

DRAFT

1.0 AIRPORT SYSTEM RESILIENCE

The extensive aviation system in Oregon is a crucial asset to the state during times of emergency. Airports allow emergency rescue crews to quickly access remote or hard-hit areas, supply resources to, and evacuate areas that may otherwise be unreachable via roadway, boat, and rail. As such, this study included an inventory of airports that support emergency services. Further, this study inventoried airports located within the Cascadia subduction zone (CSZ) that may be impacted or destroyed during a zone event. This study did not include an in-depth resiliency study but rather a high-level overview of airports that currently provide emergency services and those that may likely be unable to provide such service following a Cascadia subduction zone event¹.

1.1 Airport Roles in the 2013 Oregon Resilience Plan

Oregon emergency management officials and lawmakers recognize the vulnerability of airports and the communities they serve to potential earthquake events. Oregon has established the Oregon Seismic Safety Policy Advisory Commission (OSSPAC) which provided the Oregon Resilience Plan to the 77th Legislative Assembly. The authors of the 2013 Oregon Resilience Plan set out to help Oregonians know what to expect from the state's infrastructure should that disaster strike currently, and to propose the level of infrastructure reliability that a resilient state should provide. The plan's recommendations highlight ways to close the gap that separates expected and desired performance. The Transportation Task Group (Chapter Five) assessed the seismic integrity of Oregon's multi-modal transportation system, including bridges and highways, rail, airports, Ports, Sea-ports, and public transit systems. The Plan identified 29 airports in Oregon which can support recovery efforts related to a CSZ event. As discussed in previous sections of the OAP, Oregon airport system is comprised of 97 facilities grouped into five categories of airports.

In 2017 an Airport Resiliency Workgroup was formed to further identify system airports within each category that have the potential to maintain or quickly restore operational functions after a major earthquake. Workgroup was formed by the House of Representatives and the membership consisted of individuals from: Department of Aviation, Office of Emergency Management, State Resilience Office, and the Oregon Pilots Association. The Airport Resiliency Workgroup arranged the 30 airports into a tier system to indicate the priorities for making future investments.

Tier type and base concept:

Tier 1 (ISB, BSI, or Type 1 FSA)

Based on existing airports, Tier 1 (T1) are also referred to as Incident Staging Bases (ISB)(FEMA), Base Support Installation (BSI)(DOD), Type 1 Federal Staging Area (FSA)(FEMA), or National Guard Logistics Staging Base (NGLSB)(State). These are

¹ Oregon has the potential for a 9.0+ magnitude earthquake caused by the Cascadia Subduction Zone and a resulting tsunami of up to 100 feet in height that will impact the coastal area.
<http://www.oregon.gov/oem/hazardsprep/Pages/Cascadia-Subduction-Zone.aspx>



functioning as Aerial Port of Embarkation / Departure (APOE/D) for the response and simultaneously Tier 3 resupply points. They are capable of the full spectrum of response operations.

- Airfield Max Runway Strength 125,000 to 500,000 POUNDS (see Appendices further detail)
- Identified now
- Preplan usage now
- Pre-coordinate design now
- Acts as all Tiers
- Provides distribution to local communities
- Responder Base Camp (RBC)
- Joint reception, staging, onward movement, and integration (JRSOI)/ Relief in Place(RIP) Location

Tier 2 (T2) (Type 2 FSA)

Based on existing airports, Tier 2 (T2) are larger networks of airports that provide access to most rural areas and will be needed to restore major commercial operations. May also be referred to as Type 2 Federal Staging Areas (FSA). These function as forward APOE/D for the response and are simultaneously used as Tier 2 resupply points, and immediate area Tier 3s. They should be capable of the full spectrum of response operations.

- Airfield Max Runway Strength 25,000 to 125,000 POUNDS (see Appendices for further detail)
- Identified now
- Preplan usage
- Pre-coordinate design
- Serves as logistics base and RBC
- Provides distribution to local communities
- JRSOI / RIP Location

Tier 3 (T3) (Type 3 FSA w/Airport)

Tier 3 bases come in two varieties, with or without airports. Both are located based on the forecast needs of their surrounding population and provide economic and commercial restoration to the entire region after a disaster event. Tier / Type 3 Base with Airport is pre-identified location and is pre-coordinated with the airport manager.

