



MEETING AGENDA

Hillsboro Airport Roundtable Exchange
Wednesday November 4, 5:30 – 7:30 p.m.
 City of Hillsboro Civic Center, 150 E. Main Street

5:30	Brian Lockhart Steve Nagy	Welcome <ul style="list-style-type: none"> • Announcements • Approval of previous meeting minutes
5:40		Public Comment
5:50	Jon Hay	Hillsboro Aero Academy Presentation from Hillsboro Aero Academy on operations at HIO
6:10	Stan Watters	Port of Portland Resiliency Planning Presentation on the Port of Portland’s resiliency planning and the role of Hillsboro Airport
6:20	Jason Gately	2005 Hillsboro Master Plan Presentation on items identified from the 2005 Hillsboro Master Plan
6:50	Sub-committee Chairs HARE members	Sub-committee reports
7:00		Break Check in with presenters and ask questions informally
7:15		Public Comment
7:30		Adjourn



**Hillsboro Airport Roundtable Exchange Meeting Minutes
September 30, 2015: Hillsboro Civic Center, 5:30 p.m. – 7:30 p.m.**

MEMBERS PRESENT

Brian Lockhart	Global Aviation (Airport Business)
Bob Braze	Citizen
Bob Flansburg	Alternate for House District 30 (Jurisdictional)
Senator Chuck Riley	State Senate District 15
Deanna Palm	Hillsboro Chamber of Commerce (Business)
Debbie Raber	City of Hillsboro (Alternate for Mayor Willey)
Henry Oberhelman	CPO 8 (Citizen)
Jack Lettieri	Citizen
Kimberly Culbertson	CPO 9 (Citizen)
Larry Atree	Portland Community College (Airport Related Business)
Mike Gallagher	Citizen
Rhonda Legge	FAA (Technical)
Stephen Roberts	Alternate for Washington County Commission (Jurisdictional)
Steve Nagy	Port of Portland
Representative Susan McClain	State House District 29

MEMBERS ABSENT

Annette Campista	Latino Business Community
Bert Zimmerly	Hillsboro Airport Historian
Bill Braack	Oregon International Airshow Alternate
Fred Hostetler	Citizen (Land owner adjacent to HIO)
Mayor Jerry Willey	City of Hillsboro (Jurisdictional)
Mike Warrens	Oregon International Airshow

CURRENT MEMBERSHIP VACANCIES

Hillsboro Airport Business Association
Westside Economic Alliance

SUMMARY

Introductions and Welcome

Brian started the meeting at 5:33 p.m. He noted a change in the agenda to allow for public comment at the beginning of the meeting as well as at the end of the meeting.

Public Comment

Dale Feik is Washington County resident. His testimony is attached to the minutes. He has concerns about both the safety of the airport as well as MoGas. The county doesn't have an emergency planning committee, even though there is a state mandate for the county to have one. He is currently working with the city and the Forrest Grove Fire Department. He assumes that the Port will be involved in that committee once it comes together. He has had conversations with Mike Gallagher, Henry Oberhelman and Steve Nagy. He thinks that there should be a good plan to address. He has provided an email to the committee that shows his conversation with those people. He hopes that there will be safety related information to the citizens in the event of an emergency at the airport.

His second concern is related to MoGas. He has concerns about the use of leaded fuel in aircraft flying in and out of HIO. There is no safe level of lead. What is the cost of not taking the steps to eliminate the use of leaded fuel? In the interest of everyone, he feels this issue should be addressed sooner rather than later.

Brian thanked Dale for his comments and then asked for approval of the meeting minutes. Mike noted that emails going back and forth suggested that the Port had more information on the Mogas conversation than was reflected in the meeting minutes. Henry asked that the minutes for the meeting be sent out the committee sooner so that they can remember what was discussed to make sure that the important things are included in the minutes. Jack said he remembered that the Port mentioned that they were willing to relax the standards related to fueling at the airport so that a fuel truck could potentially offer mogas at the airport. Steve suggested that the committee receive just the meeting minutes only rather than receiving the questions/answers to the public comment portion as well as that takes time. Henry moved to accept the meeting minutes. Kimberly seconded the motion. The minutes were adopted as written.

Steve welcomed Senator Chuck Riley who is new to the committee. He also welcomed Rhonda Legge, who is the new FAA Tower Manager. She came from Sacramento and has been in the tower since July.

Hillsboro Aviation: Ryan McCartney

Ryan McCartney provided an overview of Hillsboro Aviation. He discussed the history of the organization which started as a helicopter company that grew into what it is today. Hillsboro Aviation used to own the flight school, but sold the majority ownership of the flight school in November 2014. Today, the organization has a contract & charter business and then a sales & service business. They have 13 turbine aircraft, over 80 employees, 3 Hillsboro facilities with plans for a new facility in 2016 and 8 seasonal remote bases. The business operations of the

organization is heavily regulated by the federal government for both their aircraft maintenance work as well as the charter firefighting services they provide among other certifications.

Different operations:

- Contract and charter
 - One of the most experienced and largest combined helicopter and airplane operators in the Northwestern United States
 - 25 pilots
- Aircraft Fleet
 - Bell 205 A1++
 - Bell 407
 - Airbus AS350 B3e
 - Bell 206L4/L3
 - Bell 206B3
 - King Air C90
- Search and Rescue
 - Work for the Teton County Sherriff to do search and rescue work outside Jackson Hole Wyoming
 - Firefighting: This year they had 8 helicopters out on contract to help with firefighting operations.
- Heli-Portable Seismic
 - National gas or oil exploration
- LiDAR Aerial Imaging: Mapping of the earth's surface. Best way to measure the earth's surface to measure vegetation. Used for powerlines and a variety of other industries.
- Geological survey: Used for survey underground
- Aerial Photography: Movies, news, TV
- Sightseeing Tours: operation up at Mt. St. Helens as well as Sedona
- Executive charter: Used primarily in the northwest
- Sales & service:
 - Factory authorized maintenance, repair and overhaul
 - Avionics sales, repair and installations
 - Staff has an average of 19 years of experience
- MRO Services
 - Retrofit of new aircraft for customers such as the police department
- International Sales
- Performance upgrades
- Avionics Sales and Installation
- Sales and Service
 - International parts sales
 - International aircraft sales

Corporate Headquarters

Hillsboro Aviation has three facilities at the airport right now. They also own property outside the airport fence. The building that exists on their existing property is phase 1. Phase 2 is a 50,000 square foot facility on airport property. They broke ground August 10 and are looking to complete the project and move in April 2016. The new facility will host locations for maintenance, aircraft sales and their headquarters.

Mike asked if Ryan could explain a bit better where the facility/land is. Steve noted that it is closer to Solar World's property.

Representative McClain asked how many of their firefighting aircraft are used in state. Ryan responded that it depends based on the contracts with the Department of Forestry. Three of their aircraft are on exclusive contracts with the state of Oregon this year.

Henry asked what their agricultural work entailed. Ryan said that it is the area for the business that they do the least. They used to do a lot of seeding in their past and they don't do it as much now. Henry asked about the MRO work that the company does. Ryan said that every aircraft is required to have an annual inspection regardless of whether or not the aircraft is flying. They sign off that the aircraft is airworthy. It could be a total overhaul or just a check of everything.

Ryan concluded that they also sell fuel to customers. They sell both Jet A and 100LL fuel. With their new facility, they are looking to have one that is dedicated to the Jet A fuel. The second tank will be baffled to allow them to sell three different types of fuel so they could either sell mogas or they could sell the new alternate fuel that is being developed by the FAA. Mike noted that the MRO business brings a significant amount of economic development to the city with minimal noise impact because the aircraft are not based at the airport.

Airport Master Planning: Sean Loughran, Port of Portland

Sean Loughran gave an overview of what is included in a master plan process. Airport master plans have several different requirements that have to be met on the federal, state and local levels. There are a significant amount of other planning efforts going on that could intermix with the Master Plan process at the airport. They include: Hillsboro 2035, Hillsboro Comprehensive Plan, County Fairplex Planning, City/County Transportation Planning, HIO Property Site Readiness and Planning, HIO Terminal Area and Cornell Frontage Business Study, HIO Stormwater Master Plan and the Airport Zone/ASCO.

A master plan is a comprehensive review of the airport and its surroundings. It provides a framework to guide future airport use and development. It is a very important tool for the Port as it relates to how we fund things and then where those funds come from. This will be a master plan update versus a full master plan. We are not revisiting the role of the airport, but looking at a focused evaluation on the facilities and future needs. The process is specifically tailored to the needs of the airport operator and the community. The FAA is an important partner of the planning process. The Port applies for funding from the FAA for the project to be

complete. They provide assistance with scoping as well as sitting on the advisory committee. They provide approval on both the forecasts developed as well as the airport layout plan. It becomes the cornerstone document for funding on future projects at the airport.

Common elements of a master plan

- Public involvement: will be achieved through an advisory committee made up of a variety of stakeholders
- Environmental considerations
- Existing conditions
- Aviation forecasts
- Facility requirements
- Alternatives development and evaluation
- Airport layout plans
- Facilities implementation plan
- Financial feasibility analysis

Other elements for consideration

- Sustainability
 - New FAA guidance
 - Port policy
- State/local planning coordination
 - Oregon state airport planning rule
- Follow-on public involvement
 - Project Advisory Committee Report
 - HARE

Sean showed the Airport Layout Plan from 2005. Representative McClain stated that she was at a legislative committee related to transportation and they were discussing resiliency. She wanted to know if resiliency planning would be included in the environmental considerations in the master plan. Sean replied that the Port is looking at the Port overall and identifying seismic resiliency factors. Previous master plans have not included seismic resiliency, but this one will.

Senator Riley asked what the word sustainability means to the Port as it relates to this plan. Sean replied that the Port takes a triple bottom line approach and strives to find a balance between all three of those issues. The master plan will look at the economic viability of the airport, wetland/wildlife issues and then social equity issues such as what 85 jobs look like for the community as well as the noise impacts on the community.

Henry asked that about a major seismic event. He feels that the airport would play a major role in the recovery process from some major catastrophic event. Sean said that the master plan will address that. The state has identified both Hillsboro and Portland Airport as critical facilities for both emergency response as well as recovery.

Mike said that it was his understanding that the HARE used to be HAIR and they were the key driver for the last master plan. He feels like that the HARE should be heavily involved in this next master plan. Steve clarified that the HAIR committee was a result of the compatibility study from the 2005 master plan. During this new master plan update, the HARE will be suspended while a project advisory committee meets. That project advisory committee will then make a recommendation if the HARE should resume and if so, what it would look like.

Stephen Roberts suggested that the project still keep open houses for the project, but also look at other ways to get people involved. Sean agreed that it will be a host of solutions rather than one single solution.

Parallel Runway Update: Phil Stenstrom, Port of Portland

Phil Stenstrom gave an update on how the air traffic is working with the new parallel runway in operation. The operations are showing what the EA said it was going to do. Mike noted that he lives in between the airport and Costco. When the new runway opened, the flight training operations now turn over Costco. It has had a very favorable effect. He said compliments to those folks that are telling the flight school to fly over the industrial areas as it makes it difference. Kimberly asked for clarification on the complaint logs. Is that a complaint made or is it a resolved complaint. Phil explained that every complaint made is logged whether or not the information is provided for the committee to follow up. Kimberly asked why callers were asked to provide tail numbers when calling in. Phil said that due to the lack of radar at HIO, not every flight is tracked in and out of HIO. Having a tail number allows the noise management system to look up the operator and see what additional information is available. There will be new technology coming online in the next couple of years. Jack clarified for the audience that the new technology will be replacing the radar technology that airports currently have. Kimberly asked if Hillsboro Aero Academy has committed to installing the tracking technology in their aircraft. Phil said it is a federal mandate, so they will be required to do so.

Subcommittee Reports

Brian noted that there will not be a noise report as Fred is not in attendance. Steve noted the Port is committed to talking with our tenants about selling the mogas should there be an interest. Steve noted that based on Ryan's presentation, Hillsboro Aviation is putting in the fuel tank to allow for the sale of mogas. In addition, Hillsboro Aero Academy is committed to working trying it out in some of their training aircraft as well to see how well it works and to determine if there are any additional maintenance costs or issues. They are starting to introduce the mogas fuel to their fleet this winter/fall. They are not an FBO so they won't be selling it to other customers, but Hillsboro Aviation will be exploring that option.

Mike said that he has concerns about the proposals because it will be long term and many years down the road. If the fuel truck that is at the other airport in the state already selling mogas shows up at HIO, he would like the Port to break the rules to allow for that to happen. There is already one airport in the state that is doing it and Hillsboro Airport should be in the second. The airport has an opportunity very quickly to address some of the lead that is being dispensed into the atmosphere. He challenged Steve and the Port to act quickly.

Jack asked where the truck was. He said the Port will already make accommodations. No one has showed up yet. Mike said that there is still a hang-up on the Port's side that prevents a fueling truck from coming on the airport property to sell mogas.

Kimberly said that from her opinion that it would be very progressive for the Port to allow for the fuel to be sold. Steve clarified that the Port is doing everything they can short of selling the fuel themselves to offer the fuel at the airport. The Port has upgraded fuel tanks at the airport for other businesses to use so that there aren't any upfront capital costs. The Port did a study to show that there will be a market if mogas is offered. Hillsboro Aviation will be online in April 2016 which is about six months away. The Port can't remove the requirements for things like spill removal plan but where they can, they have removed the barriers. If Hillsboro Aviation came with a truck tomorrow, they would let them. Henry asked that the Port take a bold leadership step to bring a 5,000 gallon tank to the airport to sell mogas. Steve responded that the Port has spent \$20,000 of their own money to redo the tanks under the "mushroom" fuel island at Hillsboro Airport to allow for a business to bring mogas fuel into the airport. Mike said that the committee was obviously not going to resolve this issue tonight, so he asks that there be a standing report on each of the HARE committee's agendas for a Port update on the status of the offering of mogas.

Henry suggested that the committee support a renewing of the lead subcommittee to look at issues. He said that he feels that a big focus will be pushing the Port in moving forward with offering mogas. Brian also noted that the committee could also look at other environmental issues. Jack noted that he doesn't have an issue with the subcommittee moving forward, but noted that the committee should be careful to not go on a fishing expedition. Henry made a motion to have the committee be expanded to look at other environmental issues besides just lead. Bob Braze cautioned that the committee be careful of accepting everything that is testified for that is a potential pollutant as truth. Henry said that he thinks that it shouldn't be a carte blanche approach as there are also Port resources supporting the subcommittee. The committee approved the extension of the lead subcommittee to include other broader environmental issues. Henry said the first priority will be to look at the offering of mogas at the airport as well as the schedule on the federal level for the formal replacement by the FAA. Then they will focus on the other issues.

Public Comment

Victor Simmons lives on the NW corner of 273rd. He has lived there for 42 years. Since the third runway has opened, the traffic over his house has increased 100 fold. It used to be when they used the long runway, two or three airplanes would fly over their house per month. Now, he has three to fifteen flights over his house and a great percentage of those are less than 200 feet. He's invited the Port to come to his house, but no one has come out. He gets a lot of lip service but not a lot of support. Yesterday, he had three aircraft that he identified. They are coming by four or five times, so they are coming out of Hillsboro Aviation (editor's note: Hillsboro Aero Academy). It is his understanding that they are supposed to be at 250 feet before they turn. His concerns are the safety, noise and the pollution. The aircraft are taking the right-hand turn. Where they used to circle farther west, they weren't a problem. They are

now a problem. The pollution is bad. Hillsboro Airport is rated 25th in the nation out of 50,000+ airports for bad pollution. They are dumping lots of tons of lead over people's houses. He wants them to fly out further rather than flying over his house. Whatever can be done as a committee to help resolve this problem would be greatly appreciated.

Teresa Tse provided written comment that she provided for the record, see attached. Jack asked Teresa if she knew there was an airport next to her home before she moved in her home. She said that it hasn't been an issue except for the last three years. Kimberly said that she didn't feel it was respectful to ask whether or not someone knew that there was an airport next to their home as it deflects the issue. Mike said that he would propose that the noise office collect some of the information to go to some of the hot spots for HARE members to go and see what these members of the community are experiencing. Teresa asked Phil Stenstrom why the noise office won't put a permanent noise monitor in Jones Farm for longer than a few days. Phil responded of the four permanent monitors that are in the area, none of them have found an exceedance. Those exceedances set for the monitors are lower than the federal thresholds even. The portable units aren't intended to sit out in the weather for a full year, but the noise office is willing to look at installing a temporary monitor for a longer period of time to gather data.

Miki Barnes lives in Manning, Oregon. She moved 12 miles away from the airport and she still has flight training operations. PCC is using tax payer dollars to degrade the livability of the community. This is endemic throughout the county. The runway report from Phil was interesting to her. The runway opened April 30. The aviation statistics on the Port's website indicate that operations were shifted from Hillsboro to PDX and Troutdale airport. There was a decrease in operations at Hillsboro and an increase in operations in PDX and Troutdale airport. It is highly suspicious. There are no assurances that they are not going to come back to Hillsboro. Also, she was talking with someone from the EPA that there may be some issues with trucks with leaded fuel at airports that there may be a requirement to have that fuel in an underground tank rather than in a truck. The fuel should go into our groundwater, so the Port should consider the resiliency issues with that as well. Another issue that came out is that our numbers on actual lead at this airport are way down. People may remember when the hush house went in at PDX, when the FAA comes up with their lead numbers; they aren't measuring their ground based operations. Run-ups are one of the biggest contributors to lead emissions. The Port left out ground based operations from their CDM study. She thinks the lead levels are much higher than anyone is admitting. The other request is to have the detailed information on the flights per operator from Hillsboro Airport like what is offered at PDX. The excuse she got from Steve is that those airlines pay landing fees, so that we can figure it out. There should be a way to figure it out. The public has a right to know as they are paying millions of dollars to support this airport. There are larger aircraft like the Intel jets that would be paying landing fees so there is some data available. At PDX, there are 10-12 noise monitors in strategic locations under the flight paths. She would like to see the noise monitors placed around HIO in the areas where there are more complaints. She said that people complain that the noise monitors around HIO being in places to avoid capturing noise.

Senator Riley said that there is something that Miki said that resonates that people's bodies do respond to the noise. Representative McClain noted that she thinks there is an opportunity to have a positive dialogue during the master plan process to look at creating a more positive experience of how the complaint process can be done where citizens can feel that their inputs be heard. Mike said that he agreed. He said that one of his recommendations is that the Port hires a consultant to look at all the noise practices employed by the Port to see if the Port is doing things in the way that they should. He feels the Port has a moral obligation to address the noise issues wherever possible. On the lead based issue, there was a study done at certain airports around the nation that looked at including the ground run-ups.

Ruth Warren said that she has stopped complaining because it does no good. She had health problems and the noise monitor by her house is covered by trees, so it's not accurate.

Brian concluded the meeting at 7:59 p.m.

Public Comment Response

Airport Operations

Comment/Question

Victor Simmons lives on the NW corner of 273rd. He has lived there for 42 years. Since the third runway has opened, the traffic over his house has increased 100 fold. It used to be when they used the long runway, two or three airplanes would fly over their house per month. Now, he has three to fifteen flights over his house and a great percentage of those are less than 200 feet. He's invited the Port to come to his house, but no one has come out (Victor Simmons).

Teresa asked Phil Stenstrom why the noise office won't put a permanent noise monitor in Jones Farm for longer than a few days (Teresa Tse)

At PDX, there are 10-12 noise monitors in strategic locations under the flight paths. She would like to see the noise monitors placed around HIO in the areas where there are more complaints. She said that people complain that the noise monitors around HIO being in places to avoid capturing noise (Miki Barnes).

Ruth Warren said that she has stopped complaining because it does no good. She had health problems and the noise monitor by her house is covered by trees, so it's not accurate (Ruth Warren).

Answer

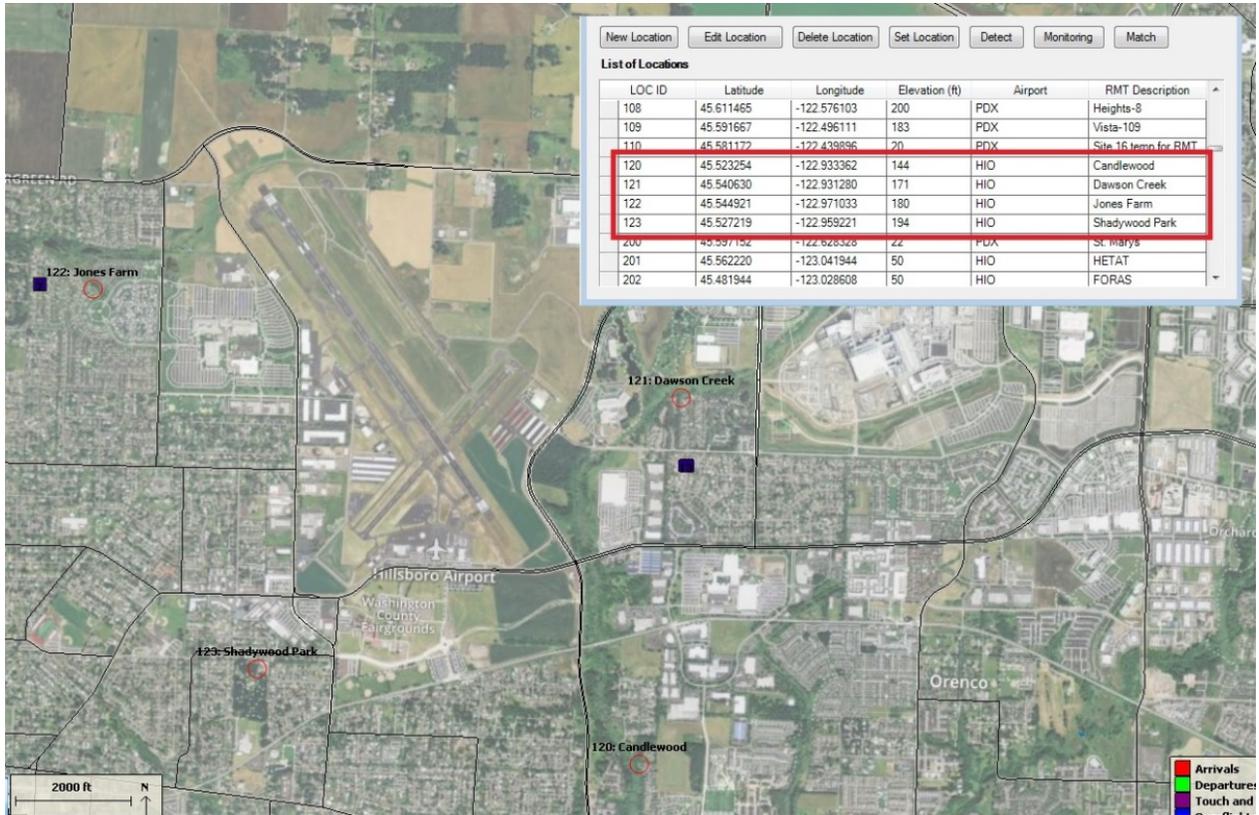
Noise staff have been in contact with Mr. Simmons about coming out to do monitoring at his home per his request.

