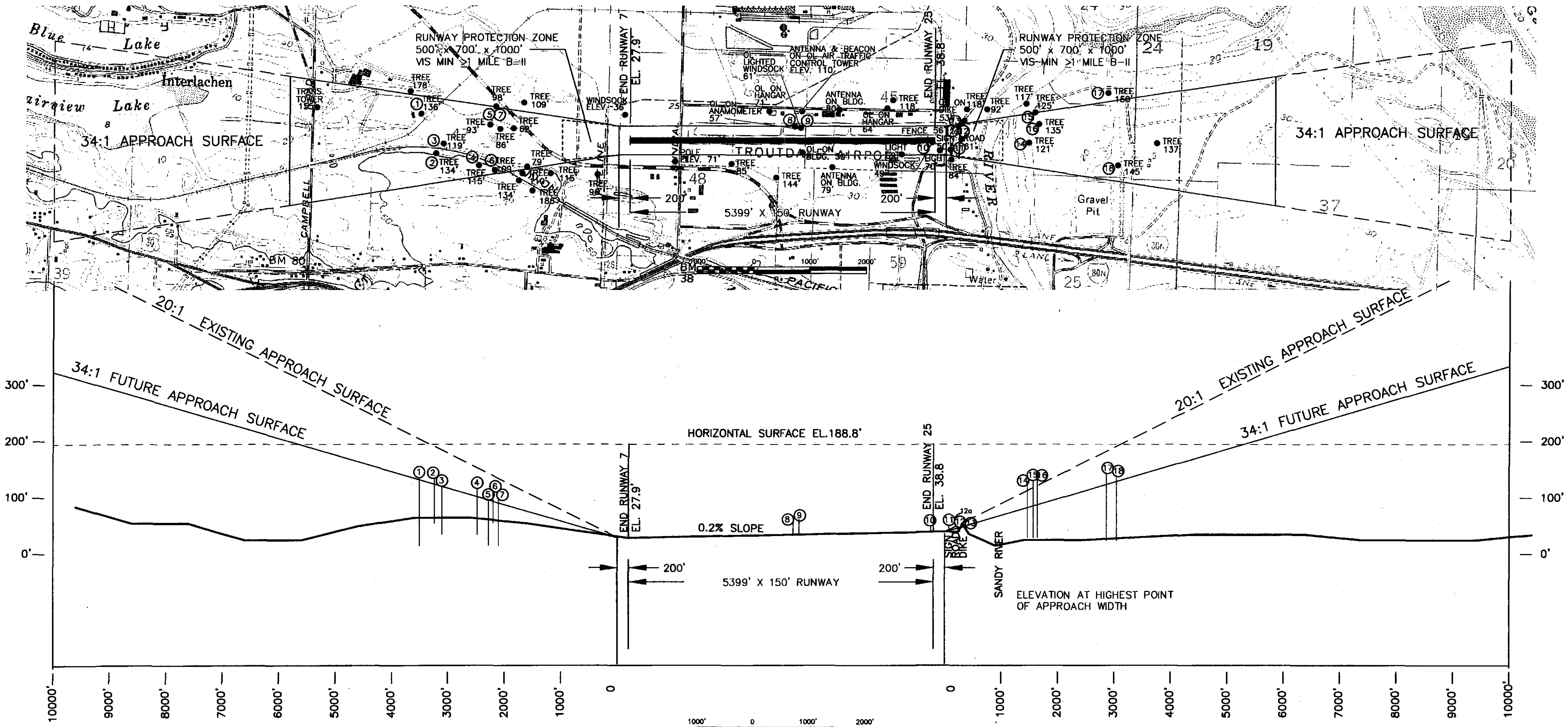
TROUTDALE AIRPORT
AIRPORT LAYOUT PLAN UPDATE

FAR PART 77 AIRSPACE PLAN

DRAWING NO. 2a

SHEET NO. 3 OF 5



SCALE OF FEET
HORIZONTAL SCALE: 1" = 1000'

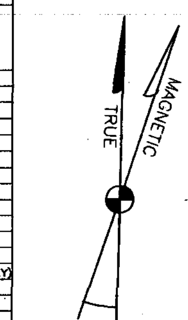
SCALE OF FEET
VERTICAL SCALE: 1" = 100'

NOTES:

1. GROUND PROFILE IS A COMPOSITE OF THE HIGHEST ELEVATIONS ACROSS THE WIDTH OF THE APPROACH.
2. TR = TRANSITIONAL
   AP = APPROACH
   P = PRIMARY
   C = CONICAL
   H = HORIZONTAL
   DIST = DISTANCE FROM RUNWAY END
3. UPON ALP APPROVAL, IT IS THE PORT'S RESPONSIBILITY TO ACCOMPLISH THE OBSTRUCTION DISPOSITION.
4. OBSTRUCTIONS NUMBERED 1 THROUGH 20 USE SAME ID NUMBERS AS IN CHART OC649 DATED 1993.
5. ALL OBSTRUCTION ELEVATIONS FROM OC649 DATED FEBRUARY 1993 ARE IN GVD29. CORPSCON VERSION 5.11.08 WAS USED TO DETERMINE THAT 3.36' CAN BE ADDED TO ACHIEVE NGVD88 COORDINATES. THE PORT OF PORTLAND SURVEY DEPARTMENT USES A CONVERSION OF 3.83' BETWEEN NGVD29 AND NGVD88. BECAUSE THE ORIGINAL OC649 DATA LISTED ACCURACY TO ONLY INTEGER FEET, A CONVERSION OF 4.0' WILL BE USED TO MAINTAIN SIMILAR ACCURACY.
6. ● STANDS FOR OBSTRUCTION.

OBSTRUCTION TABLE DETAILS

RUNWAY	OBSTRUCT. NUMBER	DESCRIPTION / DIST FR RW END	SURFACE PENETRATION TYPE / DIST	OBSTRUCTION ELEVATION	DIST. FROM RUNWAY	PROPOSED DISPOSITION
25 to W. (EXIST. 5399' LENGTH)	1	TREE @ 9100'	AP/4' EST.	136' EST.	440' N EST.	REMOVE OR TOP
	2	TREE @ 8870'	AP/10' EST.	134' EST.	200' S EST.	REMOVE OR TOP
	3	TREE @ 8680'	AP/1' EST.	119' EST.	30' S EST.	REMOVE OR TOP
	4	TREE @ 8080'	AP/14' EST.	115' EST.	400' N EST.	REMOVE OR TOP
	5	TREE @ 7850'	AP/1' EST.	93' EST.	300' N EST.	REMOVE OR TOP
	6	TREE @ 7780'	AP/16' EST.	109' EST.	490' S EST.	REMOVE OR TOP
	7	TREE @ 7690'	AP/7' EST.	98' EST.	220' N EST.	REMOVE OR TOP
7 to E. (EXIST. 5399' LENGTH)	8	ANOMOMETER @ 2920'	P/23' EST.	57' EST.	270' N EST.	NONE
	9	WINDSOCK @ 3020'	P/26' EST.	61' EST.	220' N EST.	EX. OBST. LIGHT
	10	WINDSOCK @ 5390'	P/10' EST.	49' EST.	30' S EST.	EX. OBST. LIGHT
	11	SIGN @ 5650'	AP/9' EST.	50' EST.	160' S EST.	NONE
	12	ROAD @ 5850'	AP/1' EST.	57' EST.	20' N EST.	NONE
	12a	7' FENCE @ 5840'	NONE	56' EST.	CONTINUOUS	NONE (FOR INFO. ONLY)
	13	DIKE @ 5900'	TR/4' EST.	53' EST.	350' N EST.	EX. OBST. LIGHT
	14	TREE @ 7010'	AP/44' EST.	121' EST.	40' S EST.	REMOVE OR TOP
	15	TREE @ 7180'	AP/45' EST.	125' EST.	520' N EST.	REMOVE OR TOP
	16	TREE @ 7220'	AP/55' EST.	135' EST.	290' N EST.	REMOVE OR TOP
	17	TREE @ 8490'	TR/21' EST.	150' EST.	830' N EST.	REMOVE OR TOP
	18	TREE @ 8630'	AP/10' EST.	145' EST.	430' S EST.	REMOVE OR TOP