- Airfield Max Runway Strength <20,000 POUNDS (see Appendices for further detail)
- Identified now
- Preplan usage
- Pre-coordinate design
- Serves as log base and RBC
- Provides distribution to local communities
- Responder Base Camp
- JRSOI / RIP (-) Location

Table 1-1 Recommended Organization of Oregon Airports:

Tier 1 (ISB, BSI, or Type 1 FSA)	Tier 2 (Type 2 FSA)	Tier 3 (Type 3 FSA w/Airport)
Redmond (RDM) FEMA	Tillamook (TMK) 4	Bandon (S05)
Klamath Falls (KLM) 6	Corvallis (CVO)	Siletz Bay (S45)
Portland International Airport (PDX)	Scappoose (SPB)	Independence (7S5) 11
Salem McNary (SLE)	Roseburg (5S1)	Grants Pass (3S8)
Newport (ONP)	McMinnville (MMV)	Myrtle Creek (16S)
Eugene (EUG)	Albany (S12) 10	Cottage Grove (61S)
Medford (MFR)	Aurora (UAO) 9	Creswell (77S)
Hillsboro (HIO)	Troutdale (TTD)	Brooking (BOK)
Cape Blanco State (5S6)		Florence (6S2)
Pendleton (PDT)		Portland Heliport (61J)
		Mulino (4S9)
		Lebanon State (S30)

On request by FEMA the State of Oregon prioritized 11 airports to have a federal assessment done. In March 2018 FEMA has assessed Redmond Municipal Airport (RDM). In 2019 Portland International Airport (PDX) and Salem Municipal Airport (SLE) are scheduled for FEMA assessment. The other airports that Oregon has prioritized:

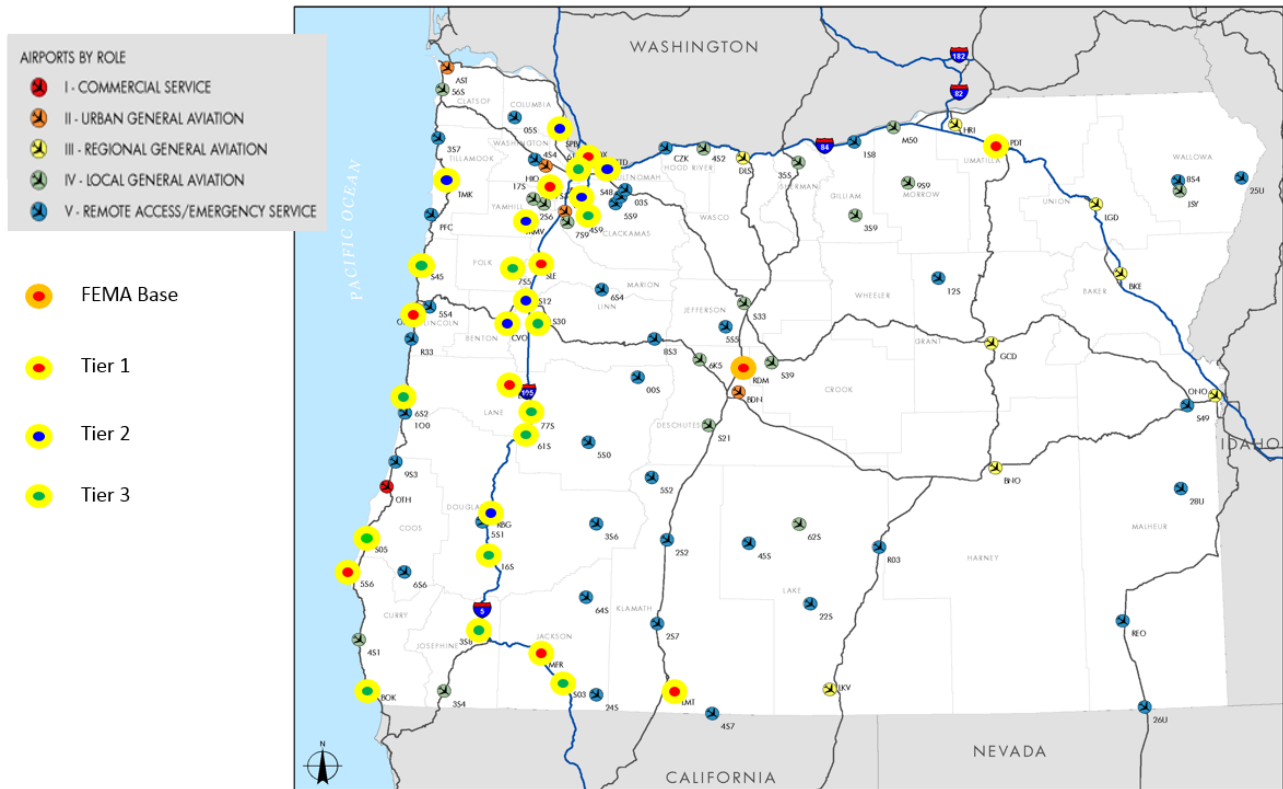
- Cape Blanco State Airport (5S6)
- Tillamook Airport (TMK)
- Eugene (EUG)
- Klamath Falls (KLM)
- Hillsboro Airport (HIO)
- Aurora State Airport (UAO)
- Albany Airport (S12)
- Independence State Airport (7S5)