A permanent monitor is located very close to Jones Farm (see image below). Due to the close proximity of Ms. Tse's house to the existing permanent monitor, an additional permanent monitor would not be warranted. Portable monitoring in Hillsboro presents strong challenges due to a lack of radar to corroborate findings captured by the monitor. Any attempt to accurately calculate aircraft noise values would require a noise technician to be present the entire time the monitor was in place. Port staff reached out to Ms. Tse to inquire about having portable noise monitoring done at her house.

The current HIO locations were chosen through a citizen committee process with a goal of placing one in each of the four corners of the airport. The committee began with fourteen potential sites and then through a process of eliminating sites that weren't practical, came up with the four locations that are in operation to this day. As was discussed at the HARE meeting in September, there are many constraints in placing permanent monitors including land suitability, owner permission and utility availability.

Trees don't cause any measurable noise reduction, but vegetation can influence a listener's perception of the noise environment in other ways. Trees provide a visual buffer and thereby can eliminate visual reminders of aircraft or other noise sources. Trees scatter the very high

frequency sounds that can convey "mechanical harshness," and also may provide a type of forest reverberation which reduces harshness and the impulsive nature of some noise sources. In addition, wind motion through leaves produces a pleasant sound, which can partially mask more annoying sounds. Although these effects do not reduce the overall noise level, they may affect the listener's perception of the noise environment and thereby decrease annoyance. Oftentimes "even when measurements show no significant [noise reduction] from intervening trees, many people believe strongly that such trees do quiet their environment."



From: [Dale Feik](#)
To: [Berglund, Brooke](#)
Cc: [Fred Hostetler](#); [Henry Oberhelman](#); [Mike Gallagher](#); [Nagy, Stephen](#)
Subject: Public Comment, Hillsboro Airport Roundtable Exchange Sept 30, 2015 by Dale Feik
Date: Wednesday, September 30, 2015 3:43:06 PM
Attachments: [Flying Not a Sanitary Thing to Do by Dale Feik.docx](#)
[Hillsboro Airport_email communication with Mike Gallagher Steve Nagy Henry Oberhelman Fred Hostetler.docx](#)

To: Brooke Berglund, Hillsboro Airport Roundtable Exchange facilitator

From: Dale Feik, Citizen, Washington County, cell: 503-504-5972

Re: Public Comment

Date: Sept 30, 2015

As a former pilot, I have two comments that I want to make; one has to do with safety, and the other has to do with MoGas. In addition, I have attached a short article I wrote titled 'Flying, Not a Sanitary Thing to Do'.

1. Safety: At the August 4, 2015 Washington County Commissioners meeting I made Public Comment about Local Emergency Planning Committee meetings. During that Public Comment as part of my reasons for implementing the 1986 Federal law mandating Local Emergency Planning Committees I wrote and said: *"Hillsboro Airport is adjacent to Ronler Acres Campus. Large jets fly daily to/from the airport. Based upon testimony/comments at the Hillsboro Airport Roundtable, Hillsboro does not have radar and will not have it or an equivalent system for at least five years. Concerns were expressed by not only local pilots but also people who work at the airport and were in support initially of building a third runway. A large jet or smaller plane could have an emergency and crash into the Ronler Acre facility. At a previous Hillsboro Airshow a small airplane crashed into a home and did extensive damage and I think killed the pilot."*

I also wrote that *"Air traffic controllers' work schedules often lead to chronic fatigue, making them less alert and endangering the safety of the national air traffic system, according to a study the government kept secret for years."* and provided this link:

<http://www.usnews.com/news/politics/articles/2015/08/10/ap-exclusive-air-controller-study-shows-chronic-fatigue>

Shortly after my public comment I had another meeting with Scott Porter, Washington County Director of Emergency Planning, and he said that he will work diligently to get the 1986 Emergency Planning and Community Right to Know Law implemented and I said that I would work hard to help facilitate that process. We both agreed to use the following statement to describe the situation: *"As a community, we have failed to fully implement the intent of the Emergency Planning and Community Right to Know law well."*

Please open and read the attachment titled 'Washington County Commission Public Comment by Dale Feik August.. doc'

Base upon that discussion I have had a chance to talk/email Henry Oberhelman, Mike Gallagher and Steve Nagy.

I have copied those email chains and made the document titled 'Hillsboro Airport Roundtable Exchange Public Comment by Dale Feik Sept 30, 2015'. Please read it.

2. MoGas – One of the topics on the agenda for tonight's HARE meeting - Leaded Fuel Replacement (LFR) project for HIO.

As I understand it, the LFR Project has two pieces:

- One piece considers providing a supply of "MoGas" (Unleaded automotive fuel) that could be used by some percentage of the aircraft refueling at HIO. Given a full court press by the Port of Portland this could be available within a relatively short period, just guessing, within a 6 - 12 month window.
- The second piece is the Piston Aviation Fuel Initiative (PAFI) now underway under the nominal auspices of the FAA with an end date of 2018 for "ASTM Research Report - Production Fuel Specification." as reported in www.faa.gov/about/initiatives/avgas/media/media/PAFI_Oshkosh.pdf. It is probably unrealistic to think that the approved fuel will be available to end users at that point in time and perhaps more realistic to estimate perhaps mid 2019 at best and early 2020 to be realistic.

I believe that OAW's position is that any amount of lead in the atmosphere is harmful and if it can be reduced by any degree then appropriate steps should be expeditiously taken to that end.

If the foregoing paragraph is accurate, then the question can be asked: what is the cost of not taking the steps to eliminate leaded aviation fuel.

Establishing that quantitative measure, suitably weighted by probabilistic measures, will not replace consideration of the qualitative measures that are also essential to a fully considered decision on the timetable for implementing leaded fuel replacement at HIO.

It is in the interests of all of us in the community at large to bring this issue to some mutually satisfying resolution, sooner than later.

Do you agree as members of the Hillsboro Airport Roundtable Exchange?

Because I will be able to stay for only the first 10 minutes or so of the meeting, I have emailed these public comments to you.

I look forward to further dialogue.

Safe flying,

Dale Feik
cell: 503-504-5972

Cc: Fred Hostetler
Henry Oberhelman
Mike Gallagher
Steve Nagy

Sin

"That's Not a Sanitary Thing to Do! "

by Dale H. Feik

Flying over Eastern Oregon, I had finally realized my dream. I had just obtained my private pilot's license, and my wife and I were on the last leg of our airplane trip around Oregon. On our way back to Hillsboro, the engine suddenly coughed, sputtered, and then died.

"Dale! We're going to crash!" screamed my wife, as she stiffened against the seat.

My muscles tightened, my throat was gauze.

Then I heard a voice, Holly's voice. "Relax. Establish a normal glide. Pick a field and start your approach. Don't change your mind in the middle of the stream—that's not a sanitary thing to do!"

I spotted my field: high wheat, telephone poles with wires at both ends.

"Make sure you have enough altitude to get to it, and then slip to settle right in," Holly kept saying.

The poles looked like daggers staring me in the face. But we slipped over the top of them, thrashed the heads of the wheat and sank to the bottom of the golden sunshine. Miraculously, we climbed out, intact.

In a daze, we tramped to a nearby ranch, where I telephoned Holly. "Thanks for talking me down, Holly. You're a great flight instructor."

After that incident, I have had time to reflect on what made Holly a truly exceptional flight instructor:

- a. His enthusiasm for flying and teaching,
- b. His ability to organize a flight lesson, and
- c. His warm, friendly personality.

Let me illustrate what I mean.

When I met Holly, he was talking with a group of guys about their Experimental Aircraft Association fly-in to a forest service airport between Eugene and Crater Lake. After introducing myself, I said to Holly, "I started flying two years ago, but I quit because of fear. Will you help me get my license?"

"Well, let's find out what you know and don't know, see what you need to work on and get on with it," replied Holly, emphasizing safety. "I'm pretty old", Holly continued, "and I started flying when I was just a young whipper-snapper. I want all of my students to live as long as I have."

While observing me preflight the airplane, Holly observed that I was unsure of myself.

"Damn!" I muttered. "I left the owners-manual checklist in the office. I'd usually go back and get it."

"I'm surely not going to stop you," responded Holly.

After Holly explained how to check for birds under the cowling, the oil level, and the correct fuel level and octane, I started the engine. Using the radio didn't frighten or confuse me. Holly had typed the crucial phrases on a card and I had studied them.

"Remember to tell the guys in the tower what you are going to do; don't make a request. You're the pilot in command," said Holly.

"How does the airplane perform during take-off at higher altitudes?" I wanted to know.

"You take the yoke and let me control the throttle, and I'll show you," instructed Holly. We were half-way down the runway and weren't at lift-off speed yet.

"Don't panic" assured Holly. "Get her flying before you rotate the nose. That's it."

During our preflight planning I said that I wanted to work on accelerated stalls. Realizing that precision of any maneuver comes from the putting together all the components of the whole, Holly reviewed the principles of throttle and airspeed control, slow flight, power-on and power-off stalls.

Approaching an unfamiliar airport to land, I remembered to use what Holly told me, "Visualize your home airport's runways and associate to them the runways of the unfamiliar airport you are landing on." I flew straight into the correct landing pattern configuration.

As we were taxiing by the tie-downs, Holly said, "See that older fellow preflighting the Piper Cub? That's Jim. I taught him how to fly too. Once Jim did a foolish thing. On his climb-out, he banked and turned right into the middle of a cloud. That evening I called him and asked, that wasn't you that I saw fly into the clouds, was it?"

Jim sheepishly said "Yes."

Holly went on to say, "Just because a student gets his license doesn't mean that I'm through thinking about his safety. I want all of my students to live long good lives!"

After my emergency landing in Eastern Oregon, I was thankful to be alive so that I could call Holly. Even though Holly might point out a deficiency, I would welcome a call from Holly anytime.

"That's not a sanitary thing to do," is advice I can use the rest of my life.

Primary flight Instructor for Dale H. Feik was Holly K. Robinson, CFI 374613. Issued License by Examiner H.M. Ruberg (sp?), Final FAA Certificate progress check for Private Certificate October 13, 1973, Certificate No. 2200564, Airplane Single Engine – Land.

I, Dale Feik, started flying at Springfield, Oregon, at McKenzie Flying Service July 13, 1970, Ron Byers, Instructor. Last flight with license was September 22, 1977 with 136.6 total hours flown, mainly with Cessna 150 or Cessna 152s.

From: [Dale Feik](#)
To: [Berglund, Brooke](#)
Cc: [Fred Hostetter](#); [Henry Oberhelman](#); [Mike Gallagher](#); [Nagy, Stephen](#); [Susan McLain](#); [chuck Riley](#)
Subject: HARE public comment failed to attach this --- FW: Andy Duyck all commissioners Davis, Prince Porter Local Emergency Planning Committee meetings, public comment made before you August 4, 2015
Date: Saturday, October 03, 2015 8:00:22 AM
Attachments: [Washington County Commissioners Public Comment Aug 4 2015 Local Emergency Committees.docx](#)

To: Brooke Berglund for HARE committee

From: Dale Feik

Re: Failed to include a document that I referenced in my Public Comment that I made to HARE Sept 30, 2015

Date: Oct. 3, 2015

My flight instructor said it is always better to admit to the Tower early when I am in trouble or when I make a mistake. So, I goofed. I said that was going to attach the public comment that I made before the Washington County Commissioners relating to Local Emergency Planning Committee meetings. I failed to do so. So following is that public comment. Please note my last two paragraphs and how it relates to my Hillsboro Airport comments.

Thank you Steve for suggesting to Chair Brian Lockhart that I be allowed to make public comment at the beginning of the meeting because I had a Washington County Citizen Action Network (WC-CAN) Board meeting starting at 6:00 pm. Thank you also for letting me know that the meeting time had been changed from 6:00 pm to 5:30 pm.

Safe flying,

Dale (Feik –feek)
cell: 503-504-5972

Cc: Fred Hosteller
Henry Oberhelman
Mike Gallagher
Steve Nagy
Rep. Susan McLain
Senator Chuck Riley

From: Dale Feik [mailto:dfeik33@comcast.net]
Sent: Tuesday, August 11, 2015 11:00 AM
To: andy_duyck@co.washington.or.us; 'dick_schouten@co.washington.or.us'; greg_malinowski@co.washington.or.us; roy_rogers@co.washington.or.us; bob_terry@co.washington.or.us
Cc: Robert Davis (robert_davis@co.washington.or.us); Mark Prince (markp@ci.hillsboro.or.us); Scott Porter (SCOTT_PORTER@CO.WASHINGTON.OR.US)
Subject: Andy Duyck all commissioners Davis, Prince Porter Local Emergency Planning Committee meetings, public comment made before you August 4, 2015

To: Andy Duyck, Chair Washington County Commission and Commissioners, Dick Schouten, Greg

Malinowski, Roy Rogers, Bob Terry

From: Dale Feik, citizen Washington County

Date of public comment made: August 4, 2015, follow up of comments August 11, 2015

Re: Local Emergency Planning Committee meetings

Thank you for your comments and questions after my two-minute Public Comments. I put those comments into written form. See below and attachment.

Public Comment made before the Washington County Commissioners August 4, 2015.

Dale Feik

Cell: 503-504-5972

Topic: Local Emergency Planning Committee meetings

After receiving from the State Fire Marshal's office in Salem all of the lists of the Extremely Hazardous Chemicals that Intel has on site at the Ronler Acres and Aloha Silica Chip Manufacturing facilities for the years 2009 through 2014, I became very concerned about a serious chemical spill and/or fire emergency.

The State Fire Marshal representative told me that based upon the 1986 Federal Title 42 – Public Health and Welfare, Chapter 116 – Emergency Planning and Community Right-To-Know Act, that the State Emergency Response Commission shall appoint local emergency planning committees. Therefore, the representative suggested that I use the following when talking with the Hillsboro Fire Marshal:

1. I want to participate in a Local Emergency Planning Committee.
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So I made an appointment with the Hillsboro Fire Department Fire Marshal, Mark Prince, and he told me that they do not have a Local Emergency Planning Committee. He recommended that I talk with Scott Porter, Emergency Management Cooperative Director of Washington County. I did. Scott also said that they do not have a Local Emergency Planning Committee as some other counties do, that he had been working to get one started, and that he appreciated my concern.

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1. Facility indicates they are an EHS (Extremely Hazardous Facility)?
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Not until 2014 did Intel, Ronler Acre Campus, answer yes to all of the above first five questions. Never had they answered yes to number 2, subject to Process Safety Management. Now Intel is required to submit forms to EPA for review; and those documents are public. Knowing what the Extremely Hazardous chemicals are, how they are processed, transported, and the protective measures/actions community members can take to prevent accidents, but more importantly knowing how we can be warned of an emergency and how we should act to protect our health and safety during an emergency, is crucial.

Please help establish Local Emergency Planning Committee so that that committee can work cooperatively with Intel and local emergency responders.

Things to consider:

**** On the Right to Know web site Hillsboro Fire Department is listed as the Local Emergency Planning Committee, but that is not true. Please open the following link to verify this:

http://www.rtknet.org/db/rmp/rmp.php?facility_id=100000215144&database=rmp&detail=3&datatype=T

**** **Why was the Toxics Release Inventory created?** (See page 6 of link below :)

Bhopal, India December 1984

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Institute, West Virginia August 1985

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More than 100 people hospitalized.
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**** Air traffic controllers' work schedules often lead to chronic fatigue, making them less alert and endangering the safety of the national air traffic system, according to a study the government kept secret for years.

<http://www.usnews.com/news/politics/articles/2015/08/10/ap-exclusive-air-controller-study-shows-chronic-fatigue>

Note: Following are emails from/to certain airport/airplane people. I made this document so that it could be used for discussion, problem solving and coming to common ground that protects the public's safety and health and with the hope that actions can be taken to benefit all. But my emphasis is on safety over corporate profits.

Dale Feik, Sept 30, 2015, public comment to the Hillsboro Airport Roundtable Exchange. I am a former pilot who loved to fly and see the world from above.

From: Dale Feik [mailto:dfeik33@comcast.net]
Sent: Friday, April 03, 2015 4:08 PM
To: 'Allen Schaeffer'
Cc: 'Downing.kevin@deq.state.or.us'; DEQ Palmer Mason (mason.palmer@deq.state.or.us)
Subject: Dale Feik --- Your Testimony on SB 824 Regarding Aircraft Emissions is Incorrect as stated by Allen Schaeffer, Ex Director Diesel Technology Forum

Allen Schaeffer, (Executive Director, Diesel Technology Forum),

I appreciate your feedback on my statement: "diesel is the main emission from jets". I was quoting Fred Hostetler, assistant chair of Hillsboro Airport Roundtable Exchange (HARE) in a private conversation I had with him after the last meeting.

Henry Oberhelman, also a member of HARE, helped clarify the statement that Fred made to me. Both Fred and Henry attended, I think, a workshop about jet emissions but the following may be a more accurate statement: (I am going to forward this email to them to get their feedback also.)

Here's an excerpt from a Wikipedia search for Aviation Fuel: **Jet fuel** is a clear to straw-colored fuel, based on either an unleaded kerosene (Jet A-1), or a naphtha-kerosene blend (Jet B). It is similar to diesel fuel, and can be used in either compression ignition engines or turbine engines. Jet-A powers modern commercial airliners and is a mix of pure kerosene and anti-freeze and burns at temperatures at or above 49 degrees Celsius (120 degrees Fahrenheit). Kerosene-based fuel has a much higher flash point than gasoline-based fuel, meaning that it requires significantly higher temperature to ignite. It is a high-quality fuel; if it fails the purity and other quality tests for use on jet aircraft, it is sold to other ground-based users with less demanding requirements, like railroad engines.^[5]

Please note the active links in the above Wikipedia paragraph.

Following are links to the presentation that Kevin Downing, DEQ Diesel specialist, made at the Hearing. Do you agree to the any of the negative health effects of Carbon emissions? I am carbon copying this to Devin Downing. Please reply to all when you reply to me.

<http://www.deq.state.or.us/aq/diesel/DieselHealth.htm>

Dale Feik, Ed.D.

P.S. I attached my written testimony for HB 3310.

Cc Kevin Downing, DEQ, Diesel specialist

On **Apr 3, 2015 4:18 PM**, "Dale Feik" <dfeik33@comcast.net> wrote:

Hi Fred,

I appreciated the time you took to talk after a HARE meeting. I ended up quoting you, but I want to make sure that I didn't misquote you. So please let me know whether the following captured our conversation. I hope that we can continue to have many more talks – we have very similar interest, concerns. Another concern of mine as expressed by others is the combination of small aircraft with big and smaller jets – especially since there is no radar and no technology that will be installed soon.

Dale (Feik – feek)

cell: [503-504-5972](tel:503-504-5972)

Cc: Henry Oberhelman

From: Fred Hostetler [mailto:hostetler.fred@gmail.com]

Sent: Friday, **April 03, 2015 8:00 PM**

To: Dale Feik

Cc: hoberhelman@gmail.com; Brian Lockhart

Subject: Re: Dale Feik HARE follow-up --- Your (Dale Feik) Testimony on SB 824 Regarding Aircraft Emissions is Incorrect as stated by Allen Schaeffer, Ex Director Diesel Technology Forum

Brian has much more knowledge concerning jets. I'm a GA type flying smaller, 100LL gas engines.

Not sure what you are searching for. Airports usually include large/small and fast/slow aircraft. The FAA control tower and ATC provide separation with or without radar. Pilots provide their own separation when an airport has no control tower.

Fred Hostetler
503-939-4578

From: "Dale Feik" <dfeik33@comcast.net>

To: "Mike Gallagher" <mrgoregon@comcast.net>

Sent: Thursday, **September 17, 2015** 6:45:07 AM

Subject: Dale Feik HARE quote in this email FW: Local Emergency Planning Committee meetings, public comment made before you August 4, 2015 and this Sept 17, 2015 follow up

Hi Mike,

Glad that we talked at Insomnia coffee. Note in the following email that I make reference to HARE; specifically-- Hillsboro Airport is adjacent to Ronler Acres Campus. Large jets fly daily to/from the airport. Based upon testimony/comments at the Hillsboro Airport Roundtable, Hillsboro does not have radar and will not have it or an equivalent system for at least five years. Concerns were expressed by not only local pilots but also people who work at the airport and were in support initially of building a third runway. A large jet or smaller plane could have an emergency and crash into the Ronler Acre facility. At a previous Hillsboro Airshow a small airplane crashed into a home and did extensive damage and I think killed the pilot.

