

3.0 AVIATION ACTIVITY FORECASTS

3.1 INTRODUCTION

Aviation activity forecasts are essential for airport master plans because they serve as the basis for a number of important recommendations and decisions. Aviation activity forecasts are used to determine:

- Appropriate design aircraft and FAA airport design criteria
- Facility requirements to accommodate existing and projected demand, primarily through the demand-capacity analysis
- Capital investments, project priorities, cost estimates, and timing
- Future aeronautical revenue potential
- Environmental coordination, review, and studies that may be required prior to project implementation

As stated in FAA’s Advisory Circular (AC) 150/5070-6B: *Airport Master Plans*, aviation forecasts should be “realistic, based upon the latest available data, reflect current airport conditions, and provide adequate justification for airport planning and development.”

Aviation forecasts typically encompass three planning periods: the short-term (0-5 years), intermediate period (6-10 years), and long-range outlook (10-20 years). In addition to various measures of aviation activity, forecasts also identify the future critical design aircraft. The forecast periods for the Harvey Field Master Plan are:

- Base Year: 2014
- Short-Term: 2015-2019
- Intermediate Period: 2020-2024
- Long-Term Outlook: 2025-2034

3.2 BACKGROUND

Harvey Field accommodates a wide variety of general aviation users (illustrated in **Figure 3-1**, **Figure 3-2**, **Figure 3-3**, **Figure 3-4**, and **Figure 3-5**), ranging from private/recreational flying to flight training (fixed wing and rotorcraft), scenic flights and air tours, government agency/public services, hot air ballooning, as well as an active parachute drop operation. Cessna Caravans (CE-208B single-engine turboprop) are used for the parachute operations. Flight training and parachute activity are generated by aircraft owned by the

airport owner/operator, and they generate a large volume of takeoffs and landings at Harvey Field, particularly when there are visual weather conditions (Visual Flight Rules ((VFR)). The average number of daily aircraft operations is significantly lower during periods of poor (i.e. Instrument Flight Rules (IFR)) weather conditions, compared to good weather at Harvey Field.

FIGURE 3-1 – CESSNA 208B GRAND CARAVAN – SKYDIVING OPERATIONS



Source: Harvey Field

FIGURE 3-2 – HELICOPTERS (FLIGHT TRAINING) & HOT AIR BALLOONS



Source: Harvey Field

FIGURE 3-3 – BELL 205 – SNOHOMISH COUNTY EMERGENCY RESPONSE



Source: Harvey Field

FIGURE 3-4 – CESSNA 152 – FLIGHT TRAINING



Source: Harvey Field

FIGURE 3-5 – CESSNA 172 – FLIGHT TRAINING



Source: Harvey Field

3.3 AVIATION ACTIVITY AND FORECAST DATA AVAILABLE FOR HARVEY FIELD

While forecasting is essential for a successful master plan, there are a number of inherent limitations that affect projections of future activity. Forecasts are developed based on historical data and trends, present conditions, and future outlooks accounting for a number of external variables, such as demographic trends.

The type and quality of data available concerning aviation activity on a local level has a direct bearing on the reliability (statistical level of confidence) in the forecasts. Harvey Field is similar to the large majority of airports in the U.S., which also do not have an air traffic control tower (ATCT). As a result there are no air traffic controllers compiling aviation activity counts – i.e. aircraft takeoffs and landings. Aviation activity levels at Harvey Field were estimated by the airport administration, Washington State Department of Transportation (WSDOT), and the FAA. Because the owner/operator of Harvey Field also owns and operates the flight training and parachute aircraft, the airport’s estimate of recent trends and current activity levels at Harvey Field is considered to be the most accurate.

One consequence of different sources of estimated activity levels is that they frequently do not coincide with each other. Given the fact that they are estimates, it is often difficult to reconcile the differences.

Some agencies have used various electronic counters to take sample measurements of aviation activity at non-towered airports in an effort to validate activity estimates. While electronic counters are useful, they also require a substantial investment of cost and labor, and counters are not eligible for FAA grants. Electronic counters have not been used at Harvey Field, so there has been no validation of the aviation activity estimates. Aviation counters were utilized by Washington DOT during the first Master Planning effort that was conducted in the early 1980’s, but traffic counters have not been used since then.

3.4 FORECAST TECHNIQUES

There a number of forecast techniques recommended by the FAA¹ depending on the level of activity and complexity at each airport. The forecast techniques include: regression analysis, trend analysis, and extrapolation, market share (ratio) analysis, and smoothing, as well as applied growth rates and judgmental projections, among others. The FAA recommends that the forecast techniques used be appropriate to each airport and situation. As stated in the FAA AC *Airport Master Plans*: “An existing forecast, on the other hand, may be all that is required for simpler projects. Planners should determine the appropriate level of forecasting effort in the course of pre-planning and scoping the study.” For Harvey Field, it was determined that application of the FAA’s Terminal Area Forecast (TAF) growth rate through 2034 was appropriate, for the following reasons:

¹ Sources: FAA AC 1505070-6B, *Airport Master Plans*; FAA & GRA, Inc. *Forecasting Aviation Activity by Airport*, 2001

- FAA's TAF reflects a top-down outlook based on industry trends that are consistent with activity levels at Harvey Field.
- The growth rate in FAA's TAF is consistent with the airport administration's estimate of future activity.
- Use of forecast techniques such as regression and least-squares analysis are not appropriate for Harvey Field because of the following reasons:
 - Aviation activity data at S43 is estimated, not counted.
 - The total level of aviation activity at S43 is relatively small compared to the larger socio-economic conditions in Snohomish County.
 - The statistical correlation between aviation activity at S43 and socio-economic conditions in the County are not strong enough to use regression analysis.

3.5 HISTORIC AND CURRENT AVIATION ACTIVITY TRENDS

There are four sources of historic and current aviation activity data for Harvey Field:

- Airport Management Records
- FAA Airport Master Record Form 5010 – current activity estimates:
- FAA Terminal Area Forecast (TAF) – historic and future aviation activity
- Washington State Department of Transportation (WSDOT) Aviation System Plan – historic and future aviation activity

3.5.1 S43 Airport Management Activity Records

The owner/manager (Airport) of Harvey Field reviewed the FAA Airport Master Record, Form 5010, as well as the FAA's latest Terminal Area Forecast (TAF) and noted that actual based aircraft and operations are lower than FAA estimates. The Airport examined historic fuel sales records, the number of based aircraft, hours flown by flight training aircraft, and current parachute activity, and determined that estimated annual aircraft operations in calendar year 2014 equaled 100,220. That represents an average of 274 takeoffs and landings every day of the calendar year. A formal request to amend FAA's Form 5010 and the TAF was submitted to and accepted by FAA, based on airport management records (letter attached in **Appendix C**). **Table 3-1** and **Table 3-2** depict the based aircraft numbers and operations.