As shown in **Figure 1-1** most airports in the Resilience Plan are along the Interstate 5 corridor and along the Oregon Coast. The exception to this is Klamath Falls International, Eastern Oregon Regional Airport at Pendleton, and Redmond Regional Airports. Redmond is currently the designated FEMA base of operations while Klamath Falls International has an Air National Guard base.

Additional research related to Oregon airports and a CSZ event has been recently conducted by the Airport Resiliency Workgroup. The group was tasked with developing three white papers on airport resiliency: 1) Identify Airports: Identify airports as forward operating bases and tier them based on capability; 2) Prioritize Equipment: Outline and prioritize the categories of equipment that could be used in a CSZ event; 3) Identify Funding: Identify the major avenues of funding Add paragraph on current draft work.

Analysis of Oregon Department of Geology and Mineral Industries (DOGAMI) data identifies airports within the study and their risk of earthquake damage – either through liquefaction² or Cascadia/Tsunami. It was determined that there are seven airports within a known coastal hazard area, all with both a liquefaction and Cascadia/Tsunami event hazard risk (see **Table 1-2**). None of these airports are listed as essential in the Oregon Resilience Plan and as such are not part of the Tier system.

FIGURE 1-1 AIRPORT RESILIENCY WORKGROUP – TIERED SYSTEM



² Soil liquefaction describes a phenomenon whereby a saturated or partially saturated soil substantially loses strength and stiffness in response to an applied stress, usually earthquake shaking or other sudden change in stress condition, causing it to behave like a liquid.

TABLE 1-2 AIRPORTS WITHIN A KNOWN COASTAL HAZARD AREA

Airport Name	Liquefaction Hazard	Cascadia Event Hazard ³
Astoria Regional Airport	High	Severe
Gold Beach Municipal Airport	Moderate	Violent
Nehalem Bay State Airport	High	Severe
Pacific City State Airport	High	Severe
Seaside Municipal Airport	High	Severe
Southwest Oregon Regional Airport	High	Violent
Wakonda Beach State	Moderate	Severe

Source: <http://www.oregongeology.org/tsuclearinghouse/pubs-inumaps.htm>, Jviation analysis