Are these statements accurate?

Dale

cell: [503-504-5972](tel:503-504-5972)

From: Mike Gallagher [<mailto:mrgoregon@comcast.net>]

Sent: Thursday, September 17, 2015 7:51 AM

To: Dale Feik

Cc: Nagy, Stephen

Subject: Re: Dale Feik HARE quote in this email FW: Local Emergency Planning Committee meetings, public comment made before you August 4, 2015 and this Sept 17, 2015 follow up

Dale,

The Hillsboro tower does have a display of radar information which provides information useful in sequencing arriving aircraft, especially jets, with aircraft in the traffic pattern. Although the equipment does not see all the way to the ground, it does greatly increase the ability of tower to prevent conflicts. I regularly flew jets into the airport before and after the addition of this equipment and saw first hand how much this helped avoid potential onflicts. The FAA is in the process of switching the entire air traffic control system over to a satellite based network which will eventually replace radar and will provide even better coverage for Hillsboro.

The term large jets isn't correct. The bulk of jet operations at Hillsboro are with medium size business jets which are less than half the weight of Boeing 737s. Intel's airplanes weigh about one-quarter of a 737 and are actually stage IV noise compliant which is well ahead of current requirements. A very few flights by larger MD-80 aircraft support the conversion of these aircraft to aerial tankers by a local firm. I think most people would appreciate the value of this work and these aircraft in light of the tragic fires we've experienced this summer. In addition the conversion work provides good local jobs.

Not sure how to deal with the statement that a plane could crash into the Ronler facility. Of course it is possible that any spot on the Earth could be the site of an aircraft crash, but the

risk of any single spot being hit is miniscule. The immediate arrival and departure areas are heavily restricted since the bulk of mishaps happen in those relatively small areas.

Reference the third runway, I have to say that from my perspective it has reduced the noise from general aviation aircraft where I live (just east of the airport). Most pilots using the new runway are following the desired ground track which takes them approximately over Costco and avoids residential areas. Since the runway threshold is further inside the airport boundary, aircraft remain at higher altitudes during the portions of the traffic pattern outside the airport boundary.

The aircraft mishap following an airshow several years ago resulted in some changes in airshow operations to reduce the chances of a similar mishap. Although the mishap did result in a fatality to the pilot and damage to some structures I wouldn't call the damage extensive.

I've info'd Steve Nagy on this email since I am not a spokesman for the airport or the Port of Portland and have just shared some personal observations.

Mike Gallagher

From: Nagy, Stephen [mailto:Stephen.Nagy@portofportland.com]

Sent: Thursday, September 17, 2015 12:20 PM

To: Mike Gallagher; Dale Feik

Subject: RE: Dale Feik HARE quote in this email FW: Local Emergency Planning Committee meetings, public comment made before you August 4, 2015 and this Sept 17, 2015 follow up

Mike,

Thank you for copying me in your response. You've accurately portrayed the Port's understanding of the FAA radar capabilities and how they use the technology locally at Hillsboro tower. HIO is primarily a Visual Flight Rules (VFR) airport and flight training (which overflies the area of concern around the Ronler Acres campus), is done only under VFR conditions. When the airport is under Instrument Flight Rules (IFR) conditions, the local flight training patterns are suspended and flights to and from HIO are typically on direct arrival or departure corridors (which generally do not overfly the area of concern around the Ronler Acres campus).

Our understanding of the FAA's procedures in and around HIO are that radar is used by the FAA's Portland TRACON for active traffic management and separation and that local controllers in the HIO tower can only use STARS radar screen repeaters in the HIO tower to provide air traffic advisories for aircraft in vicinity of the airport. Having said all this, I will confirm HIO tower procedures with the new ATCT manager and follow up with you at the HARE meeting this month.

In addition, the work that we did on developing the proposed Airport Safety and Compatibility Overlay (ASCO) zone a few years ago was partially based on California Department of Transportation risk analysis of aircraft incidents and accidents surrounding airports. There is a lot of good information about ground based risk from aviation that is contained within the California

Department of Transportation's handbook on this subject. In general, their conclusions were that ground based risks are mainly contained along the axis of the runway and very little risk is located laterally from the runway.

I hope this is helpful.

Steve Nagy

Port of Portland
General Aviation Airports Manager
Hillsboro and Troutdale Airports
stephen.nagy@portofportland.com

From: Henry Oberhelman [mailto:hoberhelman@gmail.com]
Sent: Thursday, September 17, 2015 2:54 PM
To: Dale Feik
Cc: Nagy, Stephen; Mike Gallagher
Subject: Re: Dale Feik HARE quote in this email FW: Local Emergency Planning Committee meetings, public comment made before you August 4, 2015 and this Sept 17, 2015 follow up

Let me jump in on this discussion.

"Large" or "Medium" may be in the eye of the beholder. Here's a link to a publication that might provide useful information, but with the caveat that I can't vouch for it's veracity:

http://128.173.204.63/courses/cee5614/cee5614_pub/acft_classifications.pdf.

I believe that both Mike's and Steve's comments on radar pertain to the control of air traffic relative to the use of HIO (Hillsboro Airport) but not necessarily to the identification of aircraft flight paths. I've heard in individual conversations or in anecdotal comments at public meeting that there are systems in use that can identify the flight tracks of individual aircraft operating around HIO irregardless of the altitude or size of those aircraft. Steve, can you provide an authoritative response on this aspect of the subject? For example, is it possible, by any means, to confirm the actual flight path of, say, an R22 helicopter operating in the Charley training area? While the community's need for this may have diminished with the relocation of some of the industrial scale flight training, it may return with the commencement of the operations of the Hillsboro Academy's new facility, particularly if the OLive's depiction of helicopter's on the ramp is accurate.

With regard to aircraft accident risk management (perhaps more correctly called threat assessment), it has the dimensions of both the likelihood and the consequences of an event. While the likelihood of an aircraft crashing while in flight over a high tech company with it's storage of hazardous chemicals may be miniscule, the consequences can be very large. Both aspects need consideration. The likelihood of any individual aircraft impacting any particular spot on the ground is dependent on many factors but certainly it's altitude, forward velocity, and aerodynamic characteristics of the bits and pieces at the inception of the crash would seem to be instrumental in the assessment of risk to a particular spot on the earth. I believe those considerations coupled with the somehow practically determined boundaries of the study area lead to the results of the overlay zone study areas.

Steve, thanks for the reference to the California Department of Transportation risk analysis. Assuming that "ground based risk" means the risk of damage being incurred to something on the ground as a result of overhead air traffic. then it follows that the concentration of air traffic along the axis of the runway will incur higher risk levels. NextGen, the label attached to the satellite based network that Mike refers to, concentrates air traffic into a much narrower approach pattern. This has led to much greater noise impacts at several larger east coast airports. It has also had influence, if not causal effects, on the introduction of remotely controlled airport control towers. Steve might wish to add to this line of discussion particularly as to the schedule and impact on HIO.

Re the Firefighting aircraft conversion: In my experience, the appearances of the large aircraft at HIO, e.g., MD-80, are so infrequent as to be virtually invisible. And yes, the national fleet of firefighting aircraft is inadequate. And yes, the work is valuable and provides good local jobs and yes, those jobs and that work could be performed at any number of airports in Oregon thus boosting those local economies which by any measure are in need of such a boost.

Henry

Public Comment made before the Washington County Commissioners August 4, 2015.

Dale Feik
Cell: 503-504-5972

Topic: Local Emergency Planning Committee meetings

After receiving from the State Fire Marshal's office in Salem all of the lists of the Extremely Hazardous Chemicals that Intel has on site at the Ronler Acres and Aloha Silica Chip Manufacturing facilities for the years 2009 through 2014, I became very concerned about a serious chemical spill and/or fire emergency.

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Please help establish Local Emergency Planning Committee so that that committee can work cooperatively with Intel and local emergency responders.

Things to consider:

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**** Air traffic controllers' work schedules often lead to chronic fatigue, making them less alert and endangering the safety of the national air traffic system, according to a study the government kept secret for years.

<http://www.usnews.com/news/politics/articles/2015/08/10/ap-exclusive-air-controller-study-shows-chronic-fatigue>

Hello, I am Teresa Tse. I have been a resident of the Jones Farm Neighborhood, since 1999.

Here we meet again. It has been almost 4 months since the last HARE meeting. I am NOT happy to report that the noise pollution has NOT improved.

I still see and hear helicopters circling from my home's back window. Under the Fly Friendly Program, I should NOT see them. We see and hear prop planes and helicopters fly extremely low over our homes, at most about 500 feet or less. We can not enjoy being in our own backyards.

I have talked with the FAA and the Port of Portland Noise Management Office. ALL have said that aircrafts do NOT need to fly so low over homes. They can fly higher in altitude before making the turn over our homes in Jones Farm.

After a year and a half of complaints presented at these HARE meetings, and with no improvements at all, I can only conclude that the pilots who fly low over our homes are just plain rude, inconsiderate and disrespectful jerks!!

I do not know how their Mothers and Fathers reared them, or what their teachers and school principals taught them. I would like to address these jerks and those of you who are in the position to make changes, to heed the message of Pope Francis, who recently visited our nation, to each and everyone, to be a GOOD CITIZEN, BE RESPONSIBLE, BE CONSIDERATE and CARING TO PEOPLE and the ENVIRONMENT.

If I was a pilot, I would fly at least 1,500 feet to 2,000 feet over people's homes, because that is the RIGHT THING TO DO.

I would not circle my helicopter over parks where families are enjoying a picnic.

In addition, I would only use unleaded gas.

Remember and live by the Golden Rule: Do unto others as you would have them do unto you.

Thank you and good night.

Port of Portland Corporate Seismic Risk Assessment Study

Final Report

May 2015

Prepared for:

Port of Portland

7200 NE Airport Way
Portland, OR 97218

Prepared by:

HNTB Corporation

BergerABAM

Geotechnical Resources, Inc.

ImageCat, Inc.

KPFF Consulting Engineers

New Albion Geotechnical

HNTB

HNTB Corporation

600 108th Ave NE, Suite 900
Bellevue, WA 98004



EXECUTIVE SUMMARY

The Port of Portland has conducted a seismic risk assessment of selected high-value Port assets. The seismic risk assessment was conducted to: 1) evaluate the seismic performance of the selected assets at multiple earthquake/ground-motion hazard levels, 2) identify potential improvements to selected assets that would mitigate hazards and enhance the seismic performance, and 3) estimate benefits of such improvements in comparison to cost of implementation. The study was intended to advance the understanding of the degree to which Port facilities are at risk of damage from a major earthquake and the potential economic benefit of undertaking projects to improve seismic resilience.

1. Port Assets Evaluated in the Seismic Risk Assessment Study

The seismic risk assessment considered 18 of the Port's approximately 230 assets. The 18 assets were selected on the basis of critical Port functions, high value, high revenue generation, and significance to the region in terms of economic impact. The assets represent both Aviation and Marine operations, and comprise approximately half the total value of all Port assets combined and 80% of the Port's revenue generation. The assets are listed below. The numbers indicate priority in terms of relative importance to the Port's operations; priorities were assigned at the outset of the study.

PDX Buildings

1. Central Utility Plant (CUP)
3. Concourse C – three sections
4. Terminal Core and South Lobby – four structurally-distinct components
5. ARFF Facility
- 6a. Port Headquarters Building and P2 Parking Structure North
- 6b. P2 Parking Structure South
13. Ground Maintenance Administration and Shops
14. Ground Maintenance Facility
15. Ground Maintenance Facility

PDX Airfield

2. Runway 10R-28L – South Runway
2. Runway 10L-28R – North Runway

Marine Facilities

7. Terminal 6 – Berths 604 and 605
8. Terminal 5 – Berth 503
9. Terminal 4 – Berths 410 and 411
10. Terminal 5 – Berth 501
11. Terminal 6 – Berth 601
16. Terminal 6 – Maintenance Warehouse
17. Terminal 6 – Electric Shop Building

Hillsboro Airport

12. Runway 13-31

In addition to representing a large majority of the Port's asset value and revenue production, these assets represent a significant regional economic impact. The assets account for an estimated \$100 million in annual Port revenue. In 2011, these assets were estimated to account for an estimated \$2 billion in regional economic impact. The regional economic impact was taken from the report The Local and Regional Economic Impacts of the Port of Portland, 2011, prepared by Martin Associates. It is expected that the contribution of the Port's assets to the regional economy has grown since that report was issued in early 2012.

2. Seismic Risk Assessments

For each of the facilities, the study conducted an assessment of vulnerability to earthquake damage. Assessments considered structural systems of the specific assets as well as site-specific soil conditions at each location. Together with the structural and soils evaluations, the study estimated the length of time each facility was likely to be out of service – or the “downtime” – following ground motions with a return period of 475 years. The facilities vary in age from 60 years to no more than a few years. The assessments considered both inertial lateral forces on structures and kinematic loading from liquefaction-induced settlement or lateral spreading. Given the varying ages of the structures and changes in building codes over the years, the capacity of the structures to resist lateral loads varies considerably both for PDX buildings and marine structures. Newer structures typically have the capacity to resist larger forces than older structures, as would be expected.

The entire PDX site has subsurface conditions susceptible to soil liquefaction and seismically-induced settlement. Many of the buildings at PDX have pile foundations. Typically, buildings with shorter pile foundations that do not penetrate to dense, non-liquefiable soil deposits are more vulnerable to settlement-caused earthquake damage than buildings with long pile foundations. Most of the older structures have shorter pile foundations. The majority of buildings at PDX, even those with long pile foundations, have slab-on-grade ground floors which will settle as the result of soil liquefaction and settlement. Consequently, earthquake-induced settlement of ground floor slabs can occur even in a building that is otherwise undamaged by forces of a particular earthquake.

All of the Port's marine structures are also located in areas where the soil is susceptible to liquefaction as well as to lateral spreading. The large estimated soil displacements caused by lateral spreading can impose significant, damaging forces on structural elements. In larger earthquake events, the majority of the marine facilities will likely be damaged beyond repair.

Findings of the preliminary assessments for each facility are summarized in the following:

PDX Building Assessments

Central Utility Plant: Originally constructed in 1970; expanded in 1992 and upgraded in late 1990s. Design capacity of the lateral force-resisting system for earthquake forces ranges from

65% to 87% of current code lateral design forces. The building is composed of a variety of different structural systems which could result in an undesirable distribution of lateral earthquake forces. The building lacks ductile detailing, and the thin, brittle exterior masonry walls are susceptible to damage. Pile foundations are relatively shallow, and the building may settle several inches even in a moderate earthquake. Downtime to rebuild and repair the CUP following seismic forces from ground motions having a 475-year return period is estimated to be approximately 12 months. Additional time could be needed to procure, install, and commission specialized equipment.

An 80-foot length of corrugated steel pipe (CSP) utility tunnel exists between the CUP and the utility tunnel under the P2 parking structure (P2). The CSP utility tunnel is not pile-supported, and it will settle relative to the CUP and the pile-supported utility tunnel under P2. The differential settlement can be expected to damage utilities inside the tunnel.

Concourse C: Constructed in late 1990s. The lateral force-resisting system is steel moment-resisting frames. Design capacity is 103% of current design requirements; however, lateral drifts of the building in a relatively large earthquake will exceed current standards for Immediate Occupancy, and the movement of the building could damage glazing and other non-structural components necessary to meet Immediate Occupancy conditions. The building is supported on deep piles which will prevent significant settlement of the structure. However, the slab-on-grade ground floor will settle in the event of earthquake-induced liquefaction. The settlement will damage architectural and MEP elements that are supported by the slab. Additionally, the utility tunnel below Concourse C is not pile-supported, and is likely to settle. Downtime to restore Concourse C to an occupiable condition after the 475-year hazard level ground motions is estimated to be two months.

Terminal Ticket Lobby: Originally constructed in 1973; seismically upgraded in the mid-1990s. The lateral force-resisting system is composed of concrete shear walls with steel braced frames above the Mezzanine. Design capacity for the shear walls is 97% of current code, and for the braced frames is 63% of current code. The building lacks ductile detailing which will likely result in localized damage in a major earthquake. The original pile foundation is relatively shallow, and was supplemented with deeper micropiles in the upgrade. The shallow piles will settle when soil liquefaction occurs, causing stresses in the building structure and increased loads on the micropiles. The slab-on-grade ground floor and exit vestibules will settle, possibly by 12 inches or more in a large earthquake. Downtime to restore the building to an occupiable condition after the 475-year event is estimated to be 12 months.

Terminal South Node: Constructed in late 1990s. Design capacity is 103% of current code. However, detailing of the shear wall reinforcing may not meet current code. A lack of ductile detailing could lead to localized damage in a large earthquake. The pile foundations are deep and are not expected to settle significantly. As elsewhere in the terminal, however, the slab-on-grade ground floor will settle 12 inches or more in a large earthquake. Downtime to repair damage from the 475-year event is estimated to be two months.

Terminal Oregon Marketplace South: Originally constructed in 1956; expanded and upgraded in 1986 and 2002. The lateral force-resisting system is a combination of concrete shear walls and steel braced frames. Design capacity for the concrete shear walls is 107% of current code, and for the braced frames is 70% of current code. Similar to the Ticket Lobby, a lack of ductile detailing will result in localized damage. Piles from the original construction are shallow, and will likely settle several inches in a soil liquefaction event. The settlement will cause stresses in the building and increased loads on micropiles that were installed in the 2002 upgrade. Soil liquefaction will cause slab-on-grade settlements of 12 inches or more. Downtime to restore the building to an occupiable condition after the 475-year event is estimated to be 24 months.

Terminal Oregon Marketplace Central: Originally constructed in 1956; upgraded in 1986 and late 1990s. The ongoing phased voluntary seismic upgrade of the Terminal has not been completed in this area. If completed, the design capacities based on the existing concrete shear walls and braced frames would be 107% and 70% of current code respectively. Due to a lack of ductility in the structure, the building is expected to perform poorly in a large earthquake. The existing pile foundation is shallow, and will not prevent settlement of the building in a large earthquake. The settlement will cause extensive damage to the older concrete structure. Settlement of the slab-on-grade could be as much as 10 inches in a 500-year event. Downtime to restore the building to an occupiable condition after the 475-year event is estimated to be 24 months.

PDX Aircraft Rescue and Firefighting Facility: Constructed in the 1990s. The ARFF facility building was designed as an Essential Facility with concrete masonry shear walls. The design capacity for seismic forces is 107% of current code requirements. The structure likely does not meet current requirements for ductility, and localized damage can be expected. With a high potential for liquefaction at the site, the building can be expected to settle due to its mat foundation rather than deep piles. Settlements of approximately 6 inches could occur with ground motions having a 200-year return period, and more than a foot with larger ground motions. The building may not be significantly damaged by the settlement, but certain elements such as the doors of the truck bays may not be workable. Downtime to restore the ARFF facility following the 475-year event is estimated to be two months.

Port Headquarters (HQ) and P2 Parking Structure: Constructed in 2009. The lateral force-resisting system is a combination of concrete shear walls and concrete and steel moment-resisting frames. Design capacity is 100% of current code requirements. The building meets code design and detailing requirements and code performance expectations. Deep pile foundations will prevent settlement of the building. However, the slab-on-grade ground floor – part of the P2 Garage – may settle as much as a foot in a large earthquake. Downtime to restore HQ/P2 to an occupiable condition after the 475-year event is estimated to be one month. The estimated one-month downtime would not include repairing the ground floor.

PDX Ground Maintenance Facilities: Constructed in the 1980s. The three buildings are of generally similar construction consisting of precast, tilt-up concrete walls with plywood

diaphragm roofs. Design capacity for lateral seismic forces ranges from 31% to 37% of current code design forces. Lateral systems lack ductility, and the roof structures do not meet current design standards. The site is highly susceptible to soil liquefaction. Ground settlements of as much as 18 inches could occur in an earthquake with ground motions having a return period of as little as 200 years. Spread footings could settle an additional foot. The extreme settlements together with the seismic deficiencies of the structures will likely result in the buildings being unusable after a 200-year event. Downtime to replace the buildings is estimated to be approximately 16 months.

PDX Runway Assessment

Runways 10R-28L (South)/10L-28R (North): The South Runway was reconstructed in 2011; the North Runway was extended and rehabilitated in 2009 and 2010. As noted in the PDX building assessments, the soils at PDX are highly susceptible to seismically-induced liquefaction. The resulting settlement will affect airfield pavements. Minimal damage is likely to occur when subjected to ground motions having an average return period of 72 years, while differential settlements are likely to become operationally unacceptable at ground motion levels greater than approximately 225-year exposure intervals. Soil conditions are generally similar at the two runway sites, with the exception that a higher risk of lateral spreading exists at the north runway location. Repair times to return a runway to service will of course depend on the extent of damage, and could range from a few days for minor repairs to 10 -12 months for full reconstruction. Repairs to the asphalt concrete North Runway will likely require less time in general than repairs to the portland cement concrete South Runway.

Marine Facility Assessments

Marine structures, with the exception of Terminal 6 – Berths 604/605, were assessed in this study for performance at 72-year, 475-year, and 975-year return period ground motions in accordance with current industry approach. Berths 604/605 were evaluated in an earlier study conducted by the Port. In general, all of the facilities in their existing condition will experience some degree of damage from a 72-year hazard level ground motions, and none would be expected to survive a 475-year event.