The number of based aircraft counted by the Airport (249) is relatively close to the estimate in FAA's Form 5010 (258). The number of based aircraft fluctuate at any given airport within a given time period due a variety of factors.

TABLE 3-1 – BASED AIRCRAFT (2014)

Aircraft Type	Amount
Single Engine	231
Multi Engine	6
Turbine	3
Glider	1
Helicopters	6
Ultralight	2
Total Based Aircraft	249

Source: Harvey Field Records, 2015

TABLE 3-2 – AIRCRAFT OPERATIONS

Aircraft Type	Operations
Air Carrier:	0
Air Taxi:	1,500
General Aviation Local:	51,920
General Aviation Itinerant:	46,600
Military:	200
Total Operations:	100,220
Average Operations Per Day	274
Average Operations Per Based Aircraft (OPBA)	402

Source: Harvey Field Records, 2015

3.5.2 FAA Airport Master Record Form 5010

The FAA Airport Master Record Form 5010 provides historical based aircraft and operational data as filed with/by the FAA. Form 5010 is part of FAA’s Airport Master Record, and the forms are normally compiled by State DOT airport inspectors. Inspectors typically visit each airport and interview the airport manager and tenants to compile activity estimates. The Form 5010 is used to primarily cross-reference other data sources. **Table 3-3** depicts the based aircraft and **Table 3-4** the aircraft operations as detailed on the 5010. The 139,195 aircraft operations estimated for year ending July 31, 2014 represent an average of 381 aircraft takeoffs and landings each day of the year. The Form 5010 estimates of annual operations at Harvey Field are 39 percent higher than the Airport’s records indicate. Given that a large percentage of aircraft operations at Harvey Field are conducted by aircraft owned and operated by the airport management, the airport’s records of activity are considered to be more accurate in terms of existing activity levels.

TABLE 3-3 – BASED AIRCRAFT - FAA FORM 5010

Aircraft Type	Number
Single Engine (SE):	233
Multi Engine (ME):	8
Jet (J):	1
Total Fixed Wing: (SE + ME + J)	242
Helicopters:	8
Gliders:	2
Military:	0
Ultra-Light:	6
Total Based Aircraft	258

Source: FAA Airport Master Record Form 5010, year ending July 31, 2014

TABLE 3-4 – AIRCRAFT OPERATIONS - FAA FORM 5010

Aircraft Type	Operations
Air Carrier:	0
Air Taxi:	8,445
General Aviation Local:	44,540
General Aviation Itinerant:	86,135
Military:	75
Total Operations:	139,195
Average Operations Per Day	381
Average Operations Per Based Aircraft (OPBA)	539

Note: Operations for 12 months ending: July 31, 2014

Source: FAA Airport Master Record Form 5010

3.5.3 FAA Terminal Area Forecast: Historic and Future Aviation Activity at Harvey Field

The FAA Terminal Area Forecast (TAF) provides both historic and projected aviation activity for specific airports included in FAA’s National Plan of Integrated Airport Systems (NPIAS). The FAA’s TAF is updated annually and is used by the FAA to determine budget and staffing needs of the FAA, as well as being a resource for airport operators, the general public, and other interested parties. The TAF provides a guideline for developing forecasts, and is used for comparison of scenario-driven forecasts with FAA developed forecasts.

An acceptable forecast analysis that is consistent with the FAA TAF is generally the requirement for FAA’s approval of an airport master plan forecast.² **Table 3-5** details percent change in aircraft operations at Harvey Field from 1990 through 2040. **Figure 3-6** details the historic operations from the TAF, while **Figure 3-7** details historic based aircraft. **Figure 3-8** and **Figure 3-9** detail the forecasted operations and based aircraft, respectively and **Table 3-6** details the compound annual growth rate for operations.

² FAA AC 150/5070-6B, *Airport Master Plans*

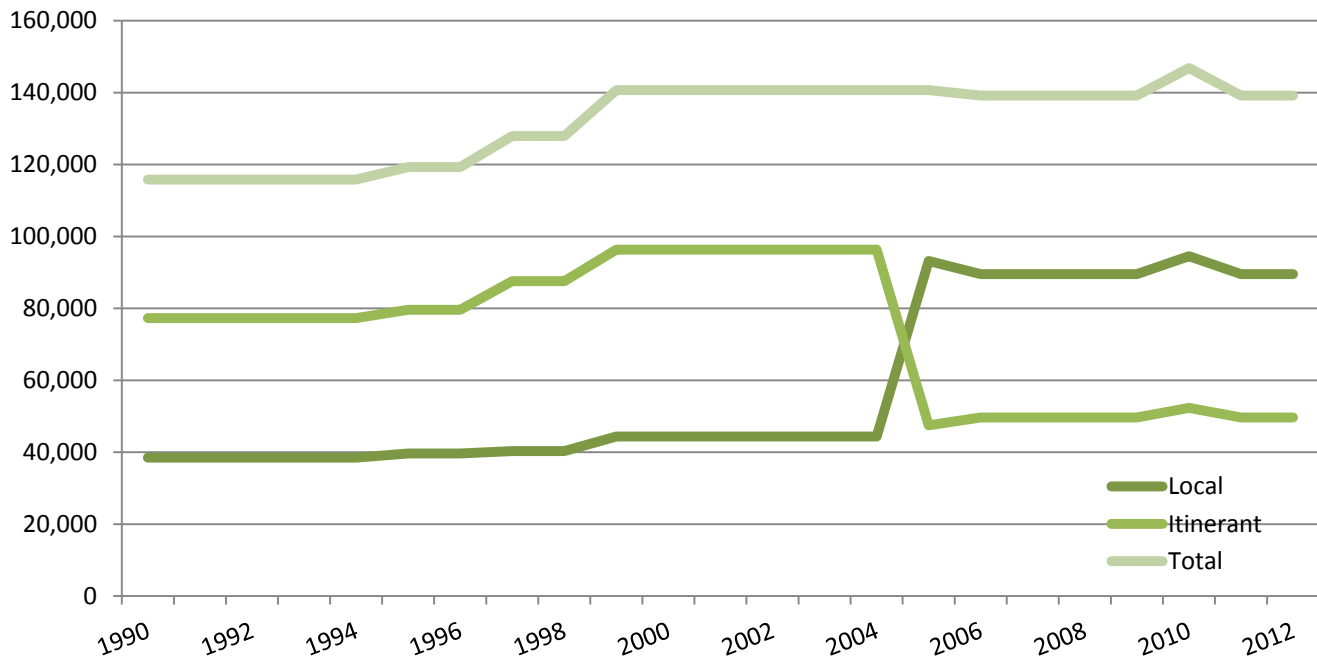
TABLE 3-5 –AIRCRAFT OPERATIONS AT HARVEY FIELD - PERCENT CHANGE

Period	Itinerant	Local	Total	Based AC
1990-2012	-35.8%	132.5%	20.2%	-30.1%
2013-2040	16.0%	16.2%	16.1%	25.5%