1.1.1 Coastal Airports Supporting Cascadia/Tsunami Event

In addition to the airports located within a known coastal hazard area, it was determined that ten more airports are at risk of impacts resulting from an earthquake; however, they are not located within a known coastal hazard area related to tsunami due to these airports inland locations and/or higher elevations. These airports are shown in **Table 1-3. Appendix 1** profiles these airport’s attributes and locations. These airports have a higher probability of less damage by tsunami and can be utilized in the event of a natural disaster along the Oregon coast. Additionally, seven of the ten airports profiled are listed in the Oregon Resilience Plan and have potential to maintain or quickly restore operational functions after a major earthquake. It is important to note that an earthquake generated tsunami may not be felt locally.⁴

TABLE 1-3 AIRPORTS OUTSIDE A KNOWN COASTAL HAZARD AREA

Airport Name	ORP Tier	Liquefaction Hazard ⁵	Cascadia Event Hazard ⁶
Bandon State Airport	T2	Moderate	Violent
Brookings Airport	T2	N/A	Severe
Cape Blanco State Airport	T2	Moderate	Violent
Florence Municipal Airport	T3	High	Severe
Lakeside Municipal Airport		Moderate	Severe
Newport Municipal Airport	T2	Low	Severe
Powers Hayes Field		Moderate	Severe
Siletz Bay State Airport	T2	Moderate	Severe
Tillamook Airport	T2	Moderate	Severe
Toledo State Airport		Moderate	Severe

Source: <http://www.oregongeology.org/tsuclearinghouse/pubs-inumaps.htm>

³ Violent shaking is greater than Severe shaking. In general, airports located closest to coast will likely experience greater shaking than airports higher in elevation and further from coast.

⁴ The last earthquake that occurred in this CSZ fault was on January 26, 1700, with an estimated 9.0 magnitude. This earthquake caused the coastline to drop several feet and a tsunami to form and crash into the land. What is most surprising is that evidence for this great earthquake also came from Japan. Japanese historic records indicate that a destructive distantly-produced tsunami struck their coast on January 26, 1700. By studying the geological records, the flow of the Pacific Ocean, scientists have linked the tsunami in Japan with the great Pacific Northwest earthquake. Native American legends support the timing of this last event.

⁵ Jviation analysis of Earthquake Hazard maps at <http://www.oregongeology.org/hazvu/> liquefaction data is based on soft soils analysis by DOGAMI

⁶ Jviation analysis of Cascadia Event Hazard maps at <http://www.oregongeology.org/hazvu/>

Several of the airports listed in **Table 1-4** serve areas with significant population numbers. If an earthquake were to damage or leave any of these airports inoperable, the region and its residents may experience delayed emergency response. Table 1-4 depicts these airports along with the population within a 30-minute drive, 20-miles, and within the city limits. It is important to note these airports are not included in a known coastal hazard area and may not be commonly associated with earthquake risks. **Figure 1-2** depicts the location of these airports.