17D31'E
08/09/04
DATUM

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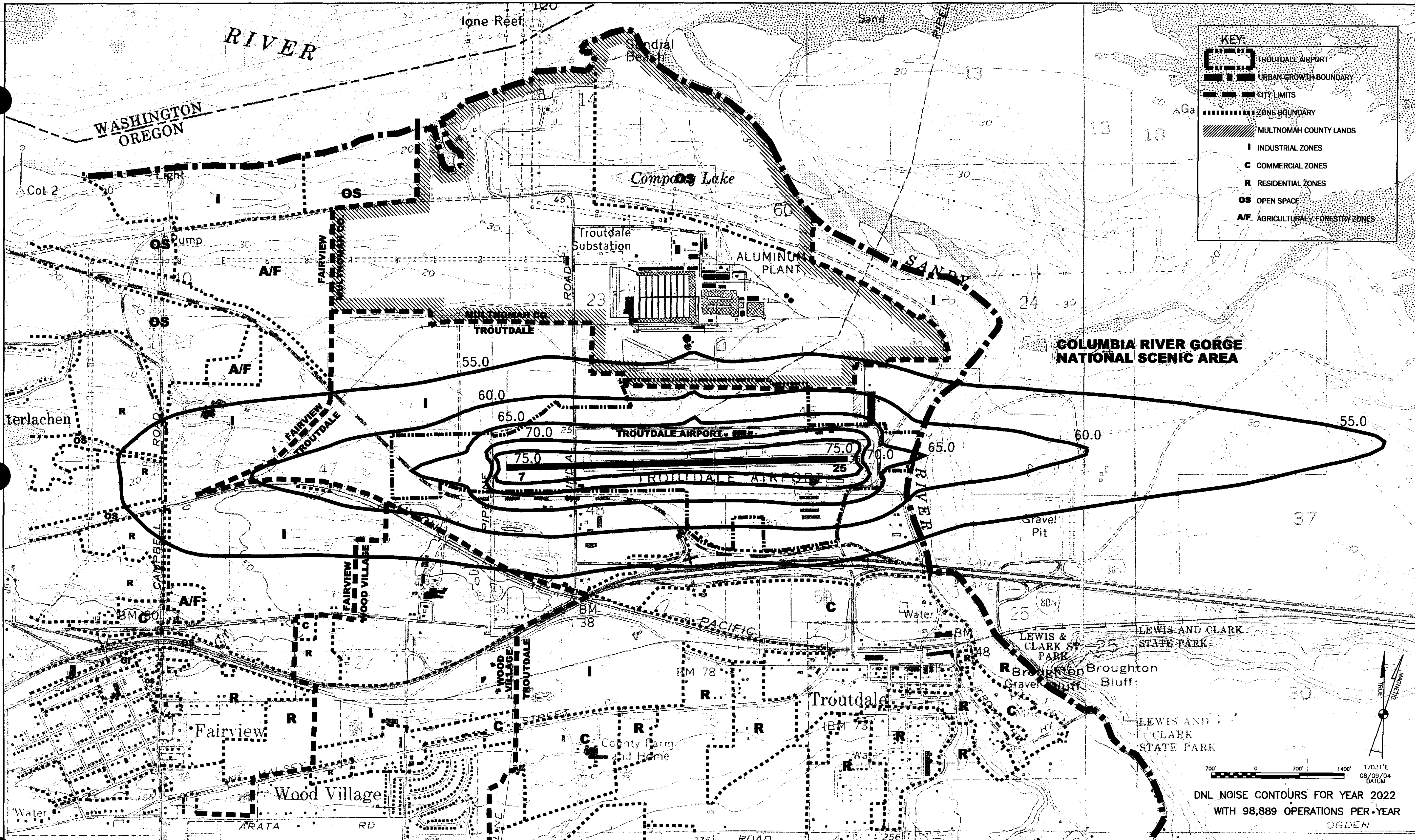
DATE: OCTOBER 6, 2004		PROJECT: TROUTDALE-2b	

TROUTDALE AIRPORT
AIRPORT LAYOUT PLAN UPDATE

RUNWAY APPROACH SURFACE PLAN & PROFILE

DRAWING NO. 2b

SHEET NO. 4 OF 5



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DESIGNED BY:	DRAWN BY:	CHECKED BY:	SCALE:
AF	MB	DM	1" = 700'
DATE: OCTOBER 6, 2004		PROJECT: TROUTDALE-3	

TROUTDALE AIRPORT
AIRPORT LAYOUT PLAN UPDATE

AIRPORT LAND USE PLAN WITH 2022 NOISE CONTOURS

DRAWING NO. 3

SHEET NO. 5 OF 5