Source: FAA Terminal Area Forecast, issued January 2015

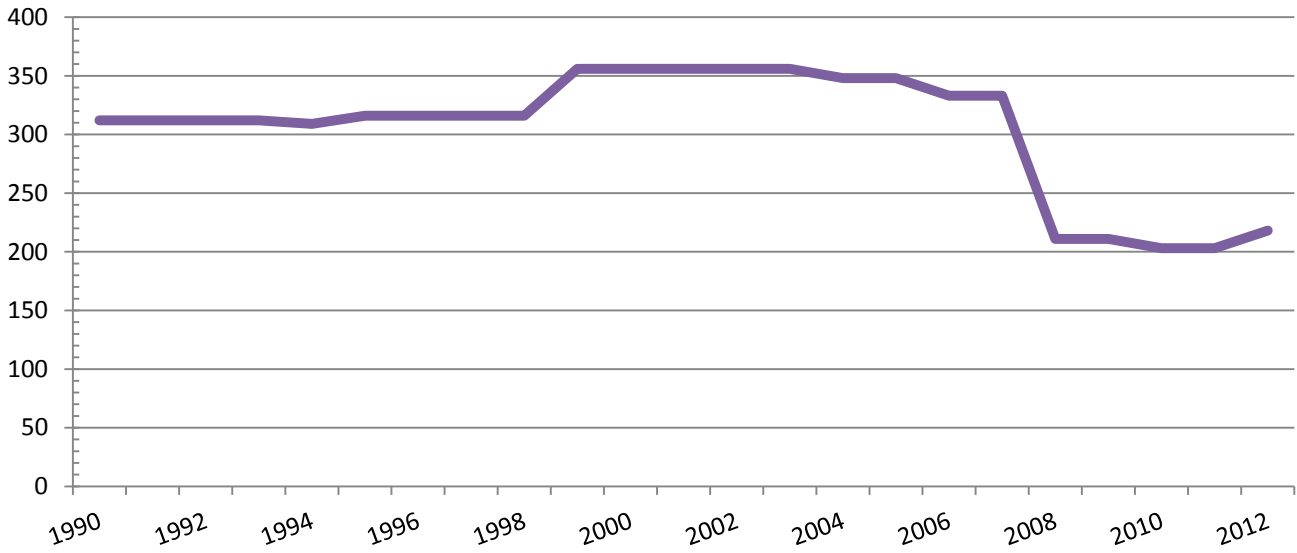
General aviation activity records maintained by air traffic controllers at specific airports show that aircraft operations at any given airport typically fluctuate over given time periods. The fluctuations estimated by the FAA at Harvey Field are therefore consistent with broader activity trends. However, FAA did not indicate why activity levels fluctuated at Harvey Field as shown in **Figure 3-6**, particularly in the 2005 time frame when there was a large change in local and itinerant operations or the drop in based aircraft shown in **Figure 3-7**.

FIGURE 3-6 – TAF HISTORIC OPERATIONS AT HARVEY FIELD (1990-2012)



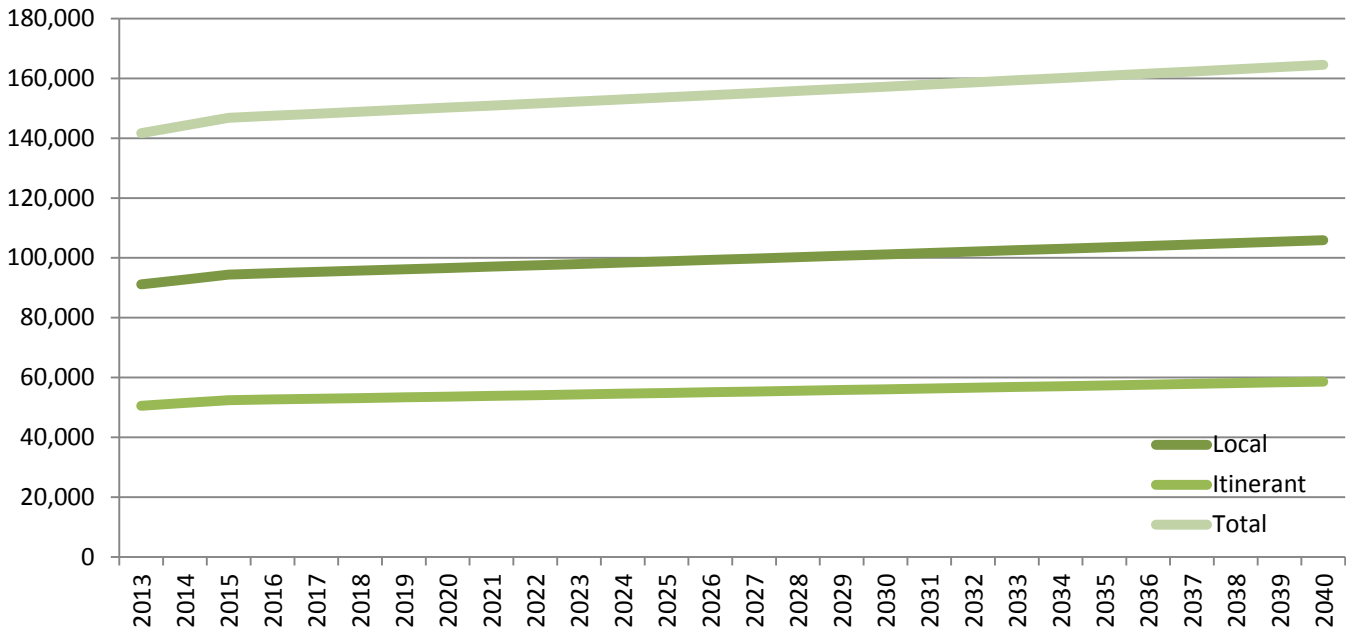
Source: FAA Terminal Area Forecast, issued January 2015