Terminal 6 – Berths 604/605: Originally constructed in 1974; modified in 1994 and 2011/2012. Berths 604 and 605 are sand-filled cellular sheet pile structures. Ground improvements to increase seismic resilience of an 800-foot section of the wharf were undertaken by the Port in 2011 and 2012. Based on evaluations conducted previously by the Port, the improved section should survive ground motions at a 200-year return period. The unimproved section of the facility is expected to be vulnerable to damage beyond a 50-year event.

Terminal 5 – Berth 503: Constructed in 1992. Original design criteria for Berth 503 are unknown. It can be expected that the criteria were considerably below current code requirements. The structure is composed of concrete piles, concrete pile caps and beams, and a concrete deck with isolated steel batter pile elements. The structure is expected to survive 72-

year ground motions with relatively minor damage. Downtime for repairs following the 72-year event is estimated to be 5 to 8 months. A recent evaluation conducted for the facility indicates that ground motions at the 475-year return period, without consideration of the effects of liquefied soils, would cause forces in the structure at or slightly above capacity. At this return period, soil liquefaction will result in lateral spreading estimated to be on the order of seven feet. This extent of soil displacement may cause substantial damage, such that the berth may not be repairable. A 26- to 38-month downtime for replacement can be expected.

Terminal 4 – Berths 410/411: Berth 411 constructed in 1959; Berth 410 constructed in 1962. Design capacity for the lateral systems is approximately 30% of current code design forces. Structural systems vary, with Berth 410 constructed primarily of timber elements and Berth 411 constructed of concrete elements. However, the performance of the two berths is expected to be similar. The structures will likely survive a 72-year return period event with repairable damage. The 475-year event will induce significant soil liquefaction which will cause large lateral soil displacements. The soil displacements will result in excessive forces on structural elements. The facilities are not expected to survive the 475-year event. Downtime to reconstruct the berths is estimated at 26 to 38 months.

Terminal 5 – Berth 501: Constructed in 1974. Design criteria for this facility are unknown, but are likely to have been well below current code. The facility is a hybrid pier structure consisting of three large-diameter sheet pile cells supporting a concrete deck. Earthquake-caused liquefaction at the site will induce large lateral soil deformations resulting in significant forces on the sheet pile cells. The 72-year event will likely cause significant damage requiring extensive repairs. Downtime to repair damage from the 72-year event is estimated to be 12 to 16 months. The 475-year event will likely damage the pier beyond repair. Reconstruction time is estimated to be 22 to 34 months.

Terminal 6 – Berth 601: Constructed in 1989. Berth 601 is a floating dock with a trestle connection to the shore. The floating dock will not experience significant damage from an earthquake, as a result of being waterborne. Design capacity for the lateral system of the trestle is approximately 11% of self-weight, which is approximately equal to current code forces for the 72-year return period event. Soil lateral spreading displacements at the site will be extensive, estimated at several feet from ground motions at the 72-year event and in excess of 10 feet at the 475-year event. The trestle and other landward elements are expected to suffer significant damage from the soil displacements in the 72-year event, and may not survive. Downtime to construct a new trestle and replace other landward elements is estimated at 15 to 21 months.

Terminal 6 Maintenance Warehouse: Constructed in the 1970s. Design capacity, originally based on wind loading, ranges from 35% to 77% of the current code seismic design forces. The lateral system is composed of a combination of tension rod bracing and steel moment frames. The design lacks the ductile configuration and detailing required by current code. Additionally, soil liquefaction could lead to settlements exceeding a foot in ground motions at a return-period

of less than 300 years, resulting in significant damage. The building is not likely to survive beyond a 200-year event. Downtime to replace the building is estimated to be 12 months.

Terminal 6 Electrical Shop: Constructed in the late 1980s. The building was designed for wind loading, similar to the Maintenance Warehouse. Design capacity is 167% of the current code seismic design forces in one direction, but only 28% of the current code in the other direction. The lateral system consists of tension rod bracing and moment frames, which lack the ductility required by current code. As noted for the Maintenance Warehouse, large settlements at the site will likely occur in relatively small earthquakes. The building is likely to be damaged beyond repair in a 200-year event. A 12-month replacement downtime would be expected.

Hillsboro Airport Runway Assessment

Hillsboro Runway 13-31: Soils at the site of the Hillsboro Airport are less prone to seismically-induced liquefaction and settlement than the soils at PDX. Screening-level analyses indicate that there is a low risk of significant soil settlement at the Hillsboro site. A magnitude 9.0 earthquake is likely to cause some runway settlement but not take the runway out of service. Portions of the runway may need to be repaired to return the runway to original condition, but such repairs will not likely need to be undertaken immediately to maintain the runway in service.

3. Seismic Risk Mitigation Strategies for Selected Assets

The study identified potential strategies to mitigate the expected seismic risk for a selected group of the assets evaluated. The selected group of assets included the CUP, Concourse C, sections of the main passenger terminal, and the South Runway at PDX, and marine Terminal 4 – Berths 410/411, Terminal 5 – Berths 501 and 503, and Terminal 6 – Berth 601. For buildings, seismic risk mitigation was targeted at achieving a condition of Immediate Occupancy for ground motions having a 475-year return period. For marine facilities, the objective of mitigation was to achieve survivability for the 475-year return period event.

Seismic risk mitigation for the Port's assets will generally entail both improvements of structural systems and improvements of soils. At all PDX and marine facilities, mitigation must necessarily address the liquefaction potential of the soils. The soils are deep alluvial flood deposits of the Columbia River and Willamette River, and as noted in the foregoing narrative are highly susceptible to liquefaction. The ground settlements and lateral spreading that are triggered by liquefaction can be damaging to all types of structures.

The potential mitigation strategies identified in the study are summarized in the following:

Central Utility Plant: Improve the foundation to prevent settlement of the building by installing deep micropiles at each column and other load-bearing elements, and at locations of critical equipment. Strengthen the lateral capacity of the building by retrofitting with a concrete shear wall system. Replace the brittle exterior wall system composed of masonry blocks and brick veneer with a more flexible system such as metal studs and metal panels. Improve anchorages

and support for essential MEP equipment and systems. A rough order of magnitude estimate of probable construction cost for these actions is \$16 million. The estimate is based on 2014/2015 costs.

In addition to the CUP, risks to the unsupported utility tunnel that exists between the CUP and the parking structure should be addressed. A new pile-supported concrete tunnel could be constructed around the existing tunnel to eliminate settlement potential.

Concourse C: Install micropiles under the slab-on-grade ground floor to prevent significant settlement. Alternatively, reinforcing the slab with a reinforced topping slab bonded to the existing slab would be feasible in some areas. Install micropiles to support the utility tunnel. For the lateral system of the building, install a force damping system to improve seismic performance. Some additional bracing of critical MEP systems would be needed. Order of magnitude estimate of cost: \$81 million total for all three sections of the concourse.

Terminal Ticket Lobby: Install micropiles at each column and other load-bearing element to prevent settlement of the building. Install micropiles under the slab-on-grade ground floor to prevent settlement, or replace the slab with a structural slab. Replace steel braced frames in the lateral system with more ductile braces for better ductility performance, and reinforce certain structural connections. Additional bracing of critical MEP systems would be needed. Order of magnitude estimate of cost: \$47 million.

Terminal South Node: Install micropiles under the slab-on-grade to prevent settlement, or replace the slab with a structural slab. Install micropiles to support the utility tunnel. Improve structural diaphragm connections to improve the strength and ductility of the lateral structural system. Additional bracing of critical MEP systems would be needed. Order of magnitude estimate of cost: \$36 million.

Terminal Oregon Marketplace South: As for the Terminal Ticket Lobby, install micropiles at each column and other load bearing elements to prevent settlement. Install micropiles under the slab-on-grade. For the lateral system, replace braced frames with more ductile bracing, with the exception of two braced frames that should be replaced with concrete shear walls. Additional bracing of critical MEP systems would be needed. Order of magnitude estimate of cost: \$20 million.

PDX Runway: Install stone columns or jet grout the supporting soil. At either the North Runway or the South Runway, stone columns would extend to a depth of approximately 40 feet below the pavement surface. Jet grouting treatment would extend to a depth of approximately 30 feet. Stone columns would be installed as part of a scheduled reconstruction project; jet grouting could be undertaken as a retrofit. Order of magnitude estimates of cost: \$137 million for jet grout treatment of the South Runway, \$67 million for stone column improvements for the South Runway, and \$68 million for stone column improvements for the North Runway.

Terminal 4 – Berths 410/411: Given the age of these facilities and the cost of improvements that would be needed to achieve survivability at the 475-year return period, the only mitigation

action that would be economically viable is to replace the berths with a modern facility. It is expected that replacing the two berths with a single combined facility would be the preferred approach. Order of magnitude estimate of cost for a combined replacement facility: \$42 million.

Terminal 5 – Berth 501: Conduct ground improvements to limit soil displacements. Ground improvements could consist of installing stone columns or other strengthening method in the river embankment, around the trestle abutment, and in the cellular structures. Install new piles to support the conveyor bridge tower, and strengthen structural members and connections throughout the facility. Order of magnitude estimate of cost: \$20 million.

Terminal 5 – Berth 503: Conduct ground improvements along the shoreline using stone columns, and strengthen piles, pile connections, and concrete beams. Order of magnitude estimate of cost: \$13 million.

Terminal 6 – Berth 601: Conduct ground improvements using stone columns around the approach trestle bents and abutments, and install piles at each bent. Retrofit the trestle structure by strengthening structural elements and connections. Order of magnitude estimate of cost to retrofit the trestle with new piles and stronger connections: \$5 million.

It should be noted that mitigation strategies other than those mentioned here were considered and may be appropriate; discussion of other strategies was omitted in the interest of brevity. Future work and additional in-depth studies by the Port would determine the optimal mitigation strategy for any asset.

4. Risk and Benefit-Cost Analyses

The study conducted risk and cost-benefit analyses of the assets and the potential mitigation strategies. The analyses were conducted to evaluate the benefits of mitigation by comparing existing “as is” conditions with the mitigated conditions. Eight different cases were evaluated, considering Port-only revenue impacts and Port-plus-Region combined economic impacts:

- a. Port Only Impacts – Buildings, Existing (“As-is”)
- b. Port Only Impacts – Buildings, Runways and Marine Facilities, Existing (“As-is”)
- c. Port Only Impacts – Buildings with Mitigation
- d. Port Only Impacts – Buildings, Runways and Marine Facilities with Mitigation
- e. Port and Regional Impacts – Buildings, Existing (“As-is”)
- f. Port and Regional Impacts – Buildings, Runways and Marine Facilities, Existing (“As-is”)
- g. Port and Regional Impacts – Buildings with Mitigation
- h. Port and Regional Impacts – Buildings, Runways and Marine Facilities with Mitigation

Benefit-Cost for Mitigation of PDX Assets

The total order of magnitude estimated cost of the potential mitigation strategies identified in the study for the PDX assets is \$267 million. The assets include the CUP, Concourse C, the three units of the passenger terminal, and the South Runway.

	<u>Estimated Cost of Mitigation</u>
CUP	\$16,000,000
Concourse C	\$81,000,000
Terminal Ticket Lobby	\$47,000,000
Terminal South Node	\$36,000,000
Terminal Oregon Marketplace South	\$20,000,000
<u>South Runway</u>	<u>\$67,000,000</u>
Total	\$267,000,000

Considering Port plus regional economic impacts, benefit-cost analysis shows a benefit-cost ratio of 1.4 for the combined mitigations. A benefit-cost ratio of 1.4 represents a relatively good payback on investment, on the basis that a ratio greater than 1 indicates a positive economic benefit.

A comparison of the cost-effectiveness of the potential mitigation actions for each of the PDX building assets showed that the greatest benefits in loss reduction would be produced by mitigations for the CUP, the Terminal Ticket Lobby, and the Terminal Oregon Marketplace South. The order of magnitude cost estimate for mitigations of these three building assets is \$83 million. With the South Runway mitigation at \$67 million, the total cost of the mitigation strategies for this smaller group of assets would be \$150 million. Considering Port and regional economic impacts, the benefit-cost analysis shows a benefit-cost ratio of 2.2 for risk mitigation for this smaller group.

Benefit-Cost for Mitigation of Marine Assets

Benefit-cost analysis for the potential retrofit mitigation actions at all of the marine facilities evaluated, with the exception of Terminal 4 – Berths 410/411, shows benefit-cost ratios greater than 1 considering Port and regional economic impacts. Specific benefit-cost ratios for mitigation actions are as follows:

	<u>Estimated Cost of Mitigation</u>	<u>Benefit-Cost Ratio</u>
Terminal 4 – Berths 410/411	\$42,000,000	0.8
Terminal 5 – Berth 501	\$20,000,000	3.5
Terminal 5 – Berth 503	\$13,000,000	1.8
Terminal 6 – Berth 601	\$5,000,000	2.9
Terminal 6 – Berths 604/605	\$15,000,000	2.2

As noted, the only economically viable mitigation strategy for Terminal 4 – Berths 410/411 is complete replacement. The cost of facility replacement and the time out of service take the benefit-cost ratio for that action below 1.

5. Conclusions and Recommendations

The Seismic Risk Assessment Study identified risks of seismic damage in the majority of the Port assets evaluated. Given the importance of the Port's function to the region, it is recommended that the Port continue with actions to improve the seismic resilience of key Port assets. For PDX, the focus could be on improving the resilience of a group of assets that would together represent a functional airport – a portion of the passenger terminal, a concourse, the CUP, and a runway. The Terminal Ticket Lobby, Terminal South Node, Terminal Oregon Marketplace South, Concourse C, the CUP, and either the North Runway or the South Runway would fit this description. For marine facilities, the focus could be on protecting the assets that provide the greatest revenue and functionality. Accordingly, it is recommended that the Port give consideration to the following specific mitigation projects:

PDX Runway

Mitigation of risks to a PDX runway should be a top priority. Given the liquefaction potential of the ground at PDX, relatively low to moderately strong ground motions will cause ground settlement and distortion of pavement to some extent. This would result in a high probability of a repair project that would take the runways out of service for some length of time. Without a usable runway, the airport would not be functional. Further study would determine if the mitigation should be for the South Runway or the North Runway. Planning for a runway mitigation project should include discussions with the FAA about physical condition requirements for a runway to remain in service after an earthquake, and about the potential for improving the survivability of critical FAA-owned navigational aids.

PDX Terminal

A terminal mitigation project should be pursued as a second priority. The terminal is necessary for passenger check-in functions and baggage handling. The focus of a mitigation effort should be on terminal units T1 – Ticket Lobby and T3 – Oregon Marketplace South, for which mitigation actions show the greatest cost-effectiveness. The mitigation could be part of the Terminal Core Redevelopment project that the Port has initiated; that project would provide an avenue and mechanism to accomplish the seismic retrofits.

PDX Central Utility Plant or Concourse C

A mitigation project for either the CUP or Concourse C should be a third priority. A functioning CUP is critical for full operation of the terminal and airfield functions. Further study would confirm the vulnerability of the CUP and determine the optimal retrofits. If the further study finds that the CUP is not as vulnerable as believed, consideration should be given to mitigating the risks at Concourse C as the third priority.

Marine Terminal T6 – Berths 604/605

Mitigation at Terminal 6 – Berths 604/605 should be completed, as the top priority for the Port's marine assets. A portion of the wharf has been seismically upgraded. A project to mitigate risks for the remainder of the wharf would improve the resilience of the entire facility to withstand a large

earthquake. Berths 604/605 would likely be the most important Port marine asset in supporting a regional rebuilding effort in the aftermath of a major disaster.

Marine Terminal T5 – Berth 503

Mitigation at Terminal 5 – Berth 503 should be the second priority for the marine assets. Berth 503 operates under the most stable, long-term lease of the Port’s marine facilities. Seismic vulnerabilities should be mitigated to keep this facility in business for the long term.

For each of these potential projects, next steps will include detailed geotechnical site assessments, detailed structural engineering analyses, and further explorations of potential mitigation measures, costs, and benefits.

Beyond the specific, prioritized project recommendations outlined in the foregoing, this study offers the following additional recommendations:

- Evaluate the benefit of designing each new project for greater seismic resilience than the minimum required by Building Code. Considering that code requirements for seismic design forces are based on life-safety and collapse prevention, not on property preservation or operational continuity, structures designed to minimum code requirements cannot be expected to maintain uninterrupted functionality after a major earthquake.
- Identify and evaluate mitigations for other key Port assets. This study identified and evaluated potential mitigation actions for only a limited number of the Port’s key assets. A similar effort should be undertaken for other assets considered to be critical for the Port’s functions.
- Establish a plan for extricating aircraft rescue and firefighting vehicles from the ARFF facility if the doors of the truck bays become inoperable after an earthquake.
- Broaden future seismic risk assessment efforts to include non-Port critical assets and lifelines, in coordination with other agencies and with utility owners. Pertinent examples include:
 - Services provided by regional lifeline systems such as electrical power, telecommunications, water/wastewater, fuel, and surface transportation
 - The Columbia River levee system adjacent to PDX
 - Jetties at the mouth of the Columbia River, and navigation channels along the full lengths of the Columbia River and Willamette River shipping lanes
- Confirm the plan for Port emergency operations and recovery. Immediate occupancy after a significant ground motion should not be expected for any Port facility as it currently exists. The Port should assess the current emergency response plan to ensure there is an allowance for the probable temporary unavailability of existing Port facilities.

End of Executive Summary

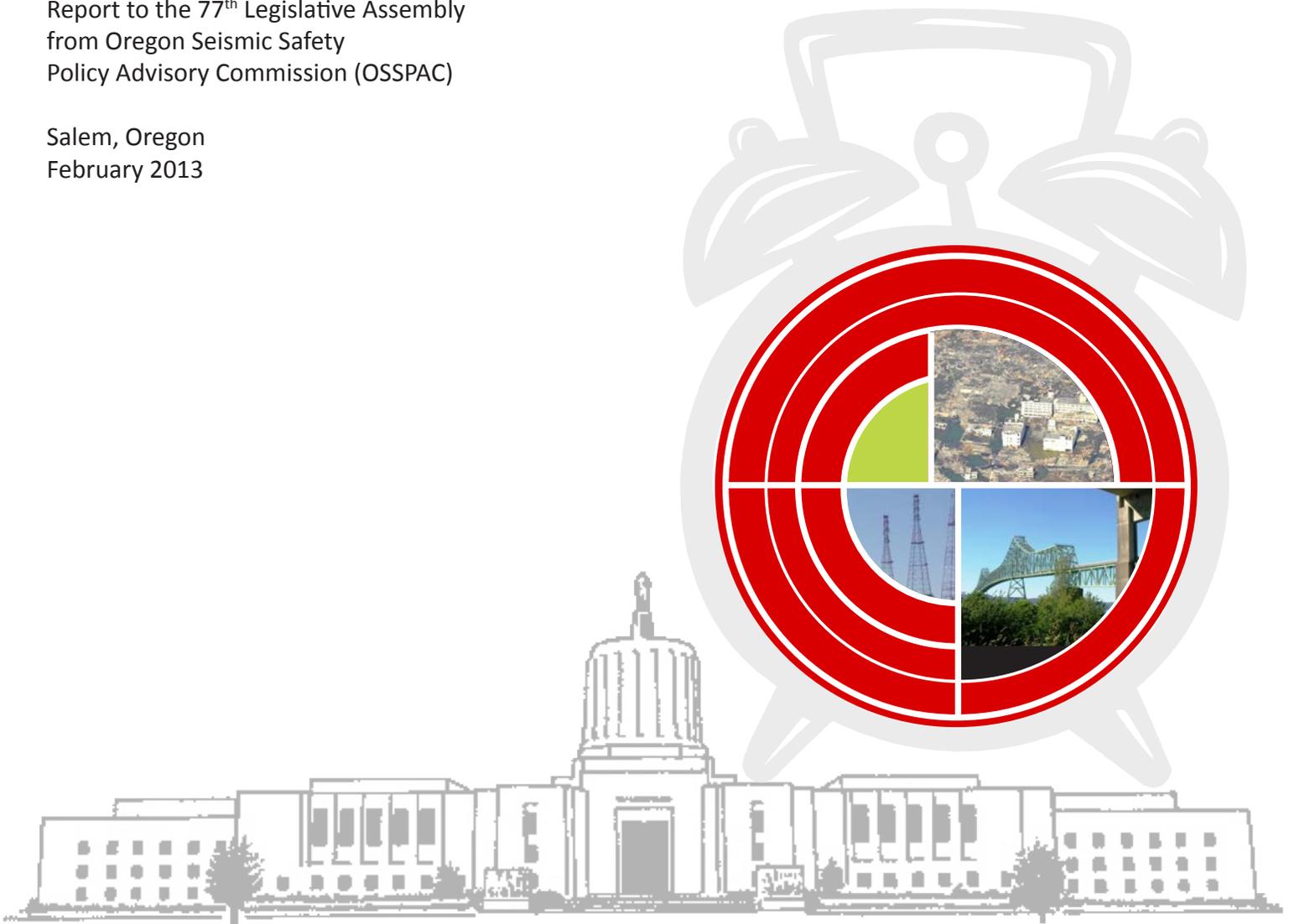
The Oregon Resilience Plan

Executive Summary

**Reducing Risk and Improving Recovery
for the Next Cascadia Earthquake and Tsunami**

Report to the 77th Legislative Assembly
from Oregon Seismic Safety
Policy Advisory Commission (OSSPAC)

Salem, Oregon
February 2013



Note: This Executive Summary selects from the large number of detailed recommendations in the chapters of the Oregon Resilience Plan. The full report is available online at the Oregon Office of Emergency Management website: <http://www.oregon.gov/OMD/OEM/Pages/index.aspx>

Foreword

“If we cannot control the volatile tides of change, we can learn to build better boats.”
—Andrew Zoll and Ann Marie Healy, *Resilience: Why Things Bounce Back* (2012)

For more than 300 years, a massive geological fault off America’s northwest coast has lain dormant. Well into that interval, Meriwether Lewis and William Clark journeyed to the mouth of the Columbia River and returned to Washington, D.C. to tell the new United States about what came to be known as the Oregon Country. Tens of thousands of settlers crossed the Oregon Trail to establish communities throughout the Willamette Valley, in coastal valleys, and beside natural harbors. With the provisional government established in 1843 followed by statehood in 1859, the modern history of Oregon began. Industries rose and fell, cities and towns grew . . . and still the fault lay silent.