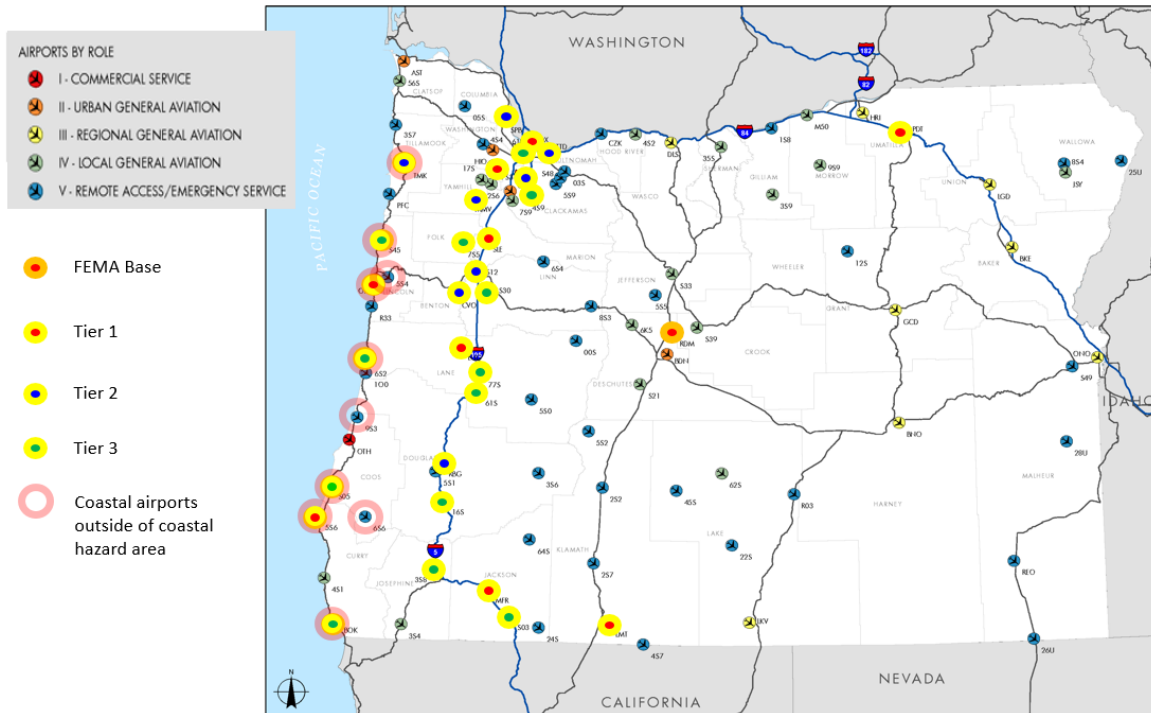
TABLE 1-4 POPULATION NEAR AIRPORTS OUTSIDE A COASTAL HAZARD AREA

Airport Name ⁷	Population within 30-min. Drive of Airport	Population within 20-Mile Radius	Population within City Limits
Bandon State Airport	7,554	29,567	3,147
Brookings Airport	13,883	25,779	6,497
Cape Blanco State Airport	3,382	4,998	1,146
Florence Municipal Airport	15,006	17,530	8,703
Lakeside Municipal Airport	29,167	48,208	1,748
Newport Municipal Airport	24,298	34,539	10,344
Powers Hayes Field	891	7,638	660
Siletz Bay State Airport	20,385	37,804	2,110
Tillamook Airport	17,630	25,025	4,976
Toledo State Airport	19,578	32,436	3,515

Source: <http://oregon.zoomprospector.com>, accessed by Jviation in 2017

⁷ All airports listed have paved runways except for Lakeside Municipal and Powers Hayes Field which are turf runways.

FIGURE 1-2 AIRPORT RESILIENCY WORKGROUP – TIERED SYSTEM AND COASTAL AIRPORTS OUTSIDE THE COASTAL HAZARD AREA



1.1.2 Coastal Airports Supporting Cascadia Event Recovery

Appendix 1 identifies Oregon airports, which are less likely to be inundated by a Tsunami due to airport elevation and distance from coast, and can be utilized to support communities on the coast in the event of a major earthquake and or tsunami. There are ten airports listed which are located outside of the hazardous zones identified by DOGAMI. Each airport’s attributes are identified in an individual two-page summary table in Appendix 1. Each table includes:

- Airport name and FAA three-letter identification code
- Airport contact person and telephone number
- Airport Communication Radio Frequency
- Airport elevation in feet and location in miles to coast
- Cascadia Event Hazard: Violent, Severe, Very Strong, Strong, Moderate, Light
- Liquefaction Hazard: High, Moderate, Low, N/A
- Airport inside DOGAMI Hazard Area
- Airport in 100-Year Floodplain

- Oregon Resiliency Plan Tier⁸:
- Airport Location Map related to Tsunami Regions (Green equals outside Known Hazard Area)
- Airport Infrastructure: Runway length and width, NAVAIDS, Weather Reporting
- Airport services: FBO Name, Fuel, and whether air ambulance aircraft are based on airport
- Airport Location: Distance to Central Business District and Local Hospital as well as distance to nearest airport on coast.
- Airports nearby with instrument approaches and distance
- Community profile: Population within 30-minutes of airport, population within 20-mile radius (by air) and population within associated city.
- Population Age distribution profile graph
- 30-minute drive time map

1.2 Airports Supporting Emergency Services

Through the collection of data during the inventory process of this study, Oregon airports were asked if they supported emergency services. **Table 1-5** depicts which airports support emergency services and what type of services are common. Airports that did not self-report supporting emergency services are not included nor were airports which research found no emergency service activity.