FIGURE 3-7 – HARVEY FIELD HISTORIC BASED AIRCRAFT (FAA TAF)



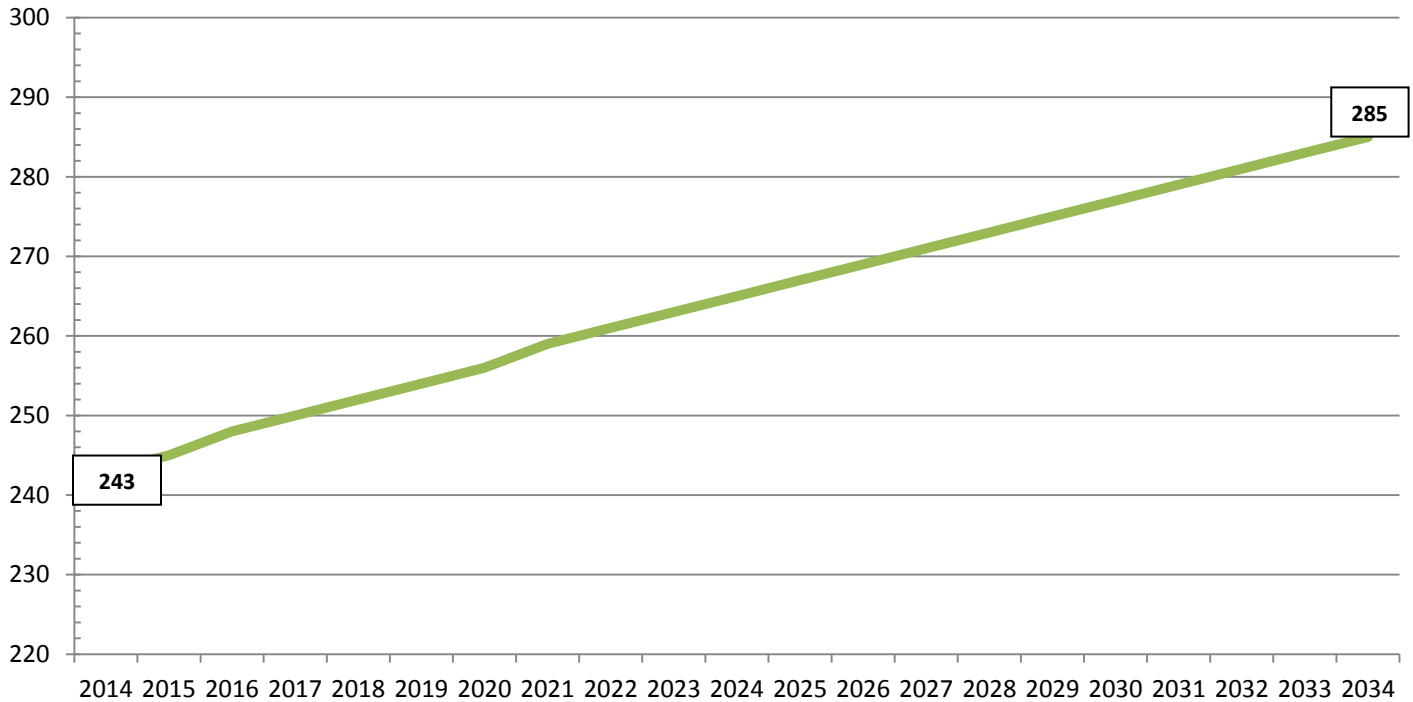
Source: FAA Terminal Area Forecast, issued January 2015

FIGURE 3-8 – TAF FORECASTED OPERATIONS AT HARVEY FIELD (2013-2040)



Source: FAA Terminal Area Forecast, issued January 2015

FIGURE 3-9 – HARVEY FIELD FORECAST OF BASED AIRCRAFT (FAA TAF)



Source: FAA Terminal Area Forecast, issued January 2015

TABLE 3-6 – COMPOUND ANNUAL GROWTH RATE (CAGR) FOR HARVEY FIELD (FAA TAF)

Period	Itinerant	Local	Total	Based AC
1990-2012	-2.0%	3.9%	0.8%	-1.6%
2013-2040	0.6%	0.6%	0.6%	0.8%

Source: FAA Terminal Area Forecast, issued January 2015

Summary of Key Points:

- Because there is no control tower at Harvey Field, activity levels are estimated. In addition, activity levels at almost every airport fluctuate over time, in response to both short- and long-term opportunities as well as pressures.
- The wide variety of aviation activity at Harvey Field means that as one segment of the market (such as private/pleasure flying) declines over a short period, another segment of activity, such as flight training and/or parachuting, often increase in response to different market forces.
- The Airport estimates that annual operations at Harvey Field were approximately 39,000 less than estimated by the FAA in 2014. Given that the airport management owns and operates the aircraft that

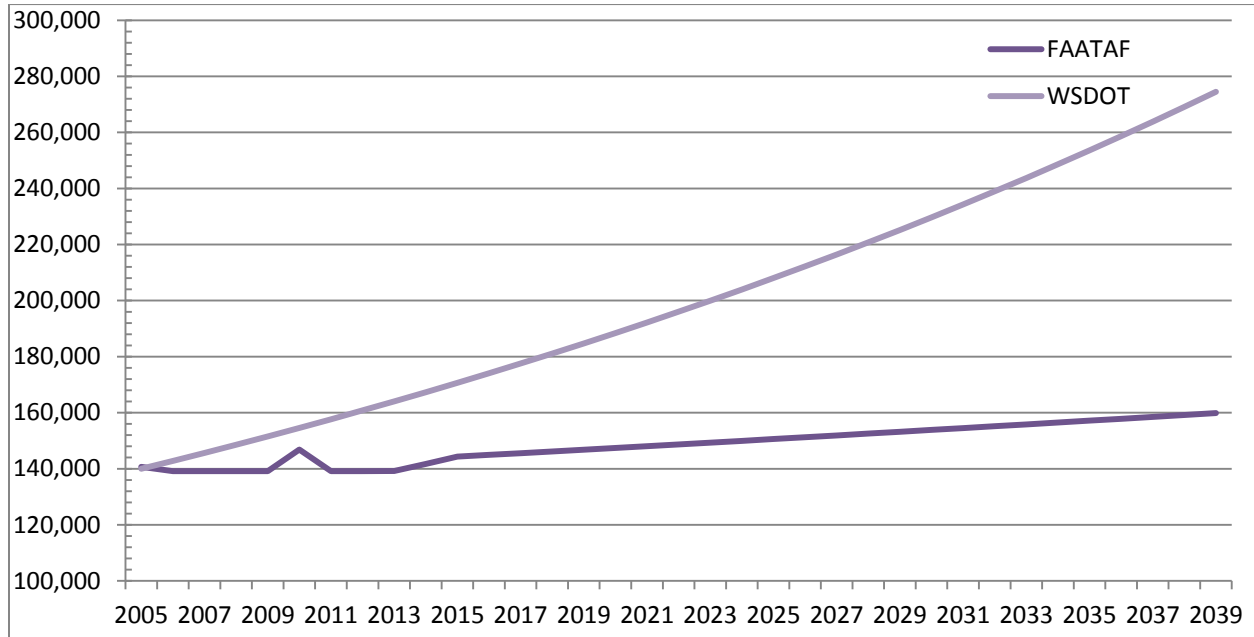
generate a large share of activity, the airport's activity records are considered to be more accurate than the FAA's Form 5010 or TAF.