Not until the 1980s did scientists recognize the Cascadia subduction zone as an active fault that poses a major geological hazard to Oregon. A decade later, the state’s building codes were updated to address this newly revealed earthquake threat to the built environment.

Since that time, scientists have documented a long history of earthquakes and tsunamis on the Cascadia subduction zone, and state and local officials have urged Oregonians to prepare for the next one. In 1999, the state’s Department of Geology and Mineral Industries published a preliminary statewide damage and loss study identifying the dire consequences of a Cascadia earthquake and tsunami for Oregon’s infrastructure and for public safety.

One official who took that warning seriously was Senator Peter Courtney, Oregon’s unchallenged champion of earthquake safety and advocate for measures to protect students who attend unsafe schools. His legislative efforts over more than a decade launched a statewide assessment of schools and emergency response facilities, and established a state grant program to help fund seismic upgrades to hazardous schools and other critical facilities. Other than California, no state has done as much—yet the hazard surpasses the commitments Oregon has made to date.

In early 2011, we suggested in the pages of *The Oregonian* that Oregon should take new steps to make itself resilient to a big earthquake. Less than two months later, the Tohoku earthquake and tsunami disaster in Japan provided the occasion for Representative Deborah Boone to introduce a House Resolution calling on Oregon to plan for the impacts of a Cascadia earthquake and tsunami here.

House Resolution 3 directed Oregon Seismic Safety Policy Advisory Commission to lead the planning effort. Chairman Kent Yu, Ph.D., has skillfully guided more than 150 volunteer professionals, including noted experts, to develop a landmark report on Oregon’s priorities to survive and bounce back from a magnitude 9.0 Cascadia earthquake and tsunami.

The authors of this Oregon Resilience Plan set out to help Oregonians know what to expect from the state’s infrastructure should that disaster strike this year, 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.

Business leaders engaged in this resilience planning effort have indicated that in a major disaster, interruptions of infrastructure services lasting longer than two weeks will put their enterprises at risk. Yet, under present conditions, we can expect some interruptions to last much longer, in some cases from 18 to 36 months or more. The state, in tandem with the private sector, has much to do to improve the reliability of basic services. Citizens, too, need to plan to be self-sufficient for far longer than the 72-hour period commonly advised for disaster preparedness.

The most recent Cascadia earthquake struck at around 9:00 p.m. on a late January evening; the next could shake a mid-July morning when hundreds of thousands of Oregonians and visitors are enjoying coastal beaches and towns. No one can predict the next time the Cascadia fault will rupture, and *today* is just as likely as fifty years from now. If we begin now, it is possible to prevent that natural disaster from causing a statewide catastrophe. Now is the time to have a plan. Now is the time to close Oregon’s resilience gap.

The Oregon Resilience Plan maps a path of policy and investment priorities for the next fifty years. The recommendations offer Oregon’s Legislative Assembly and Governor immediate steps to begin a journey along that path. The plan and its recommendations build on the solid foundation laid over the past quarter century by some of Oregon’s top scientists, engineers, and policymakers.

As we wrote two years ago, adopting and implementing such a plan can show “Oregon at its best, tackling a risk with imagination and resourcefulness while sharing the knowledge gained.”

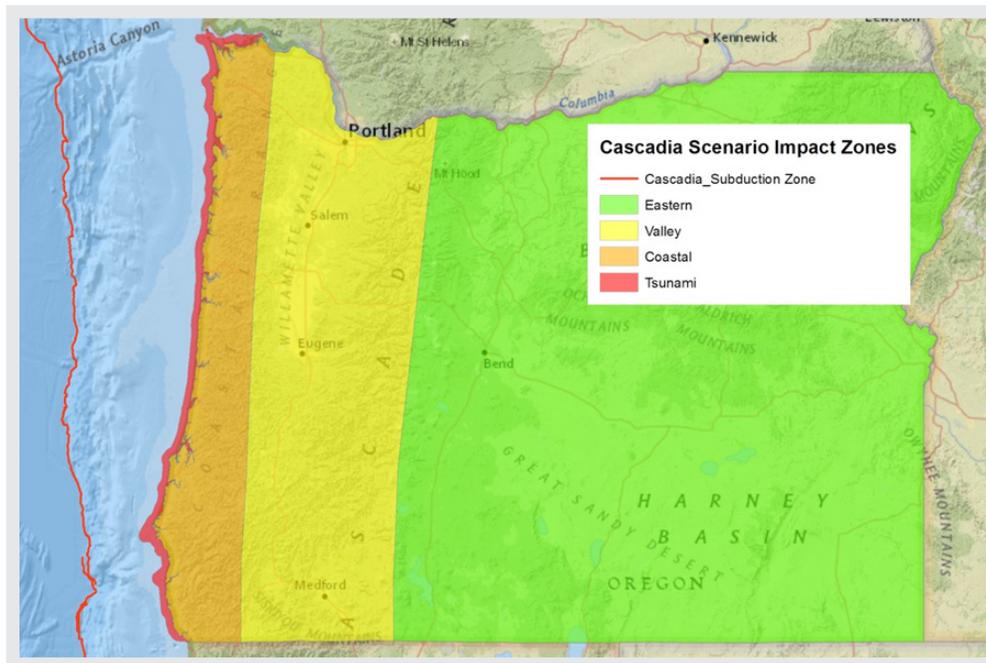
Yumei Wang, Jay Raskin, and Edward Wolf
Portland, Oregon, November 2012

Yumei Wang, Jay Raskin, and Edward Wolf are the co-authors of “Oregon should make itself resilient for a big quake,” *The Sunday Oregonian*, January 9, 2011.



Executive Summary

Very large earthquakes will occur in Oregon’s future, and our state’s infrastructure will remain poorly prepared to meet the threat unless we take action now to start building the necessary resilience. This is the central finding of the Oregon Resilience Plan requested by Oregon’s 76th Legislative Assembly.



Impact zones for the magnitude 9.0 Cascadia earthquake scenario. Damage will be extreme in the Tsunami zone, heavy in the Coastal Zone, moderate in the Valley zone and light in the Eastern zone.

About the Plan

House Resolution 3, adopted in April 2011, directed the Oregon Seismic Safety Policy Advisory Commission (OSSPAC) “to lead and coordinate preparation of an Oregon Resilience Plan that reviews policy options, summarizes relevant reports and studies by state agencies, and makes recommendations on policy direction to protect lives and keep commerce flowing during and after a Cascadia earthquake and tsunami.” OSSPAC assembled eight task groups, comprising volunteer subject-matter experts from government, universities, the private sector, and the general public. An Advisory Group of public- and private-sector leaders oversaw the Task Groups’ work, assembled in the portfolio of chapters that make up the plan.

OSSPAC offered the following definition of the seismic resilience goal:

“Oregon citizens will not only be protected from life-threatening physical harm, but because of risk reduction measures and pre-disaster planning, communities will recover more quickly and with less continuing vulnerability following a Cascadia subduction zone earthquake and tsunami.”

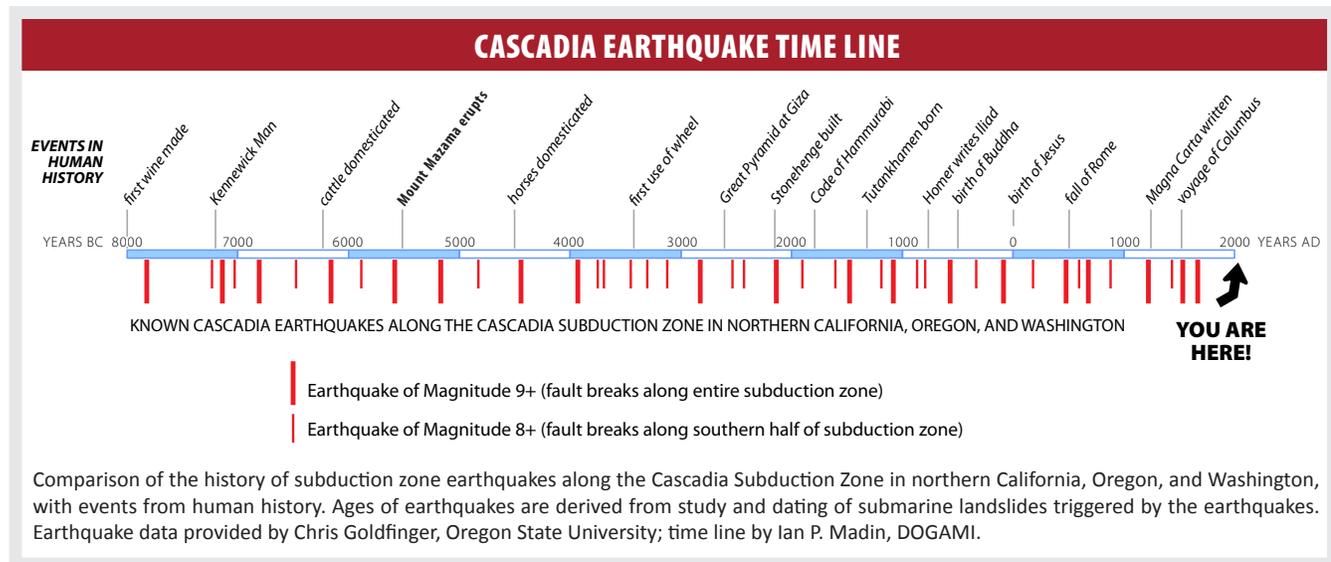
Each group was charged with three tasks for four affected zones (tsunami, coastal/earthquake only, valley, and central/eastern Oregon):

1. Determine the likely impacts of a magnitude 9.0 Cascadia earthquake and tsunami on its assigned sector, and estimate the time required to restore functions in that sector if the earthquake were to strike under present conditions;
2. Define acceptable timeframes to restore functions after a future Cascadia earthquake to fulfill expected resilient performance; and
3. Recommend changes in practice and policies that, if implemented during the next 50 years, will allow Oregon to reach the desired resilience targets.

The purpose of the analysis is to identify steps needed to eliminate the gap separating current performance from resilient performance, and to initiate that work through capital investment, new incentives, and policy changes so that the inevitable natural disaster of a Cascadia earthquake and tsunami will not deliver a catastrophic blow to Oregon’s economy and communities.

Overview of the Task Groups

The **Cascadia Earthquake Scenario Task Group** (Chapter One) reviewed current scientific research to develop a detailed description of the likely physical effects of a great (magnitude 9.0) Cascadia subduction zone earthquake and tsunami, providing a scenario that other task groups used to assess impacts on their respective sectors.



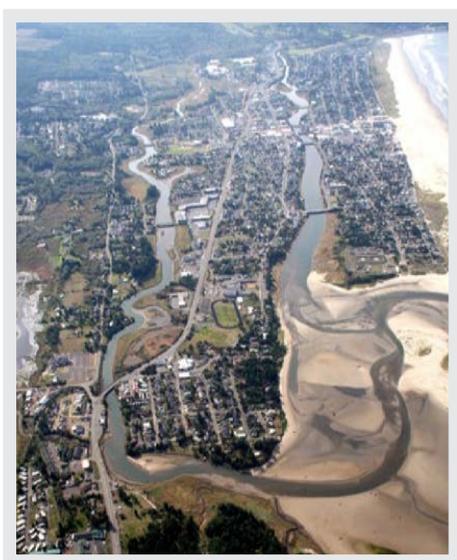
This timeline compares the 10,000-year-long history of Cascadia earthquakes to events in human history.

The **Business and Workforce Continuity Task Group** (Chapter Two) sought to assess the workplace integrity, workforce mobility, and building systems performance – along with customer viability – needed to allow Oregon’s businesses to remain in operation following a Cascadia earthquake and tsunami and to drive a self-sustaining economic recovery.

The **Coastal Communities Task Group** (Chapter Three) addressed the unique risks faced by Oregon’s coast, the region of the state that will experience a devastating combination of tsunami inundation and physical damage from extreme ground shaking due to proximity to the subduction zone fault.



Critical Facilities in the Tsunami Zone – Minamisanriku, March 14, 2011. Because their hospital, emergency operation center, and other government and community service facilities were located in the tsunami inundation zone, the surviving community lost nearly all of its capacity to respond and implement recovery efforts. Source: Asia Air Survey Co., Ltd.



Tsunami Vulnerability: City of Seaside with 83% of its population, 89% of its employees and almost 100% of its critical facilities in the tsunami inundation zone. Source: Horning Geosciences

The **Critical and Essential Buildings Task Group** (Chapter Four) examined the main classes of public and private structures considered critical to resilience in the event of a scenario earthquake, and sought to characterize the gap between expected seismic performance (current state) and desired seismic resilience (target state). The group also assessed buildings deemed vital to community resilience, and addressed the special challenges posed by unreinforced masonry (URM) and non-ductile concrete structures.

Many of existing public and private buildings such as the State Capitol Building were built prior to our knowledge of the Cascadia subduction earthquake. They are not seismically safe, and pose significant life-safety threat to the building occupants.



The **Transportation Task Group** (Chapter Five) assessed the seismic integrity of Oregon’s multi-modal transportation system, including bridges and highways, rail, airports, water ports, and public transit systems, examined the special considerations pertaining to the Columbia and Willamette River navigation channels, and characterized the work deemed necessary to restore and maintain transportation lifelines after a Cascadia earthquake and tsunami. The group’s scope included interdependence of transportation networks with other lifeline systems.

The approach (foreground) to the 1966 Astoria-Megler Bridge that spans the Columbia River has major structural deficiencies that could lead to a collapse following an earthquake. Damaged bridge sections could block waterway access to the Critical Energy Infrastructure Hub. (DOGAMI photo)



The **Energy Task Group** (Chapter Six) investigated the seismic deficiencies of Oregon’s energy storage and transmission infrastructure, with a special emphasis on the vulnerability of the state’s critical energy infrastructure (CEI) hub, a six-mile stretch of the lower Willamette River where key liquid fuel and natural gas storage and transmission facilities and electricity transmission facilities are concentrated.

Left: Site map of the Critical Energy Infrastructure (CEI) Hub on the western bank of the Lower Willamette River area in NW Portland, Oregon. The CEI Hub, outlined in red, stretches for six miles. (Google Earth)



Right: Oil terminals in the CEI Hub. (DOGAMI photo)



The **Information and Communications Task Group** (Chapter Seven) examined the inherent vulnerabilities of Oregon’s information and communications systems and the consequences of service disruptions for the resilience of other sectors and systems. The group explored the implications of co-location of communications infrastructure with other vulnerable physical infrastructure (e.g., bridges), and specified the conditions needed to accomplish phased restoration of service following a Cascadia earthquake and tsunami.

The **Water and Wastewater Task Group** (Chapter Eight) reviewed vulnerabilities of the pipelines, treatment plants, and pump stations that make up Oregon’s water and wastewater systems, and discussed the interventions needed to increase the resilience of under-engineered and antiquated infrastructure at potential failure points. The group proposed a phased approach to restoration of water services after a Cascadia earthquake and tsunami, beginning with a backbone water and wastewater system capable of supplying critical community needs.

Left:
These high voltage electrical transmission towers are built on a river bank in the Critical Energy Infrastructure (CEI) Hub susceptible to lateral spreading. (DOGAMI photo)



Right:
Structural damage to a high voltage transmission tower located at a river crossing in 2010 Chile earthquake (ASCE Technical Council on Lifeline Earthquake Engineering – TCLEE)



Key Findings

Oregon is far from resilient to the impacts of a great Cascadia earthquake and tsunami today. Available studies estimate fatalities ranging from 1,250 to more than 10,000 due to the combined effects of earthquake and tsunami, tens of thousands of buildings destroyed or damaged so extensively that they will require months to years of repair, tens of thousands of displaced households, more than \$30 billion in direct and indirect economic losses (close to one-fifth of Oregon’s gross state product), and more than one million dump truck loads of debris.

A particular vulnerability is Oregon’s liquid fuel supply. Oregon depends on liquid fuels transported into the state from Washington State, which is also vulnerable to a Cascadia earthquake and tsunami. Once here, fuels are stored temporarily at Oregon’s critical energy infrastructure hub, a six-mile stretch of the lower Willamette River where industrial facilities occupy liquefiable riverside soils. Disrupting the transportation, storage, and distribution of liquid fuels would rapidly disrupt most, if not all, sectors of the economy critical to emergency response and economic recovery.

- After the February 27, 2010 M8.8 Maule Earthquake, Chile was able to restore 90% communication services and 95% power supply within two weeks, and re-start commercial flights after ten days.
- After the March 11, 2011 M9.0 Tohoku Earthquake, Japan was able to restore more than 90% power supply in ten days, 90% telephone lines in two weeks, and 90% cellular base stations in 19 days.

Business continuity planning typically assumes a period of two weeks to be the longest disruption of essential services (i.e., utilities, communications, etc.) that a business can withstand, and service disruptions lasting for one month or longer can be enough to force a business to close, relocate, or leave the state entirely. Analysis in the *Oregon Resilience Plan* reveals the following time-frames for service recovery under present conditions:

Critical Service	Zone	Estimated Time to Restore Service
Electricity	Valley	1 to 3 months
Electricity	Coast	3 to 6 months
Police and fire stations	Valley	2 to 4 months
Drinking water and sewer	Valley	1 month to 1 year
Drinking water and sewer	Coast	1 to 3 years
Top-priority highways (partial restoration)	Valley	6 to 12 months
Healthcare facilities	Valley	18 months
Healthcare facilities	Coast	3 years

Resilience gaps of this magnitude reveal a harsh truth: a policy of business as usual implies a post-earthquake future that could consist of decades of economic and population decline – in effect, a “lost generation” that will devastate our state and ripple beyond Oregon to affect the regional and national economy.

Recommendations

Based on the findings in this *Oregon Resilience Plan*, OSSPAC recommends that Oregon start now on a sustained program to reduce our vulnerability and shorten our recovery time to achieve resilience before the next Cascadia earthquake inevitably strikes our state.

OSSPAC urges systematic efforts to assess the Oregon's buildings, lifelines, and social systems, and to develop a sustained program of replacement, retrofit, and redesign to make Oregon resilient.

Sector-by-sector findings and detailed recommendations are presented in each chapter of the *Oregon Resilience Plan*. Overarching priorities, illustrated with examples selected from the chapters, include new efforts to:

1. Undertake **comprehensive assessments** of the key structures and systems that underpin Oregon's economy, including
 - a. Completing a statewide inventory of critical buildings (those needed for emergency response and the provision of basic services to communities) in both public and private sectors (Chapter Four);
 - b. Completing an updated inventory of the local agency, transit, port, and rail assets that assure access to school buildings and hospitals and could be used during emergencies (Chapter Five);
 - c. Charging the Oregon Public Utility Commission to define criteria for seismic vulnerability assessments that can be applied by operating companies in the energy and information and communications sectors (Chapters Six and Seven); and
 - d. Requiring all water and wastewater agencies to complete a seismic risk assessment and mitigation plan as part of periodic updates to facility plans (Chapter Eight).
2. Launch a sustained **program of capital investment** in Oregon's public structures, including
 - a. Fully funding Oregon's Seismic Rehabilitation Grants Program for K-12 schools, community colleges, and emergency response facilities (Chapters Two and Four);
 - b. Seismically upgrading lifeline transportation routes into and out of major business centers statewide by 2030 (Chapter Five); and
 - c. Establishing a State Resilience Office to provide leadership, resources, advocacy, and expertise in implementing statewide resilience plans (Chapter Four).
3. Craft a **package of incentives** to engage Oregon's private sector in efforts to advance seismic resilience, including
 - a. Developing a seismic rating system for new buildings to incentivize construction of buildings more resilient than building code compliance requires and to communicate seismic risk to the public (Chapters Two and Four);
 - b. Tasking the Oregon Public Utilities Commission to provide oversight for seismic preparedness of the energy providers currently under its jurisdiction (Chapter Six); and
 - c. Working with the hospitality industry to develop plans to assist visitors following a major earthquake and tsunami and to plan strategies to rebuild the tourism industry (Chapter Three).
4. **Update Oregon's public policies**, including
 - a. Revising individual preparedness communications to specify preparation from the old standard of 72 hours to a minimum of two weeks, and possibly more (Chapters Two and Three);
 - b. Developing a policy and standards for installation of temporary bridges following earthquake disruption (Chapter Five); and
 - c. Adopting a two-tiered ratings system that indicates the number of hours/days that a citizen in a community can expect to wait before major relief arrives, and the number of days/months that a citizen can expect to wait before the community itself achieves 90 percent restoration of roads and municipal services (Chapter Two).

These and other recommendations may be refined and implemented via a combination of new legislation, regulations, administrative rules, budget priorities, and in consultation with private sector leaders as appropriate.

Looking Ahead

This *Oregon Resilience Plan* emphasizes the resilient physical infrastructure needed to support business and community continuity. The policy recommendations presented here, if implemented over the next 50 years, will enhance our infrastructure resilience, help preserve our communities, and protect our state economy.