TABLE 1-5 AIRPORTS SUPPORTING EMERGENCY SERVICES

FAA ID	Associated City	Airport Name	Coast Guard	Air Ambulance	Based Fire-fighting	Support Fire-fighting
AST	Astoria	Astoria Regional Airport	X	X		
UAO	Aurora	Aurora State Airport		X		
BDN	Bend	Bend Municipal Airport		X		
BOK	Brookings	Brookings Airport		X		
BNO	Burns	Burns Municipal Airport			X	X
CZK	Cascade Locks	Cascade Locks Airport				X
2S7	Chiloquin	Chiloquin State Airport				X
61S	Cottage Grove	Cottage Grove State Airport -Jim Wright Field		X		
EUG	Eugene	Eugene Airport -Mahlon Sweet Field				X
3S8	Grants Pass	Grants Pass Airport				X
GCD	John Day	Grant County Regional Airport			X	X

⁸ The Oregon Resilience Plan identifies airports within each state OAP Category that have the potential to maintain or quickly restore operational functions after a major earthquake. The Transportation Task Group arranged 29 airports into a tier system to indicate the priorities for making future investments. Seven of the ten airports identified in this analysis are included in the Tier System. Tier 1 (T1) is comprised of the essential airports that will allow access to major population centers and areas considered vital for both rescue operations and economic restoration. Tier 2 (T2) is a larger network of airports that provide access to most rural areas and will be needed to restore major commercial operations. Tier 3 (T3) airports will provide economic and commercial restoration to the entire region after a Cascadia subduction zone event.

FAA ID	Associated City	Airport Name	Coast Guard	Air Ambulance	Based Fire-fighting	Support Fire-fighting
JSY	Joseph	Joseph State Airport				X
LMT	Klamath Falls	Klamath Falls International Airport		X	X	X
LGD	La Grande	La Grande / Union County Airport		X	X	X
LKV	Lakeview	Lake County Airport			X	X
S33	Madras	Madras Municipal Airport				X
00S	McKenzie Bridge	McKenzie Bridge State Airport				X
MFR	Medford	Rogue Valley International -Medford Airport		X	X	X
16S	Myrtle Creek	Myrtle Creek Municipal Airport				X
ONP	Newport	Newport Municipal Airport	X			
OTH	North Bend	Southwest Oregon Regional Airport	X	X		
5S0	Oakridge	Oakridge State				X
ONO	Ontario	Ontario Municipal Airport		X	X	X
PDT	Pendleton	Eastern Oregon Regional Airport at Pendleton		X	X	X
HIO	Portland	Portland -Hillsboro Airport		X		
TTD	Portland	Portland -Troutdale Airport		X		
S39	Prineville	Prineville Airport			X	X
64S	Prospect	Prospect State				X
RDM	Redmond	Redmond Municipal Airport -Roberts Field		X	X	X
5S1	Roseburg	George Felt				X
8S3	Santiam Junction	Santiam Junction State				X
SLE	Salem	Salem McNary Field				X
S21	Sunriver	Sunriver				X
TMK	Tillamook	Tillamook Airport		X		
3S6	Clearwater	Toketee State				X
S49	Vale	Miller Memorial Airpark			X	X

Source: ODA Inventory, Oregon Department of Forestry-Fire Protection Division, ADAM Air Ambulance Atlas, Aviation analysis

Coast Guard – Of the 26 airports that were identified as supporting emergency services throughout Oregon, only three support U.S. Coast Guard aviation infrastructure. Two of the three are US Coast Guard Air Stations; Astoria Regional Airport, and Southwest Oregon Regional Airport. At Newport Municipal Airport, the U.S. Coast Guard operates an Air Facility⁹. These USCG stations and facilities support search and rescue, and emergency medivac efforts throughout the state and neighboring regions.