- FAA TAF activity data is estimated, and there is no background information that explains the large fluctuation in operations in the 2004-2005 time period.
- Although the FAA estimated that aviation activity was relatively flat between 1990 and 2012, they predict that aircraft operations at Harvey Field will increase between 2013 and 2040.
- The socio-economic and demographic characteristics of the Puget Sound Region (discussed in following text) are projected to increase through 2040, similar to the FAA's TAF forecast rate of growth for Harvey Field. As noted below, the statistical correlation between regional socio-economic trends and aviation activity at Harvey Field are not strong enough to prepare regression analysis projections, but future growth trends are similar.
- The FAA's forecast of based aircraft through 2040 appears reasonable in relation to the strong socio-economic growth projected for the Puget Sound Region. Harvey Field is attractive to airplane owners and pilots who prefer not to operate at towered airports, such as Paine Field.

3.5.4 Washington DOT (WSDOT) Aviation System Plan: Historic and Future Aviation Activity at Harvey Field

WSDOT Aviation System Plan (ASP) forecasts were prepared in 2005, and projected a higher growth rate than FAA's TAF, as shown on **Figure 3-10** and **Table 3-7**. The WSDOT forecast reflects the higher growth rates of general aviation (GA) activity experienced in the late 1990s and early 2000s compared to later in the decade, and the state's higher rate of growth reflects that trend. As noted below, data from towered airports throughout Washington show a steady decline in GA operations, and FAA's lower growth rate in their TAF is more consistent with that trend. It is recognized that Harvey Field accommodates different types of GA activities compared to most of the towered airports in the state, but the overall downward trend in towered GA operations reflects the broader pressures on the GA industry including higher fuel prices, the higher cost of new aircraft, maintenance, etc. In a number of respects, Harvey Field serves as a unique facility compared to many other airports in Washington, and as result has experienced different trends than seen elsewhere.

FIGURE 3-10 – HARVEY FIELD – FORECAST OF AIRCRAFT OPERATIONS



Sources: WSDOT Aviation System Plan and FAA Terminal Area Forecast

TABLE 3-7 – COMPOUND ANNUAL GROWTH RATE (CAGR) FOR HARVEY FIELD

Period	WSDOT	FAA TAF
2005-2040	2.0% ^{a/}	0.4%

Note: ^{a/}WSDOT period is only through 2039

Sources: WSDOT Aviation System Plan and FAA Terminal Area Forecast, issued January 2015

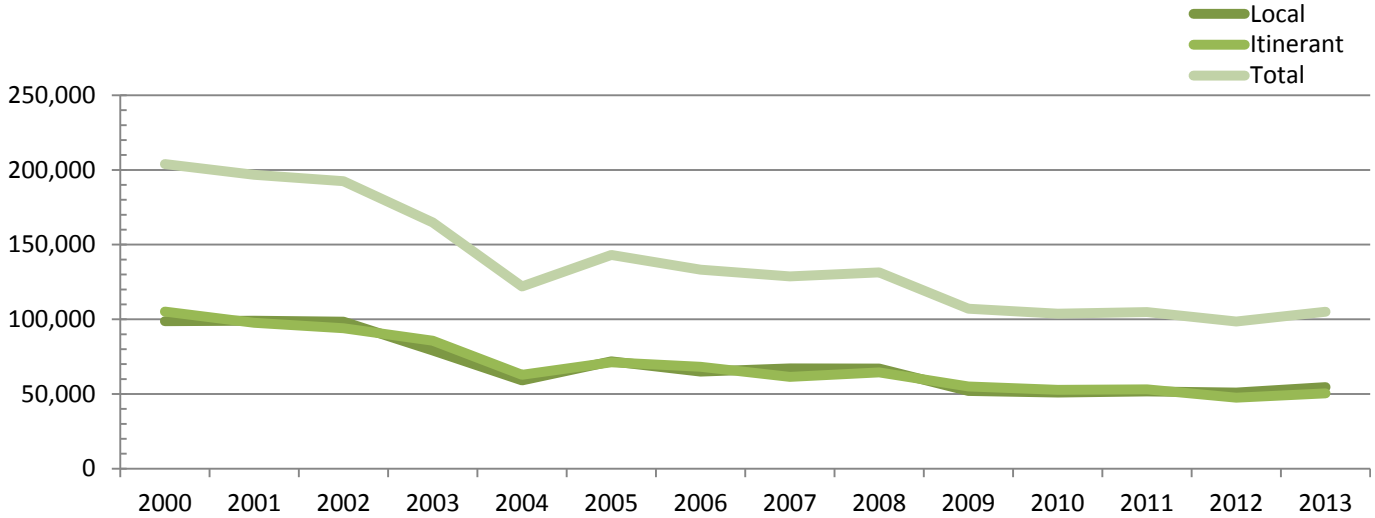
3.6 REGIONAL AND STATEWIDE GA AVIATION ACTIVITY

A number of airports within the Puget Sound Region have air traffic control towers, and therefore count aircraft operations. Paine Field (PAE) is a towered airport located less than 20 miles west of Harvey Field. As counted by the FAA air traffic controllers, total GA activity at PAE decreased by 48.5 percent between 2000 and 2013 (CAGR -5.4 percent); see **Figure 3-11**.