This is a timeframe much longer than typical of government planning efforts. To affirm Oregon's commitment, OSSPAC needs to work with the Joint Ways & Means Committee of Oregon's Legislative Assembly to track and report on progress toward seismic resilience at the beginning of each legislative session, to keep the 50-year goal in view.

Local Oregon communities can use the framework and gap-analysis methodology developed by the *Oregon Resilience Plan* to conduct more refined assessments that consider local seismic and tsunami hazards, and develop community-specific recommendations to meet their response and recovery needs.

A Cascadia earthquake and tsunami will affect both Oregon and Washington. Both states share common challenges, among them the interstate bridges and the Columbia River navigation channel as well as the regional power grid and liquid fuel supply. In particular, Oregon gets almost one hundred percent of its liquid fuel from suppliers in Washington, delivered via pipeline and river. We believe that it would be beneficial for both states to work together at a regional level to address the common challenge of resilience to a region-wide seismic event.

OSSPAC recommends expanding future resilience planning efforts to include:

1. Community-level planning
2. Human resilience
3. Civic infrastructure
4. Joint regional planning with Washington State

With resilient physical infrastructure, a healthy population, and functioning government and civic infrastructure to provide services to those in need, Oregon will be ready to withstand a Cascadia earthquake and tsunami, and to expedite response and recovery efforts quickly.

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Appendix I: House Resolution 3 and Supporting Documentation

Appendix II: January 26, 2012 Workshop

Appendix III: October 5, 2012 Workshop

Appendix IV: List of Oregon Resilience Plan Contributors

2012-2013 Oregon Seismic Safety Policy Advisory Commission (OSSPAC) Members

CHAIR: Kent Yu - Structural Engineer Stakeholder, Degenkolb Engineers
VICE CHAIR: Jay Wilson - Public Member, Clackamas County Emergency Management
Deborah Boone - Representative, Legislative Assembly
Greg Ek-Collins - Oregon Department of Transportation
Carl Farrington - Multifamily Housing Stakeholder
Fred Girod - Senator, Legislative Assembly
David Holton - American Red Cross*
Francisco Ianni - American Red Cross
Ian Madin - Department of Geology and Mineral Industries

*Retired from the commission in June 2012.

Michael Mumaw - Local Government Stakeholder, Emergency Manager, City of Beaverton
Jay Raskin - Public Member, Ecola Architects
Althea Rizzo - Oregon Emergency Management
Richard Rogers - Building Codes Division
Stephen Luckner - Department of Land Conservation & Development
Susan Steward - Building Owners Stakeholder, BOMA
Mark Tyler - Schools Stakeholder
Bryce Ward - Banking Stakeholder, ECONorthwest
Stan Watters - Utilities Stakeholder, Port of Portland
Gerry Williams - Public Member, Construction & Engineering Management Research, Inc.
Bev Hall - OSSPAC Secretary, Oregon Emergency Management

Project Team and Acknowledgments

On behalf of my fellow OSSPAC Commissioners, I want to thank several individuals whose vision and support have made our resilience planning work possible. First and foremost, we thank our colleague Rep. Deborah Boone, who introduced House Resolution 3 and won the unanimous support of her colleagues on April 18, 2011. We are also grateful to Governor John Kitzhaber, who encouraged OSSPAC's efforts on resilience, and to President Barack Obama's Senior Director for Resilience Richard Reed, who took the time to express his support for the preparation of Oregon's resilience plan.

We are very grateful to members of the project Steering Committee, who have offered their advice, counsel, and support at every stage of our work: **Jay Wilson** (Vice Chair), **Ian Madin**, **Dr. Althea Rizzo**, and **Stan Watters**.

We appreciate the commitment of our Advisory Panel, whose members participated in meetings on January 26th, 2012 and October 5th, 2012 and have made themselves available for informal consultation over the past year: **Prof. Scott Ashford**, **Sen. Lee Beyer**, **Sen. Peter Courtney**, **Ed Dennis**, **JR Gonzalez**, **Prof. Chris Goldfinger**, **Dave Harlan**, **Onno Husing**, **Bruce Johnson**, **Dr. Leon Kempner, Jr.**, **Prof. Andre LeDuc**, **Dr. Vicki McConnell**, **Dr. Jean O'Connor**, **Cameron Smith**, **Jeffrey Soulaiges**, **Yumei Wang**, **Edward Wolf**, and **Dr. Nate Wood**. In particular, we want to thank Dr. Vicki McConnell, Yumei Wang and Edward Wolf for their guidance and support.

We owe the creation of the *Oregon Resilience Plan* to diligent efforts by our eight Task Groups and the capable leadership and project management performed by our Task Group leaders, who may not have fully realized the magnitude of the project when they agreed to serve:

Earthquake and Tsunami Scenario Task Group: **Ian Madin** (Chair), Bill Burns, Art Frankel, Chris Goldfinger, Matthew Mabey, George Priest, Yumei Wang, and Ivan Wong.

Business and Work Force Task Group: **Susan Steward** (Co-Chair), **Gerry Williams** (Co-Chair), Lori Chamberlain, Patrick Estenes, Kelley Okolita, Patrick Slabe, Bert Sorio, Jeffrey Soulaiges, Rick Van Dyke, and Bryce Ward.

Coastal Communities Task Group: **Jay Wilson** (Co-Chair), **Jay Raskin** (Co-Chair), Jacquie Betz, Rep. Deborah Boone, Josh Bruce, Lori Christiansen, Charlie Davis, Sue Graves, Dave Harlan, Jeffrey Hepler, Maggie Kirby, Sen. Jeff Kruse, Margo Lalich, Jack Lenox, Gary Milliman, Sam Steidel, Wayne Stinson, and Laren Woolley.

Critical Buildings Task Group: **Ed Quesenberry** (Co-Chair), **Trent Nagele** (Co-Chair), Andre Barbosa, David Bugni, Ed Dennis, Kimberly Dills, Shane Downing, Shelly Duquette, Jennifer Eggers, Joe Gehlen, Tonya Halog, Robert Johnson, Kevin Kaplan, Amit Kumar, Dominic Matteri, Anne Monnier, Willy Paul, Josh Richards, Tim Rippey, Richard Rogers, Terry Shugrue, Jason Thompson, Mark Tobin, Jim Weston, Michael Wieber, and Edward Wolf.

Transportation Task Group: **Bruce Johnson** (Chair), Martin Callery, Lieutenant Meredith Condon, Chris Corich, Peter Duskica, Greg Ek-Collins, Herb Florer, Doug Grafe, Elsie Hamner, Chuck Hutto, Doug Kirkpatrick, Jeff Langstrom, Lee Lazaro, Mark Libby, Matt Maass, Bob Melbo, Nason McCullough, Curran Mohney, Lucy Moore, Nancy Murphy, Albert Nako, David Neys, David Olongiagh, Jeff Olson, Jon Oshel, Tom Peterson, Craig Shike, Craig Totten, Tom Wharton, John Wilson, and Holly Winston.

Energy Task Group: **JR Gonzalez** (Co-Chair), **Stan Watters** (Co-Chair), Heide Caswell, Rick Carter, Brian Doherty, Michael Dougherty, Del Draper, Dave Ford, Debbie Guerra, Teresa Hagins, Marion Haynes, Leon Kempner, Jr., Brian Knight, Lori Koho, Christy Munro, Bruce Paskett, Robbie Roberts, Dave Stuckey, Jack Vranish, Yumei Wang, Tashiana Wanger, and Grant M. Yoshihara.

Information and Communications Task Group: **Mike Mumaw** (Chair), Rick Carter, Michael Dougherty, Walter Duddington, JR Gonzalez, Alexis Kwasinski, Devon Lumbard, Kelley Stember, Alex Tang, Yumei Wang, Stan Watters, and Geoffrey Williams.

Water and Waste Water Task Group: **Mike Stuhr** (Co-Chair), **Mark Knudson** (Co-Chair), Don Ballantyne, Steve Behrandt, James Bela, Andy Braun, Scott Burns, Mel Damewood, Jim Doane, Michael Doane, Tom Hickman, Gary Irwin, Gwynne Johnson, Jeff Leighton, Arturo Leon, Ian Madin, Jim Male, Jim Newell, Bob Patterson, Sherry Patterson, Todd Perimon, Brad Phelps, Jeff Rubin, Rob Schab, Ken Schlegel, Brian Stahl, and Jeffrey Winchester.

Dr. Kyra L. Nourse compiled and edited the *Oregon Resilience Plan*, with assistance from my OSSPAC colleagues Dr. Althea Rizzo, Jay Wilson, Ian Madin, Bev Hall and from Edward Wolf. We are grateful to FEMA for financial support, through a grant administered by Oregon Emergency Management, for the technical editing of the plan.

The Port of Portland hosted our workshops on January 26, 2012 and October 5, 2012 in its headquarter building. We want to thank Michelle Walker for her planning and coordination to make the workshops successful. Cascadia Region Earthquake Workgroup (CREW) provided their endorsement for our resilience planning efforts, and also helped sponsor our January 26, 2012 workshop. We want to thank Cale Ash (then President of CREW) and John Schelling (Washington State Emergency Management) for their participation and for sharing their resilience planning experience with us.

On a personal note, I wish to thank my colleagues at Degenkolb Engineers, particularly Chris Poland in San Francisco and Stacy Bartoletti in Seattle, for their inspiration on resilience, and colleagues in our Portland office including Liz Francis and Karla Richards who helped me to manage my resilience plan responsibilities without leaving my other professional obligations too far behind.

Finally, I want to acknowledge the leadership of OSSPAC's Vice Chair Jay Wilson, who has in every respect been a full partner in the vision and execution of the *Oregon Resilience Plan*, and who is a great champion for resilience.

Many other individuals have generously shared their expertise and perspective with us during the creation of this plan. OSSPAC bears the sole responsibility for any errors or omissions it contains.

Kent Yu, Ph.D.

Chairman, Oregon Seismic Safety Policy Advisory Commission
Portland, Oregon
January 2013

Note: The full *Oregon Resilience Plan* report is available online at the Oregon Office of Emergency Management website: <http://www.oregon.gov/OMD/OEM/Pages/index.aspx>

2005 HIO Master Plan Highlights

Jason Gately

Planning and Development



 **PORT OF PORTLAND**
Possibility. In every direction.™

Overview

Last HARE meeting:

- Airport Master Planning 101

Tonight:

- Review the *highlights* of the 2005 HIO Master Plan
 - Major Elements
 - Major Findings

Next HARE meeting:

- HIO 2005 Master Plan Implementation
 - What Happened Between 2005 and 2015?



2005 Plan Goals and Objectives

Goal:

- Develop a comprehensive tool to guide the Airport's development and optimize community compatibility through the year 2025.

Objectives

- Preserve Public and Private Investments
- Be Reflective of Community Goals and Objectives
- Determine Role
- Maintain Safety
- Preserve the Environment
- Seek to Balance Disruption
- Attract Public Participation
- Strengthen the Economy



Study Elements and Process

*PAC Mtg. #1

Task 1: Inventory

* PAC Mtg. #2

Task 2: Airport Role

*PAC Mtg. #3

Task 3: Noise Review

*PAC Mtg. #4

Task 4: Aviation Demand
Forecasts & Facility
Requirements

*PAC Mtg. 5

Task 6: Alternatives Analysis

- Airside/Landside/Terminal
- Cost Estimates
- Environmental Considerations

Task 7: Refine and Select a Preferred
Alternative

*PAC Mtg. #6

Financial Program

Airport Layout Plan (FAA Approves)

*PAC Mtg. #7

Documentation

Port Approval



Major Findings

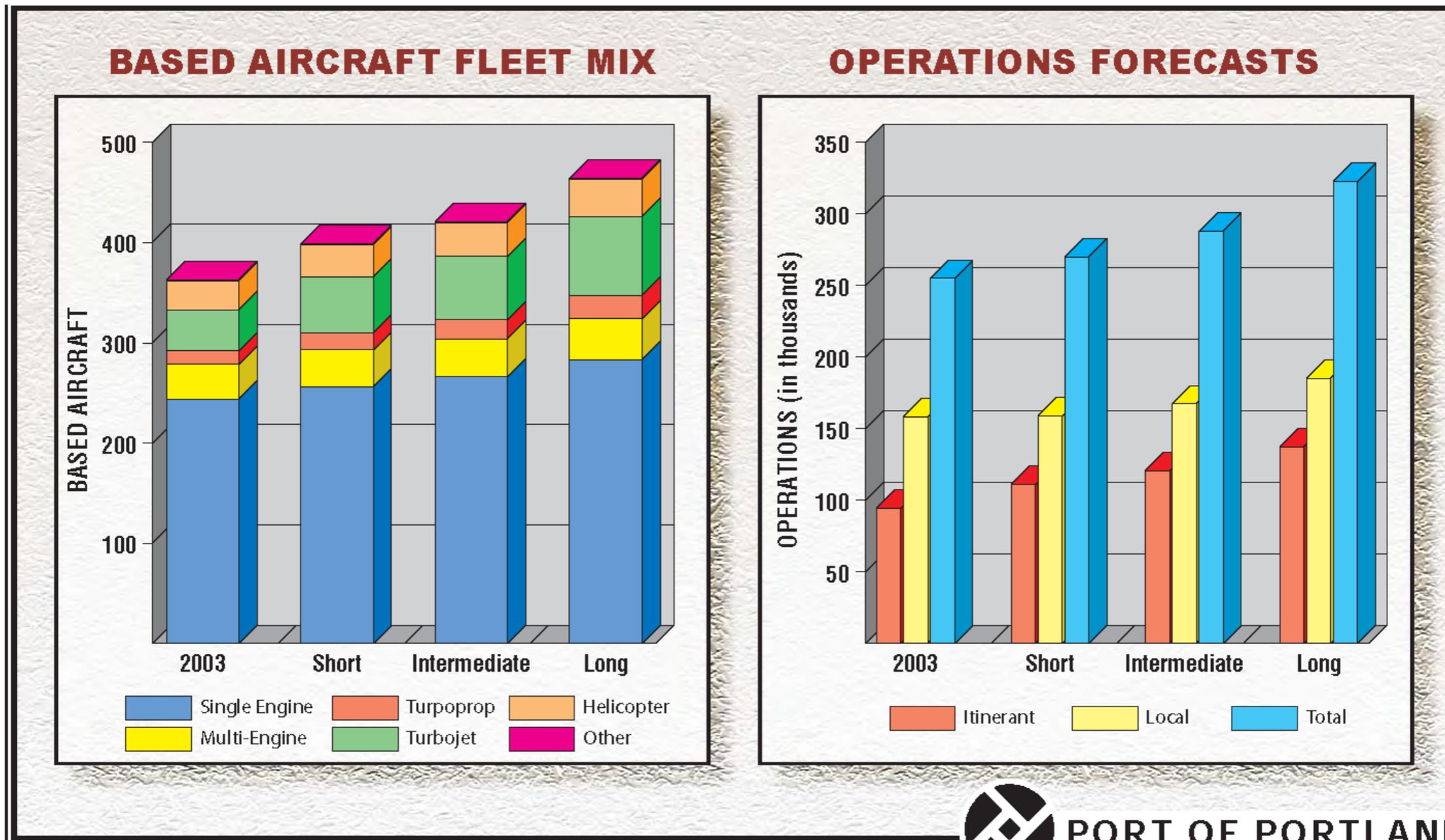
- 1.1% *average* annual growth in operations and based aircraft
- Operations

2003 (Base Year)	253,847
2008 (Actual)	256,304
2014 (Actual)	221,932
2015 (Forecast)	288,300
2025 (Forecast)	323,000

- Based Aircraft

2003 (Base Year)	363
2014 (Actual)	416
2015 (Forecast)	420
2025 (Forecast)	465

Aviation Demand Forecasts



PORT OF PORTLAND

Exhibit ES-2

FORECAST SUMMARY



Major Findings, cont.

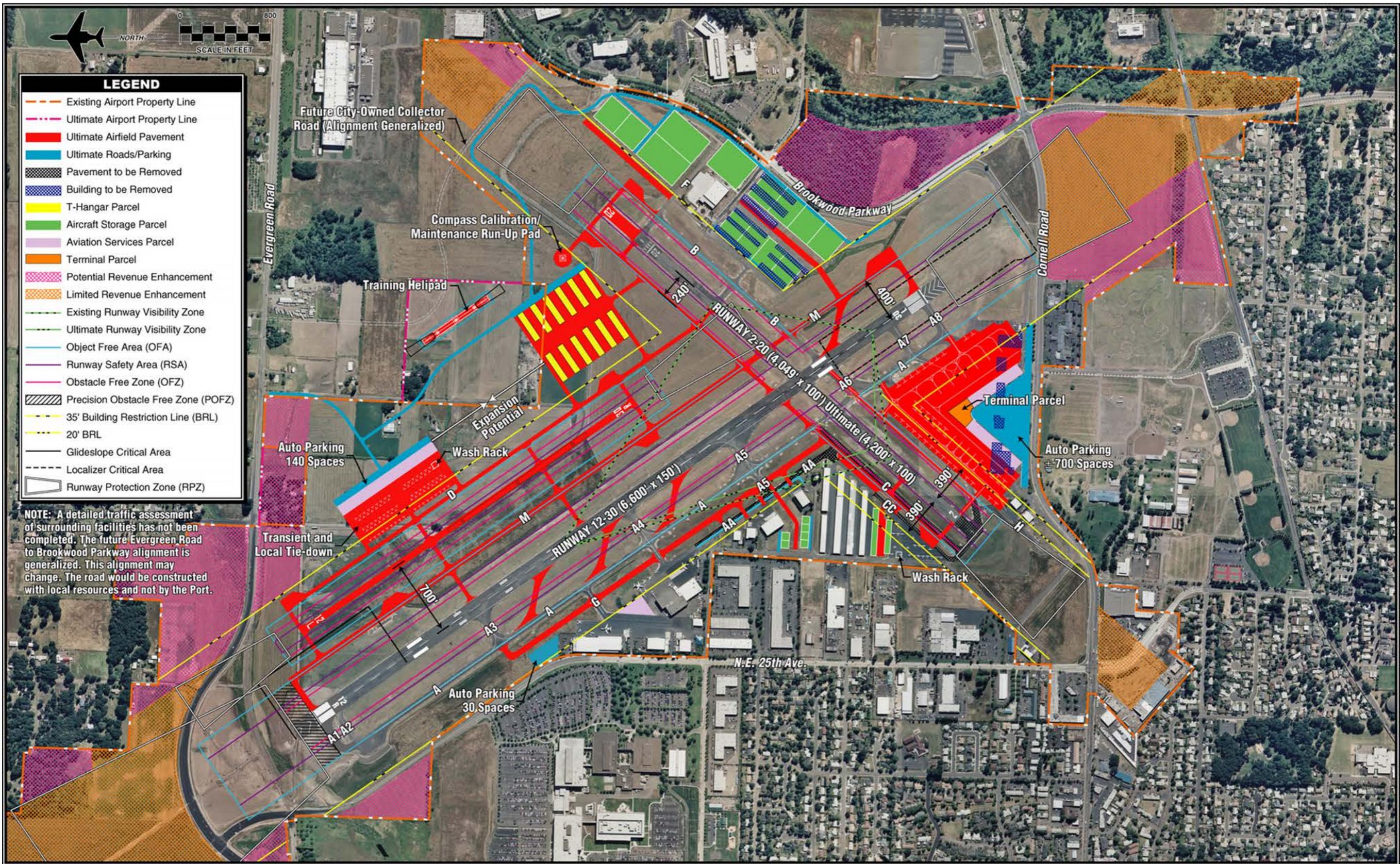
- HIO will stay a general aviation facility
- Base year and “no action” show inadequate capacity
- Major investments needed in:
 - Pavements
 - Corporate hangars
 - Safety
 - Radar
- Economic benefits of HIO:
 - 1,464 jobs
 - \$110 million business revenue
 - \$66 million personal income