Air Ambulance – As shown below, 15 of the 26 airports that support emergency services do so through a local air ambulance service provider. The following list includes airports with air ambulance series and the service provider.

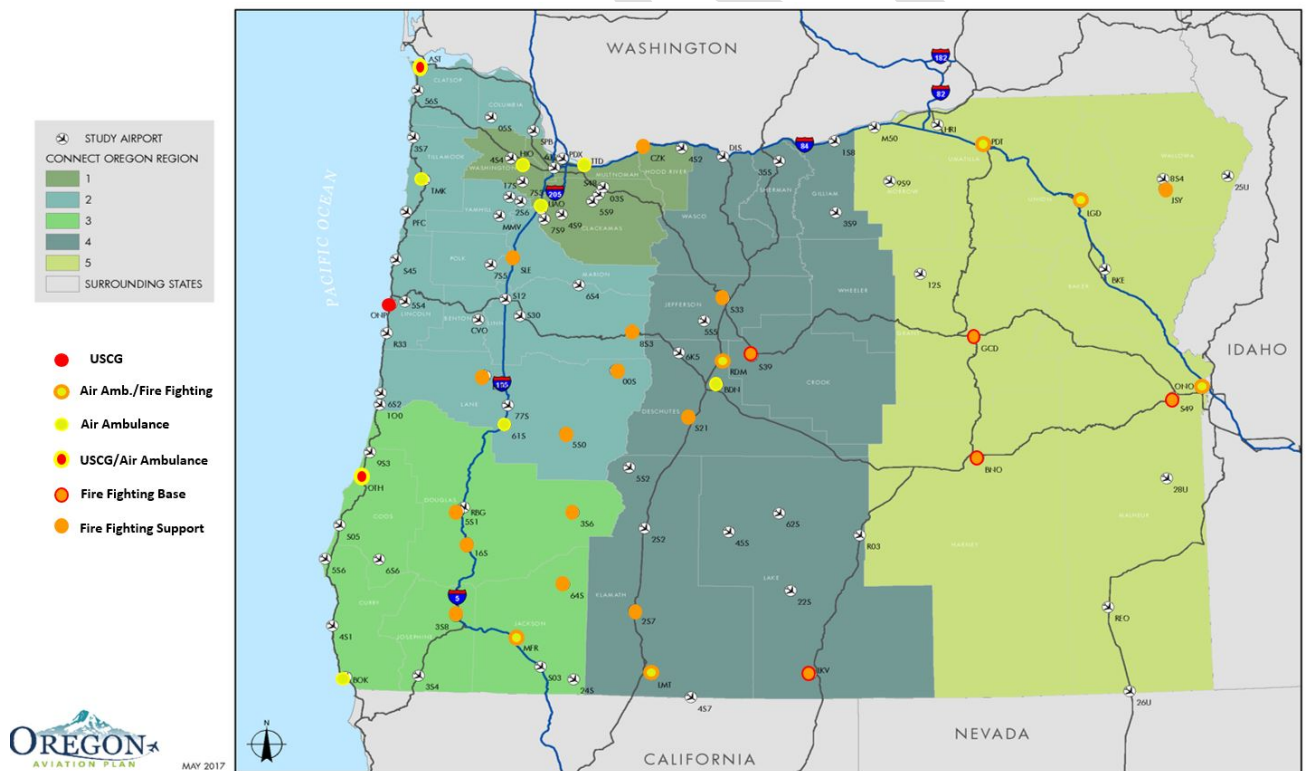
- Astoria Regional Airport - Life Flight Network
- Aurora State Airport - Life Flight Network
- Bend Municipal Airport - AirLink Critical Care Transport
- Brookings Airport - REACH Air Medical Services

⁹ USCG Air Facilities are staffed by crews that rotate in temporarily from a Coast Guard Air Station.