It is important to note that the type and nature of GA missions and aircraft that operate at PAE are different than those at Harvey Field. Therefore, the decline in traffic at PAE is not necessarily reflective of activity at Harvey Field. For example, PAE accommodates a high volume of corporate and air taxi activity, while Harvey Field accommodates high volumes of training and parachute operations. However, the decline in GA activity recorded at PAE is consistent with GA activity trends recorded by air traffic controllers throughout Washington and the FAA’s Northwest Mountain Region, and is indicative of downward

pressures on the GA industry, some of which are discussed in **Section 3.9**. Harvey Field estimated that aircraft operations have declined by approximately 20 percent over the last 10 years.

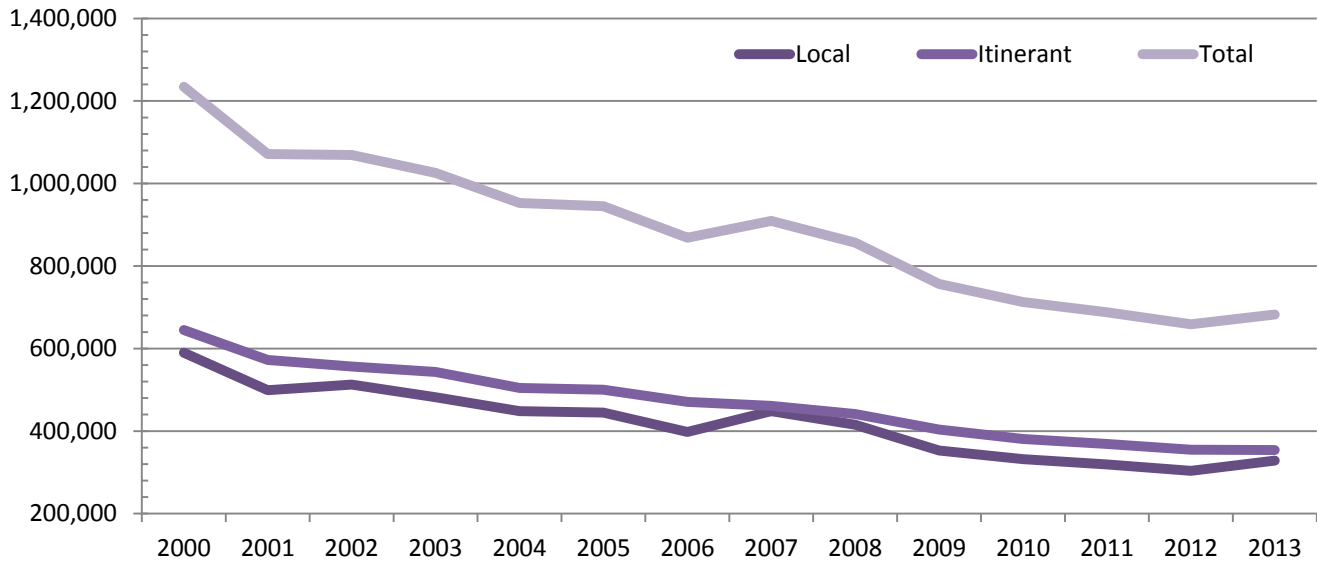
FIGURE 3-11– GENERAL AVIATION AIRCRAFT OPERATIONS – PAINE FIELD (PAE)



Source: FAA ATADS

Similar downward trends in overall GA activity were recorded at towered airports throughout Washington between 2000 and 2013; total GA operations at all towered airports in the state declined by 44.7 percent (CAGR -4.8 percent, see **Figure 3-12**). At many towered airports in Washington, such as Paine Field, corporate and air taxi activity represent a higher percent of GA traffic than at Harvey Field, which accounts for some of the different trends in activity between 2000 – 2013.