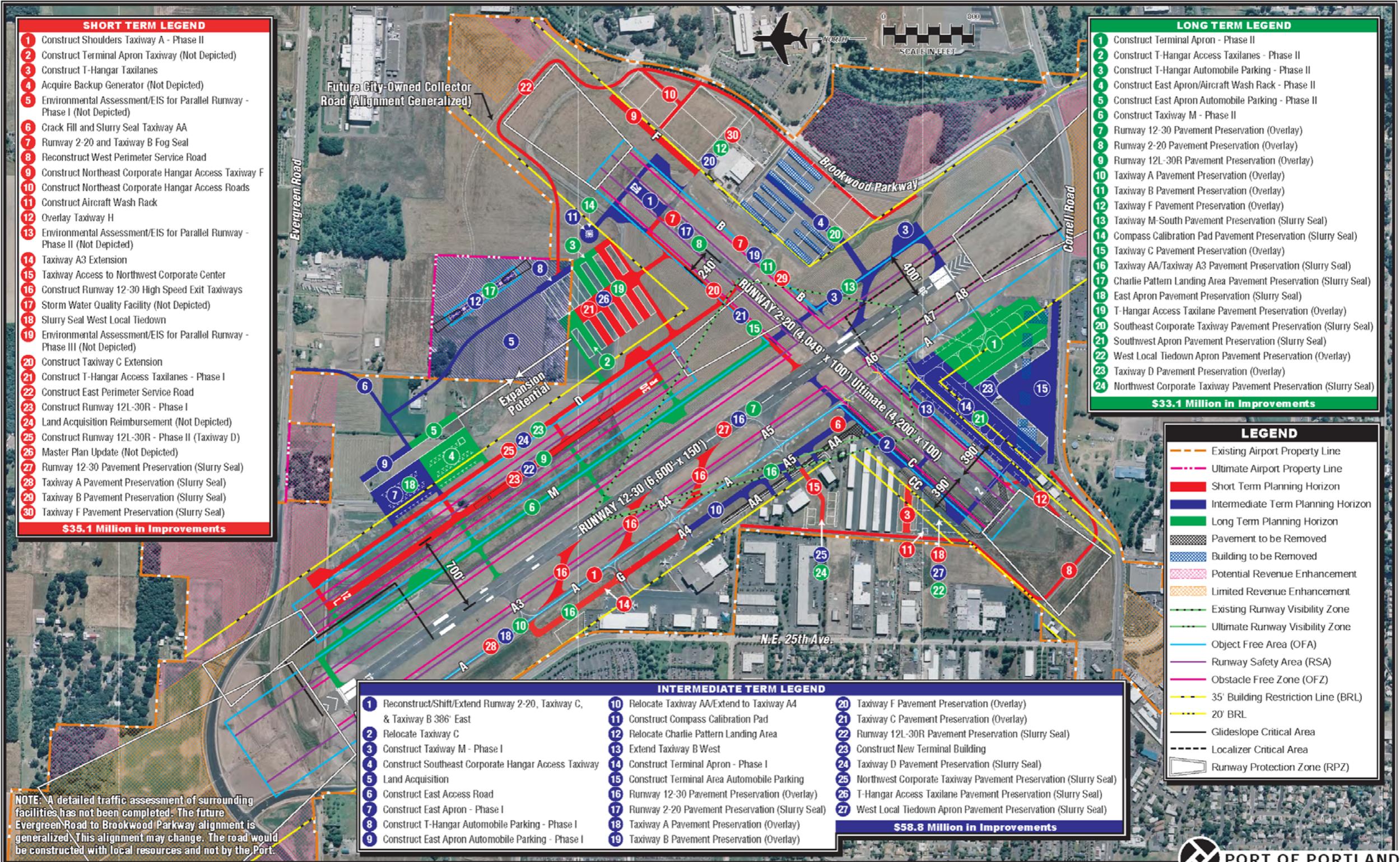


Project Advisory Committee

- **Gina Anhorn**, Emergency Management
- **Wink Brooks**, City of Hillsboro
- **Ric Chisholm**, FAA - Air Traffic Control
- **Ken Dyar**, Hillsboro Airport Business Association
- **Jim Elam**, Citizen At Large
- **Anne Grothe**, Airport Business, Non-Aviation
- **Perry Gruber**, Airport User, Business
- **Bernadette Hahn**, Citizen At Large
- **Tom Little**, Citizen At Large
- **Henry Oberhelman**, Washington Co. Residents for Safe & Quiet Skies
- **Charlie Riordan**, Oregon Department of Aviation
- **Don Suhrbier**, Greater Hillsboro Chamber of Commerce
- **Keith Thomson**, Port of Portland Commission
- **Ray Valone**, Metro
- **Andrea Vannelli**, Washington County
- **Steve Walti**, Citizen - Airport User
- **Bert Zimmerly**, Airport Business, Aviation







- SHORT TERM LEGEND**
- 1 Construct Shoulders Taxiway A - Phase II
 - 2 Construct Terminal Apron Taxiway (Not Depicted)
 - 3 Construct T-Hangar Taxilanes
 - 4 Acquire Backup Generator (Not Depicted)
 - 5 Environmental Assessment/EIS for Parallel Runway - Phase I (Not Depicted)
 - 6 Crack Fill and Slurry Seal Taxiway AA
 - 7 Runway 2-20 and Taxiway B Fog Seal
 - 8 Reconstruct West Perimeter Service Road
 - 9 Construct Northeast Corporate Hangar Access Taxiway F
 - 10 Construct Northeast Corporate Hangar Access Roads
 - 11 Construct Aircraft Wash Rack
 - 12 Overlay Taxiway H
 - 13 Environmental Assessment/EIS for Parallel Runway - Phase II (Not Depicted)
 - 14 Taxiway A3 Extension
 - 15 Taxiway Access to Northwest Corporate Center
 - 16 Construct Runway 12-30 High Speed Exit Taxiways
 - 17 Storm Water Quality Facility (Not Depicted)
 - 18 Slurry Seal West Local Tiedown
 - 19 Environmental Assessment/EIS for Parallel Runway - Phase III (Not Depicted)
 - 20 Construct Taxiway C Extension
 - 21 Construct T-Hangar Access Taxilanes - Phase I
 - 22 Construct East Perimeter Service Road
 - 23 Construct Runway 12L-30R - Phase I
 - 24 Land Acquisition Reimbursement (Not Depicted)
 - 25 Construct Runway 12L-30R - Phase II (Taxiway D)
 - 26 Master Plan Update (Not Depicted)
 - 27 Runway 12-30 Pavement Preservation (Slurry Seal)
 - 28 Taxiway A Pavement Preservation (Slurry Seal)
 - 29 Taxiway B Pavement Preservation (Slurry Seal)
 - 30 Taxiway F Pavement Preservation (Slurry Seal)
- \$35.1 Million in Improvements**

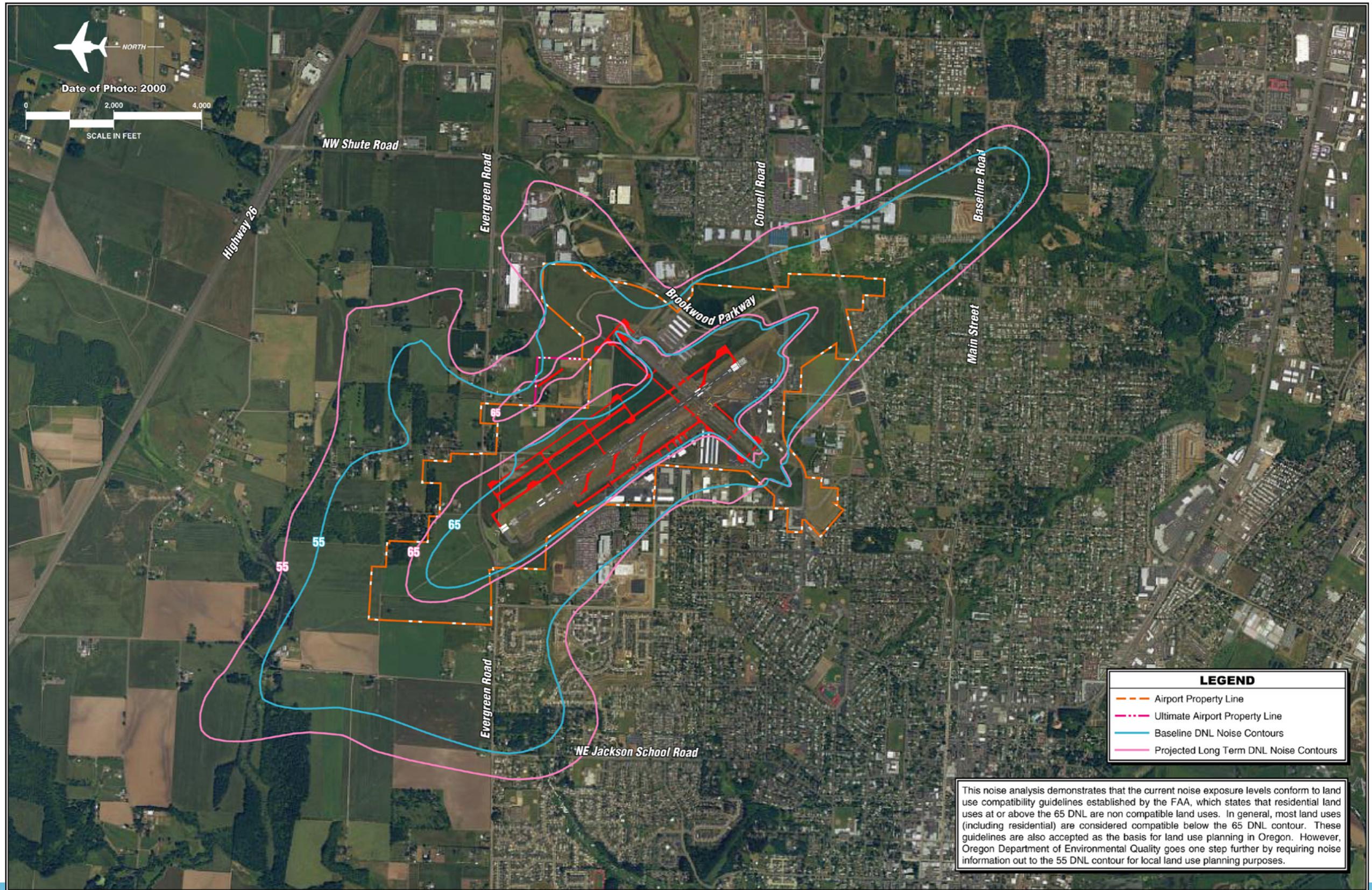
- LONG TERM LEGEND**
- 1 Construct Terminal Apron - Phase II
 - 2 Construct T-Hangar Access Taxilanes - Phase II
 - 3 Construct T-Hangar Automobile Parking - Phase II
 - 4 Construct East Apron/Aircraft Wash Rack - Phase II
 - 5 Construct East Apron Automobile Parking - Phase II
 - 6 Construct Taxiway M - Phase II
 - 7 Runway 12-30 Pavement Preservation (Overlay)
 - 8 Runway 2-20 Pavement Preservation (Overlay)
 - 9 Runway 12L-30R Pavement Preservation (Overlay)
 - 10 Taxiway A Pavement Preservation (Overlay)
 - 11 Taxiway B Pavement Preservation (Overlay)
 - 12 Taxiway F Pavement Preservation (Overlay)
 - 13 Taxiway M-South Pavement Preservation (Slurry Seal)
 - 14 Compass Calibration Pad Pavement Preservation (Slurry Seal)
 - 15 Taxiway C Pavement Preservation (Overlay)
 - 16 Taxiway AA/Taxiway A3 Pavement Preservation (Slurry Seal)
 - 17 Charlie Pattern Landing Area Pavement Preservation (Slurry Seal)
 - 18 East Apron Pavement Preservation (Slurry Seal)
 - 19 T-Hangar Access Taxilane Pavement Preservation (Overlay)
 - 20 Southeast Corporate Taxiway Pavement Preservation (Slurry Seal)
 - 21 Southwest Apron Pavement Preservation (Slurry Seal)
 - 22 West Local Tiedown Apron Pavement Preservation (Overlay)
 - 23 Taxiway D Pavement Preservation (Overlay)
 - 24 Northwest Corporate Taxiway Pavement Preservation (Slurry Seal)
- \$33.1 Million in Improvements**

- INTERMEDIATE TERM LEGEND**
- | | | |
|--|--|--|
| 1 Reconstruct/Shift/Extend Runway 2-20, Taxiway C, & Taxiway B 386' East | 10 Relocate Taxiway AA/Extend to Taxiway A4 | 20 Taxiway F Pavement Preservation (Overlay) |
| 2 Relocate Taxiway C | 11 Construct Compass Calibration Pad | 21 Taxiway C Pavement Preservation (Overlay) |
| 3 Construct Taxiway M - Phase I | 12 Relocate Charlie Pattern Landing Area | 22 Runway 12L-30R Pavement Preservation (Slurry Seal) |
| 4 Construct Southeast Corporate Hangar Access Taxiway Land Acquisition | 13 Extend Taxiway B West | 23 Construct New Terminal Building |
| 5 Construct East Access Road | 14 Construct Terminal Apron - Phase I | 24 Taxiway D Pavement Preservation (Slurry Seal) |
| 6 Construct East Apron - Phase I | 15 Construct Terminal Area Automobile Parking | 25 Northwest Corporate Taxiway Pavement Preservation (Slurry Seal) |
| 7 Construct T-Hangar Automobile Parking - Phase I | 16 Runway 12-30 Pavement Preservation (Overlay) | 26 T-Hangar Access Taxilane Pavement Preservation (Slurry Seal) |
| 8 Construct East Apron Automobile Parking - Phase I | 17 Runway 2-20 Pavement Preservation (Slurry Seal) | 27 West Local Tiedown Apron Pavement Preservation (Slurry Seal) |
| 9 Construct East Apron Automobile Parking - Phase I | 18 Taxiway A Pavement Preservation (Overlay) | |
| | 19 Taxiway B Pavement Preservation (Overlay) | |
- \$58.8 Million in Improvements**

- LEGEND**
- Existing Airport Property Line
 - Ultimate Airport Property Line
 - Short Term Planning Horizon
 - Intermediate Term Planning Horizon
 - Long Term Planning Horizon
 - Pavement to be Removed
 - Building to be Removed
 - Potential Revenue Enhancement
 - Limited Revenue Enhancement
 - Existing Runway Visibility Zone
 - Ultimate Runway Visibility Zone
 - Object Free Area (OFA)
 - Runway Safety Area (RSA)
 - Obstacle Free Zone (OFZ)
 - 35' Building Restriction Line (BRL)
 - 20' BRL
 - Glideslope Critical Area
 - Localizer Critical Area
 - Runway Protection Zone (RPZ)

NOTE: A detailed traffic assessment of surrounding facilities has not been completed. The future Evergreen Road to Brookwood Parkway alignment is generalized. This alignment may change. The road would be constructed with local resources and not by the Port.

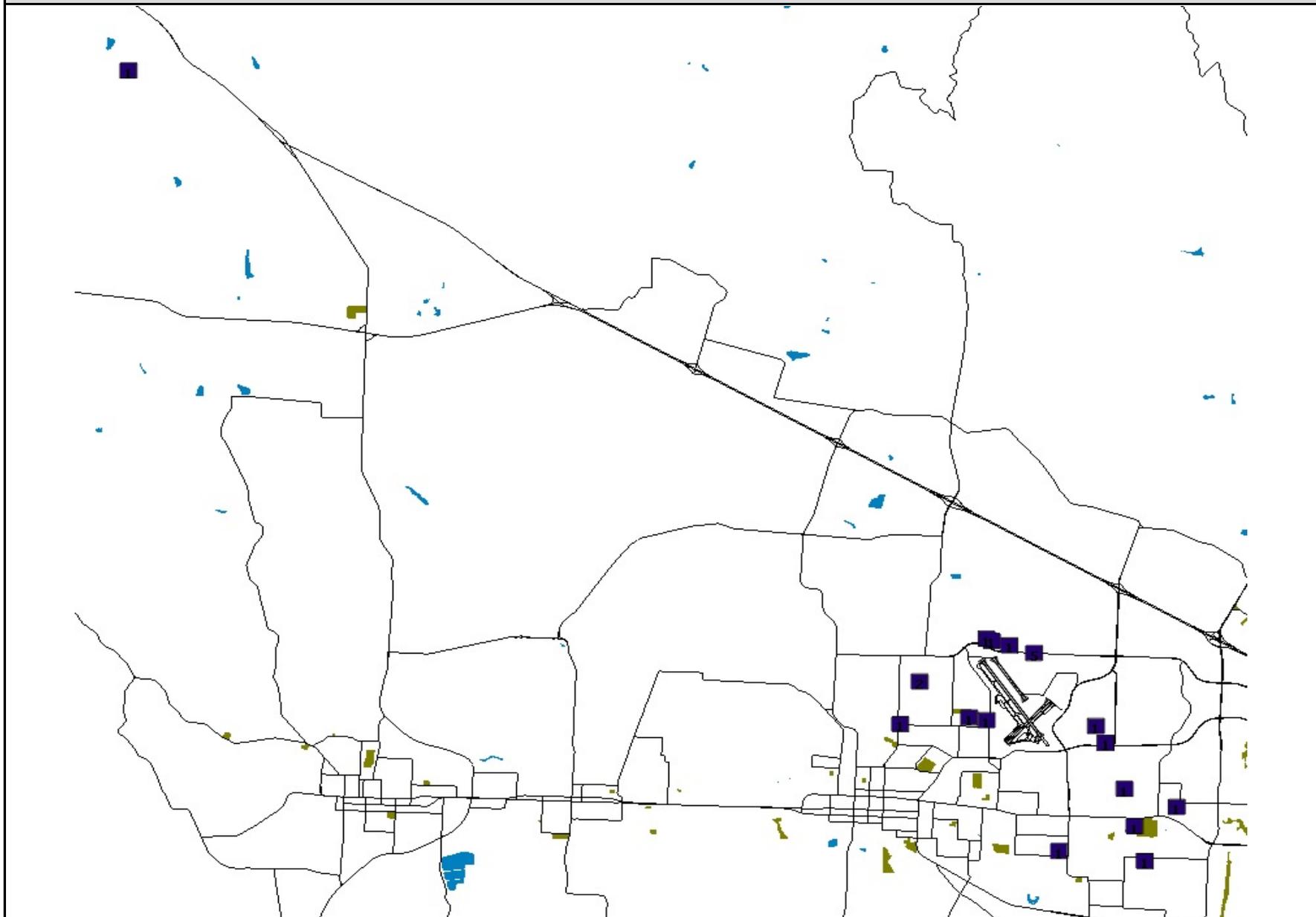
Base Case & Long-term 2025 Noise Contours



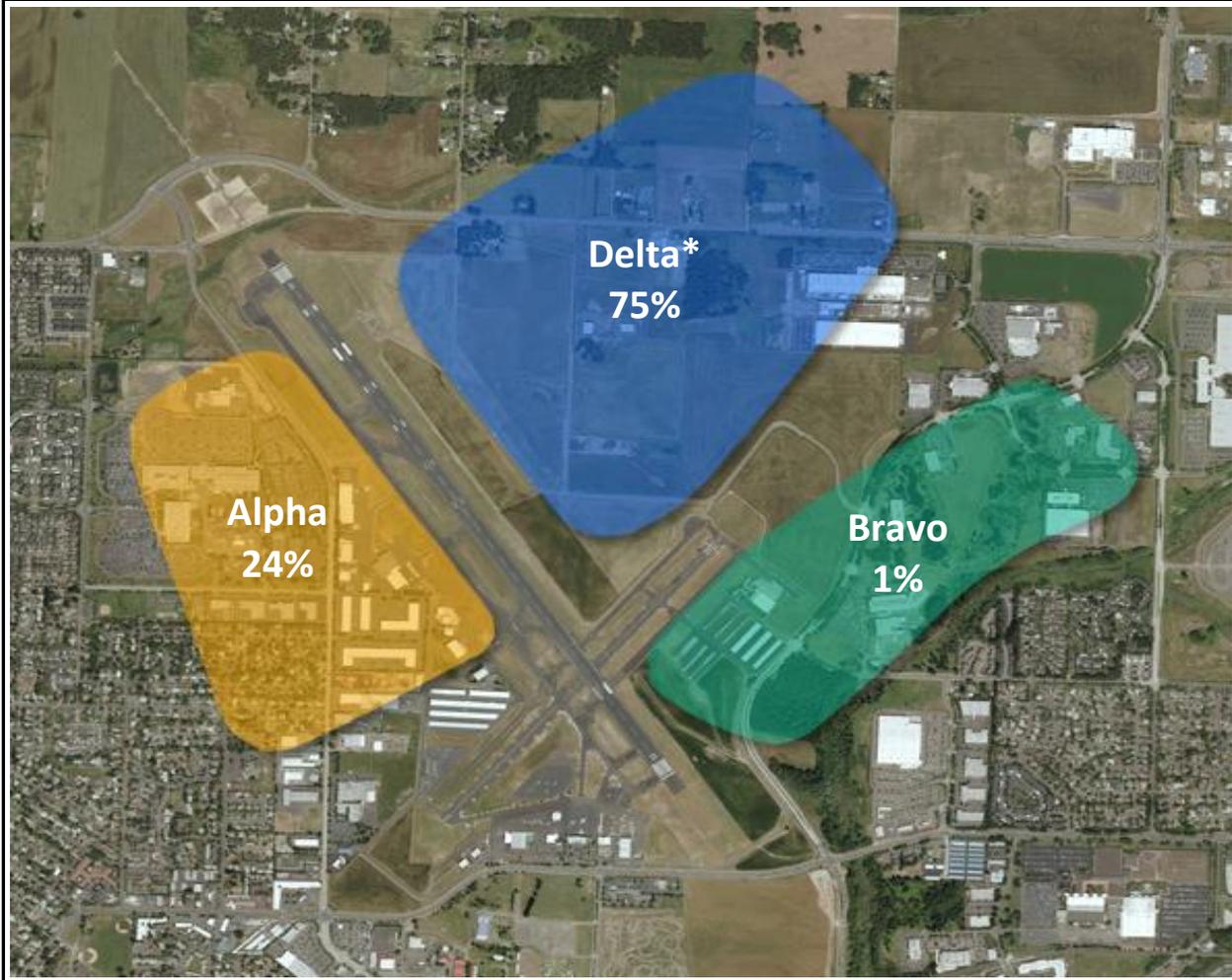
Questions?