- Corvallis Municipal Airport - REACH Air Medical Services
- Cottage Grove State Airport -Jim Wright Field - Life Flight Network
- Eastern Oregon Regional Airport at Pendleton - Life Flight Network
- Klamath Falls International Airport - "AirLink Critical Care Transport and REACH Air Medical Services"
- La Grande / Union County Airport - Life Flight Network
- Ontario Municipal Airport - Life Flight Network
- Portland - Hillsboro Airport - Premier Jets/Lifeguard Air Ambulance
- Redmond Municipal Airport - Roberts Field - Life Flight Network
- Rogue Valley International - Medford Airport - Mercy Flights, Inc. (Oregon)
- Southwest Oregon Regional Airport - REACH Air Medical Services
- Tillamook Airport - Classic Air Medical

Wildland Firefighting – The above table shows airports that support wildland firefighting services in two ways; either through a full-time based firefighting operation or through operations that are temporarily based at an airport on an as-needed basis. **Figure 1-3** shows airports in Oregon supporting wildland firefighting and other emergency services.

FIGURE 1-3 AIRPORTS SUPPORTING EMERGENCY SERVICES



Source: Aviation

Airports that support full-time firefighting operations with based aircraft and infrastructure include:

- Burns Municipal Airport - SEAT¹⁰ Base
- Eastern Oregon Regional Airport at Pendleton - SEAT Base
- Grant County Regional Airport - SEAT Base
- Klamath Falls International Airport - Heavy Base
- La Grande / Union County Airport - Heavy Base
- Lake County Airport - SEAT Base
- Miller Memorial Airpark - SEAT Base
- Ontario Municipal Airport - SEAT Base
- Portland -Troutdale Airport - Heavy Base
- Prineville Airport - SEAT Base
- Redmond Municipal Airport - Roberts Field - Redmond Air Center is the hub of aerial firefighting and training activities in the PNW. Includes smokejumper unit, regional aviation group, a regional fire case, an air tanker base, and an interagency Type I training crew (the Redmond Hotshots)
- Rogue Valley International - Medford Airport - Heavy Base

Airports that are known to have supported firefighting operations in recent years on a temporary or short-term basis include the following airports:

- Eugene Airport - Mahlon Sweet Field
- George Felt
- Grants Pass Airport
- Madras Municipal Airport
- Myrtle Creek Municipal Airport
- Salem McNary Field
- Sisters Eagle
- Joseph State Airport
- Oakridge State Airport
- Crescent Lake State Airport
- Cascade Locks State Airport
- McDermit State Airport

1.3 Airports at Risk to Natural Hazards

A second aspect of this study was to inventory airports at risk to flooding.

¹⁰ Single-Engine Attack Aircraft

1.3.1 Flooding

Study airports were evaluated and to determine which airports are located within a Flood Zone A, which has a 1% annual chance of flooding according to the Federal Emergency Management Agency (FEMA). It was found that ten airports are located within Flood Zone A and nine airports are partially located within a Flood Zone A (as shown in **Table 1-6**). These airports are considered “at risk” due to flooding hazards:

TABLE 1-6 AIRPORTS WITHIN FLOOD ZONE-A

Airport	Within 1% Annual Chance Flood Area
Ashland Municipal Airport -Sumner Parker Field	Partially
Astoria Regional Airport	Completely
Burns Municipal Airport	Completely
Cottage Grove State Airport -Jim Wright Field	Completely
George Felt	Partially
Lake County Airport	Completely
Myrtle Creek Municipal Airport	Completely
Pacific City State Airport	Completely
Portland -Troutdale Airport	Partially
Prospect State Airport	Partially
Rogue Valley International -Medford Airport	Partially
Salem McNary Field	Completely
Seaside Municipal Airport Hi	Completely
Siletz Bay State Airport	Completely
Southwest Oregon Regional Airport	Partially
Stark's Twin Oaks	Partially
Sunriver Airport	Partially
Tillamook Airport	Partially
Toledo State Airport	Completely

Source: <https://msc.fema.gov/portal/search>, Accessed 2017, Aviation analysis