FIGURE 3-12– GENERAL AVIATION AIRCRAFT OPERATIONS – CIVILIAN TOWERED AIRPORTS
STATE OF WASHINGTON

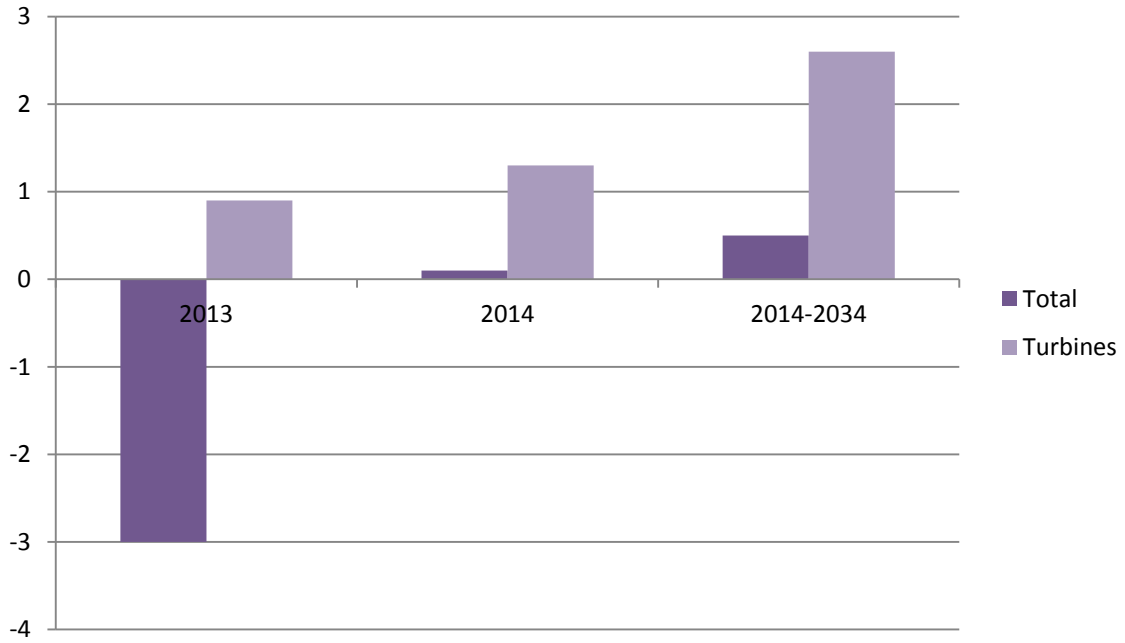


Source: FAA ATADS

3.7 NATIONAL GENERAL AVIATION ACTIVITY - FAA AEROSPACE FORECASTS, FY 2014-2034

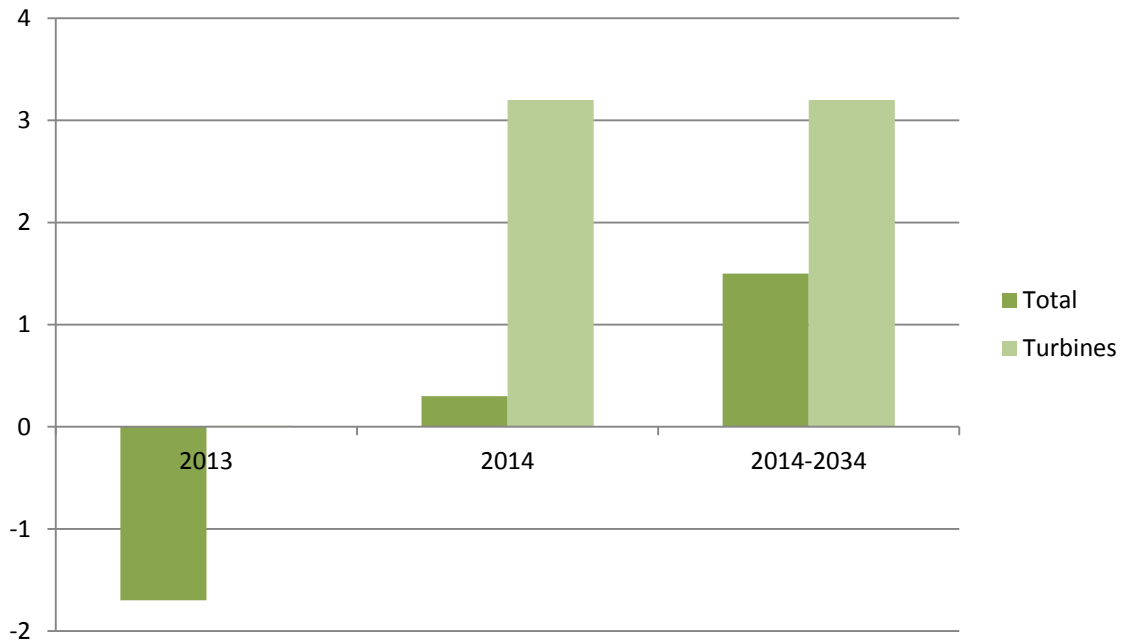
The FAA issues their national aerospace forecasts annually, which cover a 20-year period. The most recent aerospace forecast predicts that GA activity will vary significantly between piston-engine and turbine-engine aircraft. Piston-engine aircraft will experience relatively little growth through 2034, while turbine-powered aircraft will experience a more robust growth rate, see **Figure 3-13** and **Figure 3-14**.

FIGURE 3-13– ACTIVE GENERAL AVIATION AIRCRAFT AND HOURS FLOWN



Source: FAA Aerospace Forecasts, FY 2014-2034

FIGURE 3-14 – GENERAL AVIATION HOURS FLOWN



Source: FAA Aerospace Forecasts, FY 2014-2034

3.8 LOCAL AND REGIONAL DEMOGRAPHIC TRENDS

As noted previously, there are several reasons why the use of regression and least-squares analysis and forecast techniques are not relevant for projecting activity at Harvey Field, including the fact that there is not a strong statistical correlation between socio-economic trends in Snohomish County and aviation activity at Harvey Field. But overall socio-economic and demographic trends, as shown below, are projected to continue growing in the region through 2040, which at the very least means that aviation activity at Harvey Field will not be constrained by factors such as growing unemployment, decreasing population, or declining per capita income. In other words, the positive socio-economic outlook for the Puget Sound Region through 2040 should support growing activity at Harvey Field with all other factors (such as aviation fuel prices, etc.) remaining steady.

According to the Puget Sound Regional Council's 2012 Regional Macroeconomic Forecast (**Table 3-8**) the overall population, employment, and per capita income are projected to increase steadily through 2040 in the Puget Sound Region.

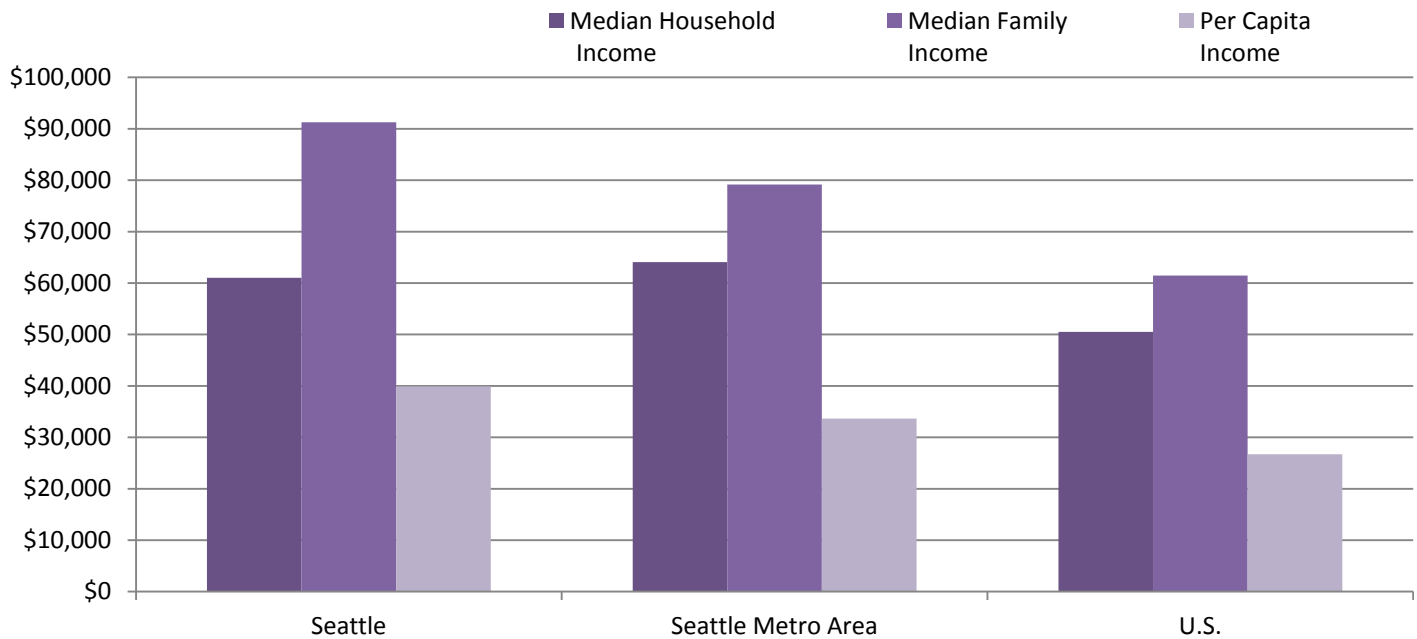
- The average per capita income in the greater Seattle Metro Region is among the highest in the U.S. (**Figure 3-15**).
- The overall strong growth in demographic trends support growing GA activity at Harvey Field, particularly in terms of personal/discretionary flying, flight training, parachuting, and business-related aviation.
- Public service and construction-related aviation activity are driven more by public agency and specific industry demands than the regional economy.