Q3 - 2015 HIO NOISE COMPLAINT LOCATIONS



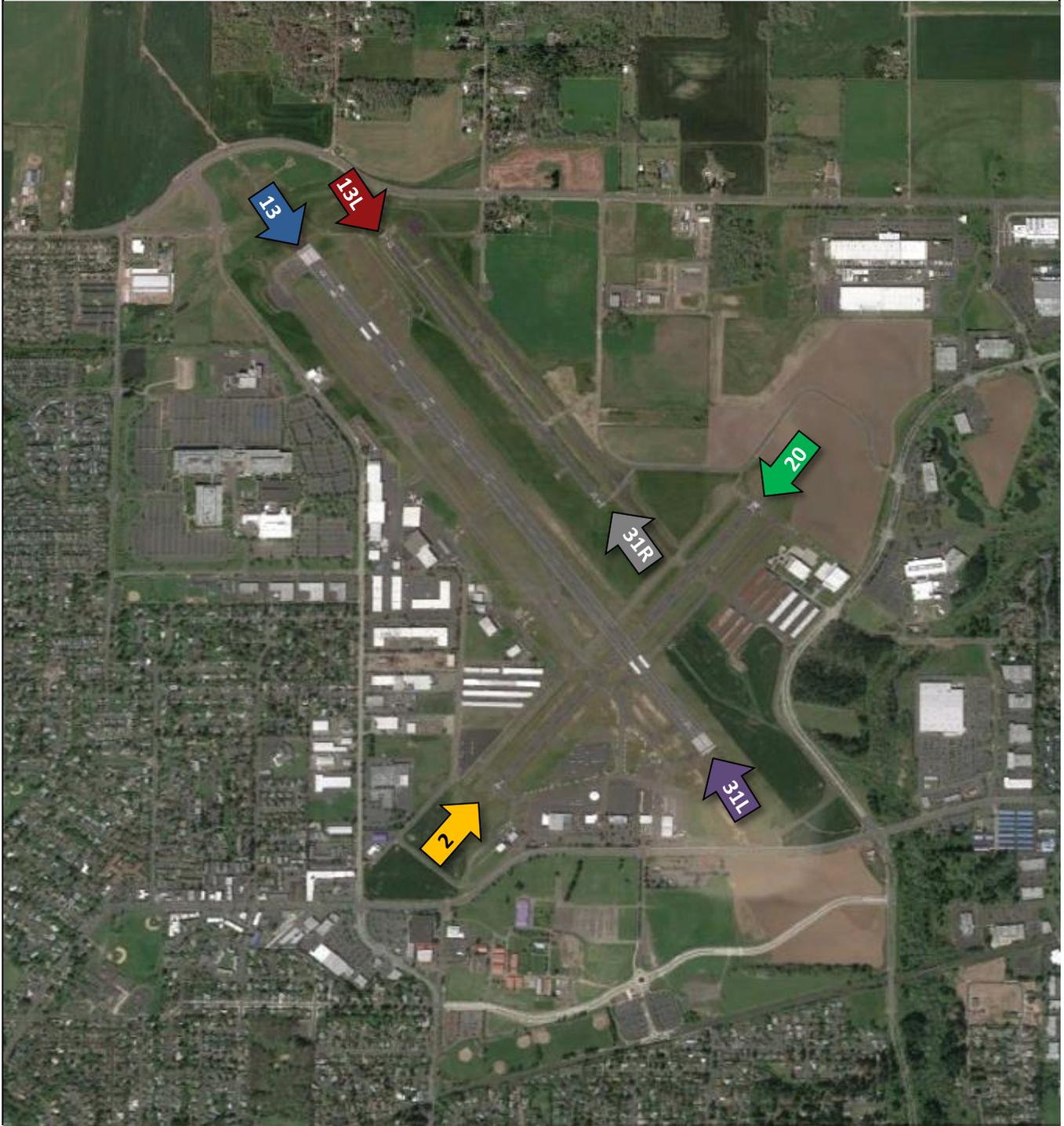
HILLSBORO HELICOPTER PATTERN UTILIZATION - Q3, 2015



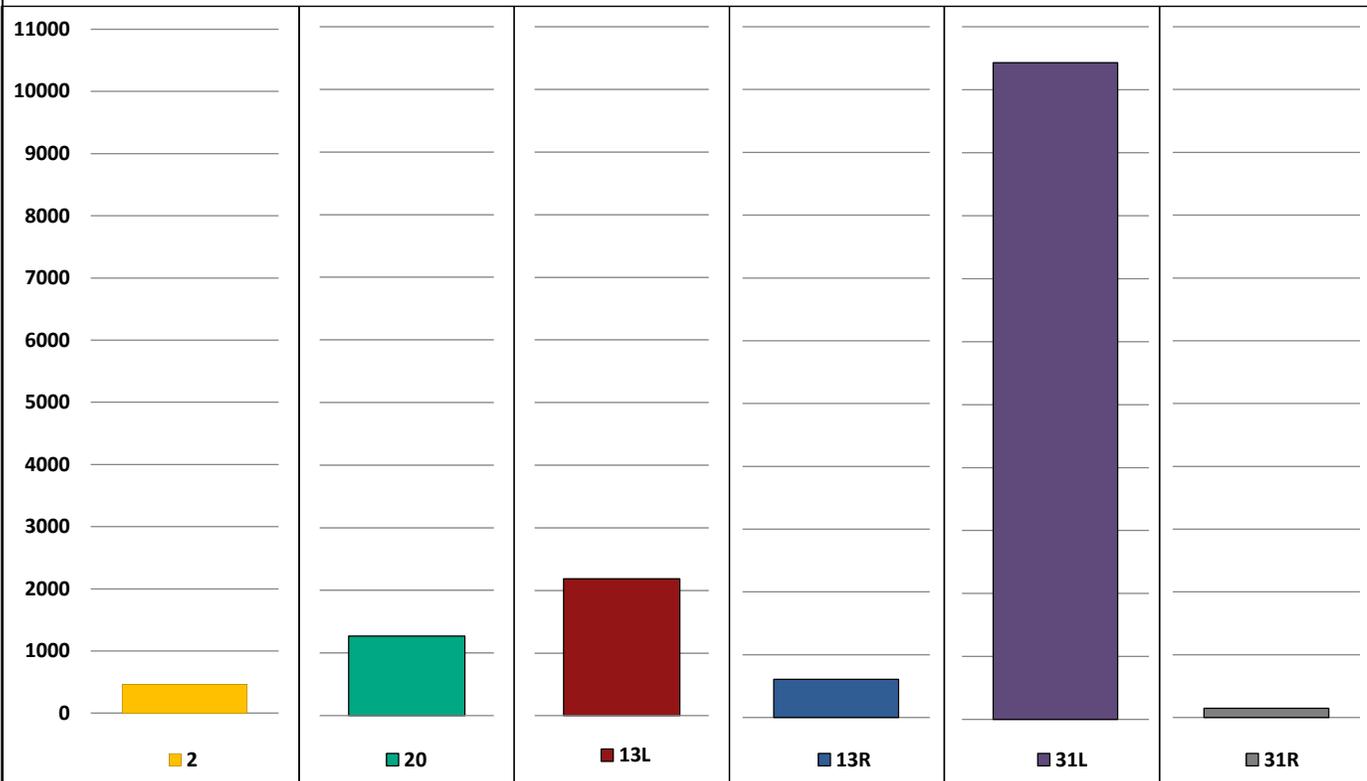
Month	Alpha		Bravo		Delta*		Total
	Count	Percent	Count	Percent	Count	Percent	
Jan	1072	27%	104	3%	2818	71%	3994
Feb	1505	30%	103	2%	3342	68%	4950
Mar	2018	37%	108	2%	3368	61%	5494
Q1	4595	32%	315	2%	9528	66%	14438
Apr	2266	44%	64	1%	2868	55%	5198
May	814	17%	5	0%	3915	83%	4734
Jun	659	14%	5	0%	4117	86%	4781
Q2	3739	25%	74	1%	10900	74%	14713
Jul	1273	26%	45	1%	3622	73%	4940
Aug	1260	24%	42	1%	3926	75%	5228
Sep	709	20%	44	1%	2843	79%	3596
Q3	3242	24%	131	1%	10391	75%	13764
Oct							0
Nov							0
Dec							0
Q4	0		0		0		0
YTD	11576	27%	520	1%	30819	72%	42915

* Charlie pattern was renamed Delta with the opening of runway 13L / 31R on 4/30/15

HILLSBORO AIRPORT RUNWAY LAYOUT



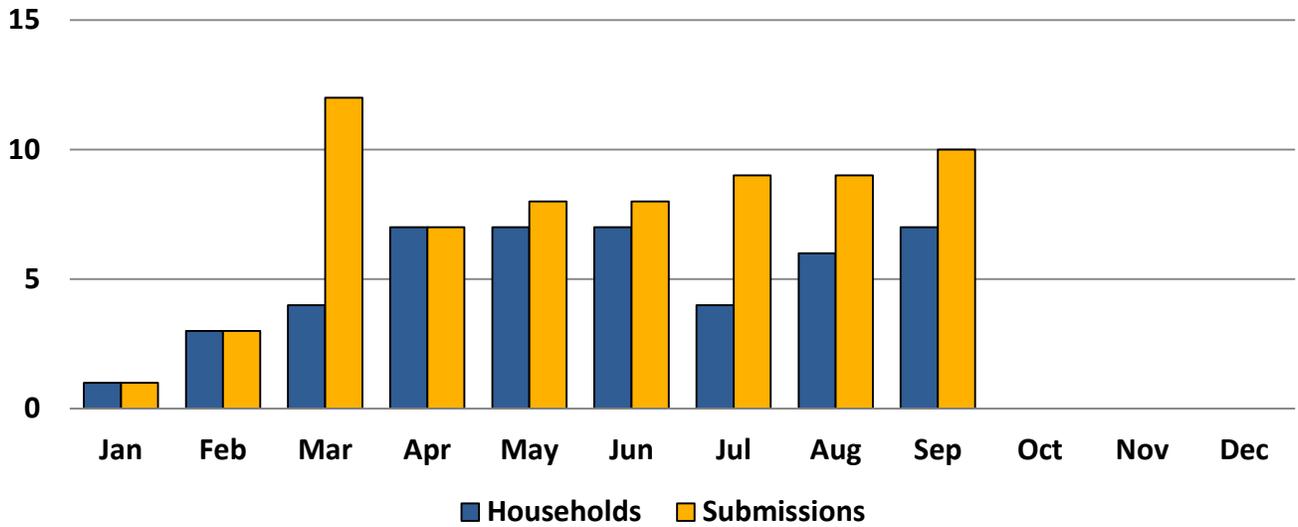
Combined Runway Utilization, Q3 - 2015



		Jan	Feb	Mar	Q1	Apr	May	Jun	Q2	Jul	Aug	Sep	Q3	Oct	Nov	Dec	Q4	YTD
2	Ops Count	156	600	175	931	296	325	324	945	136	94	237	467				0	2343
	Percentage	4%	15%	4%	7%	6%	6%	5%	6%	3%	2%	4%	3%					5%
20	Ops Count	387	387	770	1544	447	311	291	1049	392	493	387	1272				0	3865
	Percentage	10%	10%	16%	12%	9%	6%	5%	6%	10%	9%	7%	8%					9%
13L	Ops Count	0	0	0	0	0	906	2769	3675	815	853	520	2188				0	5863
	Percentage	0	0	0	0%	0%	17%	45%	22%	20%	16%	9%	14%					13%
13R	Ops Count	523	538	785	1846	496	214	127	837	43	194	374	611				0	3294
	Percentage	13%	14%	16%	14%	10%	4%	2%	5%	1%	4%	6%	4%					7%
31L	Ops Count	2896	2419	3227	8542	3865	3632	2504	10001	2609	3636	4186	10431				0	28974
	Percentage	73%	61%	65%	66%	76%	67%	41%	60%	65%	68%	72%	69%					65%
31R	Ops Count	0	0	0	0	0	41	109	150	44	94	103	241				0	391
	Percentage	0	0	0	0%	0%	1%	2%	1%	0%	2%	2%	2%					1%
All	Total	3962	3944	4957	12863	5104	5429	6124	16657	4039	5364	5807	15210	0	0	0	0	44730

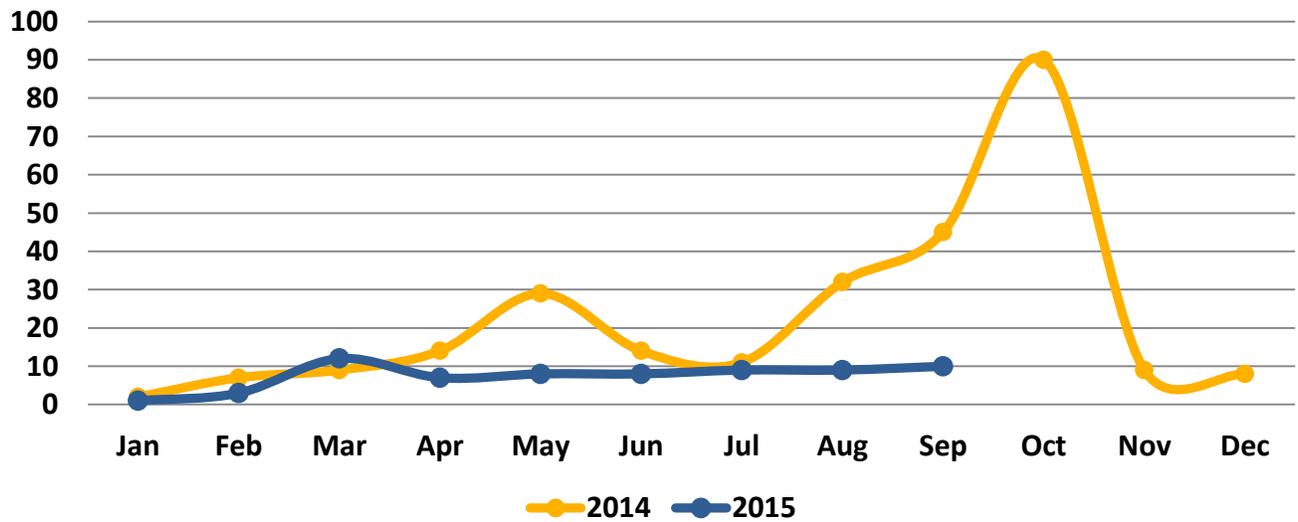
Notes: 1) Runway 13L / 31R became operational on April 30, 2015. 2) Counts reflect total operations, divide in half to estimate arrivals and departures. 3) Relatively short distance between the parallel runways limits ability to accurately separate their operations counts.

HIO SUBMISSIONS TO HOUSEHOLD COMPARISON



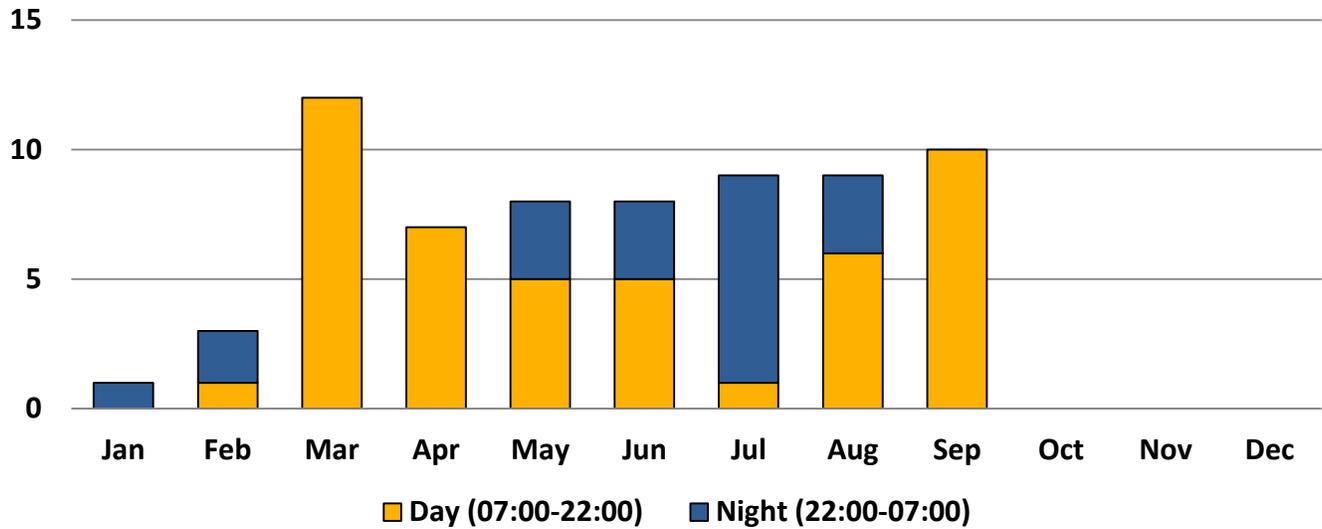
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Households	1	3	4	7	7	7	4	6	7			
Submissions	1	3	12	7	8	8	9	9	10			

HIO ANNUAL SUBMISSIONS COMPARISON - YEAR TO DATE



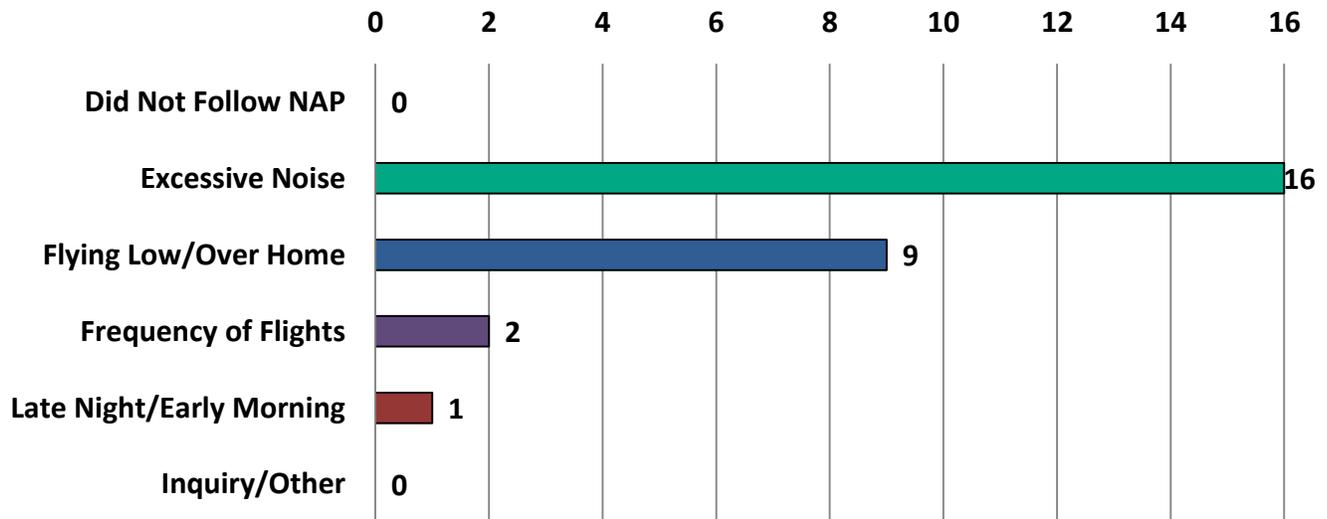
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2014	2	7	9	14	29	14	11	32	45	90	9	8
2015	1	3	12	7	8	8	9	9	10			

HIO SUBMISSIONS BY TIME OF DAY



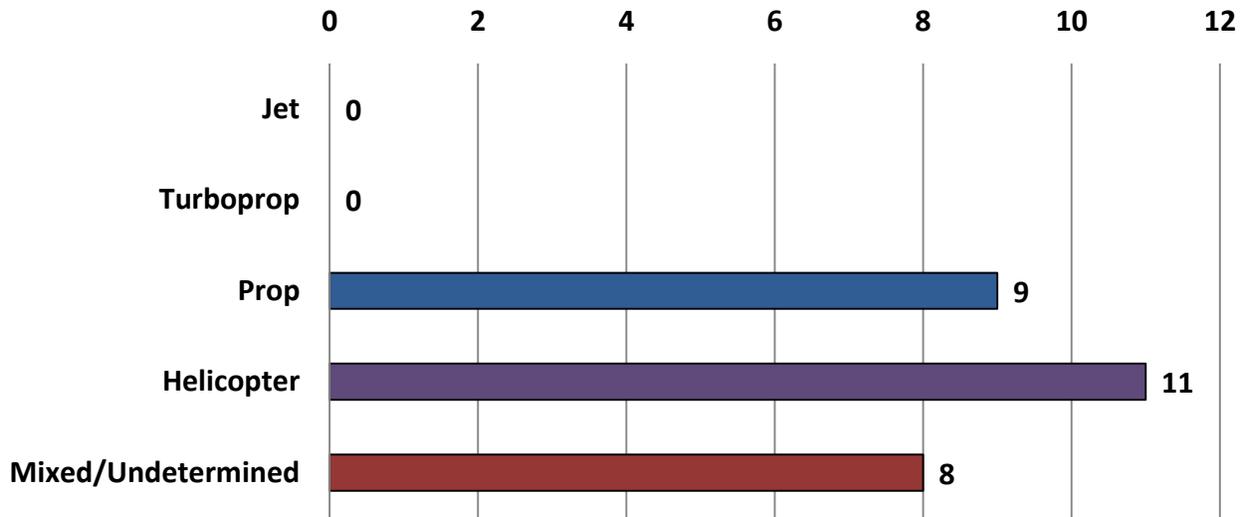
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Day (07:00-22:00)	0	1	12	7	5	5	1	6	10			
Night (22:00-07:00)	1	2	0	0	3	3	8	3	0			

HIO SUBMISSIONS BY MAIN CONCERN Q3 - 2015



	Q1	Q2	Q3	Q4
Did Not Follow NAP	0	0	0	
Excessive Noise	11	9	16	
Flying Low/Over Home	2	6	9	
Frequency of Flights	3	2	2	
Late Night/Early Morning	0	4	1	
Inquiry/Other	0	2	0	

HIO SUBMISSIONS BY AIRCRAFT CATEGORY Q3 - 2015



	Q1	Q2	Q3	Q4
Jet	0	3	0	
Turboprop	1	3	0	
Prop	3	4	9	
Helicopter	3	6	11	
Mixed/Undetermined	9	7	8	