TABLE 3-8- PUGET SOUND ECONOMIC FORECASTS: 2000-2040

Puget Sound Forecast 2012	2000	2010	2020	2030	2040	Percent Change 2000-2040
Employment (thousands)	1,721.9	1,726.6	2,091.2	2,317.6	2,711.4	57.4%
Personal Income (millions \$00)	122,204	151,101	226,205	326,645	452,491	270.3%
Consumer Price Index (1982-84 =1.00)	1.79	2.24	3.49	4.30	5.18	189.4%
Population, (thousands)	3,271.1	3,680.5	4,127.7	4,531.5	4,974.8	52.1%
Households (thousands)	1,280.7	1,460.0	1,662.5	1,819.3	2,067.8	61.4%

Source: Puget Sound Regional Council, 2012 Regional Macroeconomic Forecast

FIGURE 3-15- 2011 INCOME ESTIMATES (SEATTLE, SEATTLE METRO AREA, AND U.S.)



Notes:

- 2011 latest year income data was available on City website
- In the ACS, people are asked about income during the previous 12 months. Because the ACS is conducted throughout the year, the 2011 ACS includes incomes for the 12-month periods as early as January through December of 2010 and as late as December of 2010 through November of 2011. ACS estimates have high margins of error.

Source: 2011 American Community Survey estimates, U.S. Census Bureau, and City of Seattle Department of Planning & Development

3.9 FACTORS THAT MAY IMPACT FUTURE GA ACTIVITY

Although Harvey Field is situated in the Puget Sound Region of Washington, GA activity at Harvey Field is also affected by broad national trends. Those trends are directly impacting GA activity at many airports across the U.S. and Washington, a number of which are discussed below. Each one represents potential risks to the forecast of activity at Harvey Field, and it is difficult to predict how and when each factor will evolve over time:

- Rising price of 100LL AvGas, and potential limited availability or disappearance of low-leaded AvGas before 2020. Since mid-2014 aviation fuel prices have declined slightly due to falling oil and gas prices globally, but aviation fuel prices have also been very volatile for more than a decade. At the current time there is no ready replacement for 100LL, although FAA and several private companies are working to find a viable replacement.
- Aging and declining GA pilot population has been a long-term trend.
- Rising cost of new GA aircraft and parts has outpaced the overall rate of inflation for many years.
- The average age of piston-engine GA aircraft is more than 45 years old. As a result, maintenance costs are rising steadily, and many airplane parts are becoming scarce, and more difficult and expensive to find.
- Recent changes in minimum experience levels for new airline pilot hires (now minimum 1,500 hours flight time) significantly increased training costs and the time to obtain ATP license. That has impacted the number of students starting flight training due to the increased cost of obtaining sufficient licenses and experience needed to qualify to fly for the airlines.

3.10 METHODOLOGY AND CONCLUSIONS

Although GA activity at Harvey Field encompasses a wide variety of missions, a large share of aviation activity is generated by flight training and parachute operations, which are owned and operated by the airport. Airport management has indicated that particular activity will continue to grow throughout the future, as well as private/pleasure flying, some air taxi operations, and public service missions. The application of FAA's TAF growth rate is appropriate for Harvey Field, starting with the airport's current estimates of activity, because FAA's growth rate reflects continued positive trends reflected in stable aviation fuel prices, continued demand for flight training and sport parachuting, continued private/pleasure flying, and continued use of Harvey Field by public service agencies. As noted previously, use of forecast techniques such as regression and least-squares analysis, etc., are not appropriate for Harvey Field for a variety of reasons, including insufficient statistical confidence levels.

3.11 RECOMMENDED FORECAST OF AVIATION ACTIVITY AT HARVEY FIELD

The recommended forecast for Harvey Field (Table 3-9 and Table 3-10) matches the FAA TAF for the following reasons:

- The Puget Sound Region’s demographic indicators are projected to continue growing at a strong pace through 2040, which should stimulate demand for GA activity at Harvey Field.
- Washington DOT’s Aviation System Plan projected growth rate at Harvey Field is assumed to be too optimistic based on national trends in GA activity.
- There are potential risks to the forecasted growth in activity at S43 as listed in Section 3.8. Actual activity trends should be monitored on a regular basis to ensure they are tracking with the forecasts.

TABLE 3-9 – HARVEY FIELD RECOMMENDED FORECAST

	GA Itinerant Operations	GA Local Operations	Total Operations	Based Aircraft
Base Year:				
2014	46,600	53,620	100,220	249
2020	48,500	54,149	102,649	261
2025	49,500	55,219	104,719	272
2034	51,500	57,050	108,550	292

Note: Total includes air taxi and military which are not counted in GA itinerant or GA local
Source: Jviation

TABLE 3-10 – HARVEY FIELD RECOMMENDED FORECAST: COMPOUND ANNUAL GROWTH RATE (CAGR)

Period	Itinerant Operations	Local Operations	Total Operations	Based AC
2015-2019	0.70%	0.20%	0.45%	0.60%
2020-2024	0.40%	0.40%	0.40%	0.60%
2025-2034	0.40%	0.40%	0.40%	0.60%

Source: Jviation

3.12 CRITICAL DESIGN AIRCRAFT

The FAA’s airport design criteria are based on accommodating the largest aircraft that meet the substantial use threshold. The FAA defines “substantial use” as a minimum of 500 itinerant operations (takeoffs and landings) per year, which is an average of 1.4 operations per day. The Cessna 208B Caravan based at Harvey Field falls with Airport Reference Code (ARC) B-II (small), and generates activity levels that well exceed the FAA’s threshold. Therefore, this aircraft has been identified as the critical design aircraft for Harvey Field.