Brisbane
Aircraft Noise Monitoring

Prepared by San Francisco International Airport
Aircraft Noise Abatement Office
Technical Report #042017

April 2017
Revision 1 – 4/26/2017

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Executive Summary

The San Francisco International Airport (SFO) Aircraft Noise Abatement Office conducted aircraft noise monitoring in the City of Brisbane, California to determine the noise level within the community from aircraft operations at SFO. The monitoring was made possible with the assistance of the City Manager and a Brisbane resident, utilizing one permanent and four temporary sites in Brisbane. The overall average daily noise level from all aircraft was 53 A-weighted decibels (dBA) Community Noise Equivalent Level (CNEL), the Community daily noise level was 56dBA CNEL. Noise from all aircraft over this location increased the total average daily noise level by 1.5dBA. SFO aircraft comprised 79% of all aircraft noise events over the Brisbane community.

Community and SFO Operations

Brisbane is located approximately 4.75 miles from the center of the runway intersections. The City typically experiences aircraft utilizing the SSTIK and OFFSHORE Departures. Aircraft departing SFO from Runways 01L/R (Left/Right) for destinations to the west, south and southeast typically overfly Brisbane. Occasionally when the winds on the airfield are stronger from the west, the TRUKN OR NIITE Departures will be utilized for destinations to the east. Departing aircraft from Runways 28L/R will initiate a right turn once the aircraft reaches the minimum altitude of 520 feet, however this may have some aircraft fly over the City of Brisbane. SFO traffic arriving from the north on the BDEGA, STINS or GOLDEN GATE Arrival on a typical day (West Plan) overfly Brisbane at 10,000 feet or higher. When the Southeast Plan is in use and aircraft are utilizing the WWAVS Arrival, parts of Brisbane may experience aircraft flying over at lower altitudes. SFO operated on a West Flow Plan (Appendix 1) for nine full days and partially on five days. The Southeast Plan, during the measurement period, was used partially on five different days. Non-aircraft noise sources include residential noise, vehicular traffic, rain and wind noise. The ambient levels within Brisbane during the monitoring period were as follows: Site 7 – 54dBA, Site 966 – 48 dBA, Site 988 -51dBA, Site 989 – 49dBA and Site 990 – 48dBA.

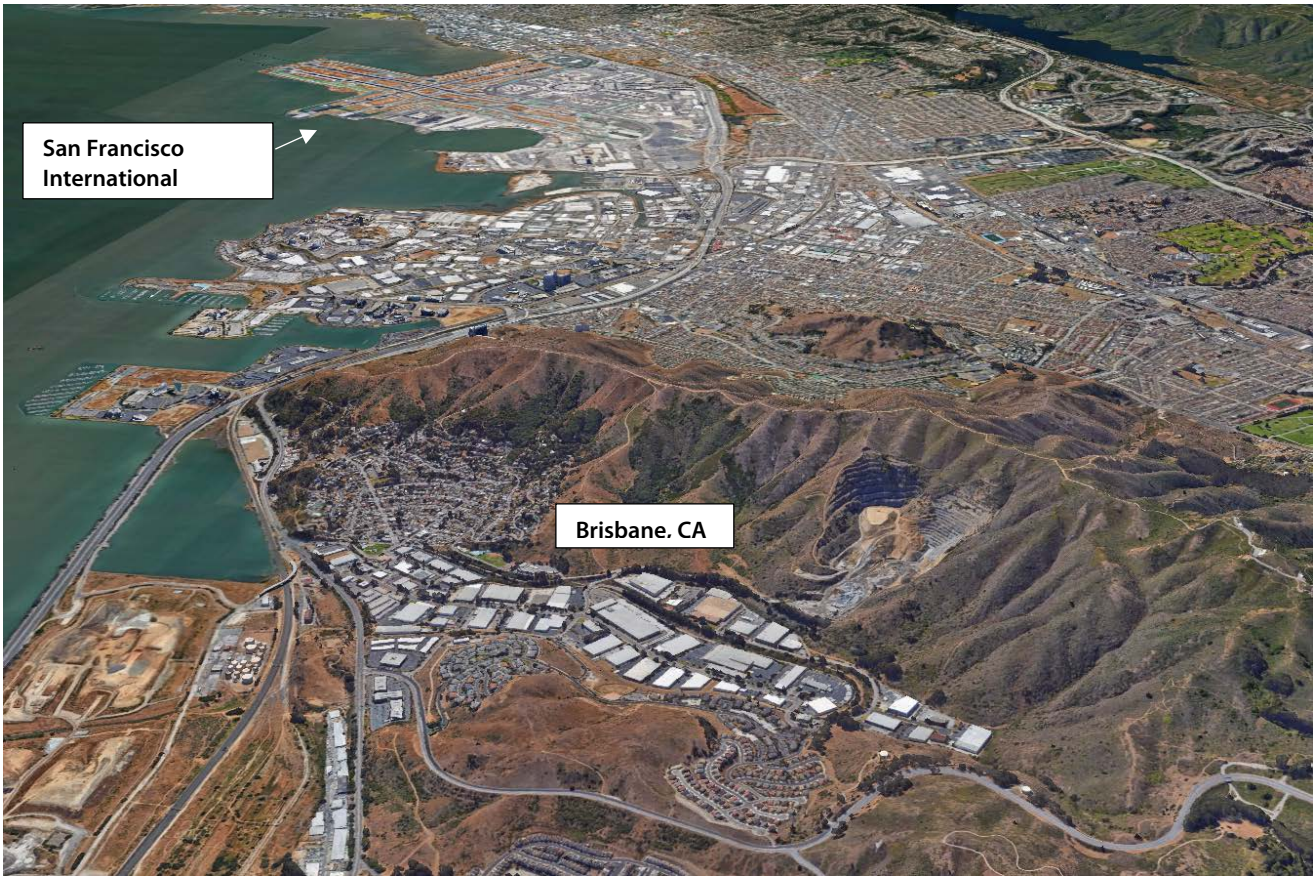
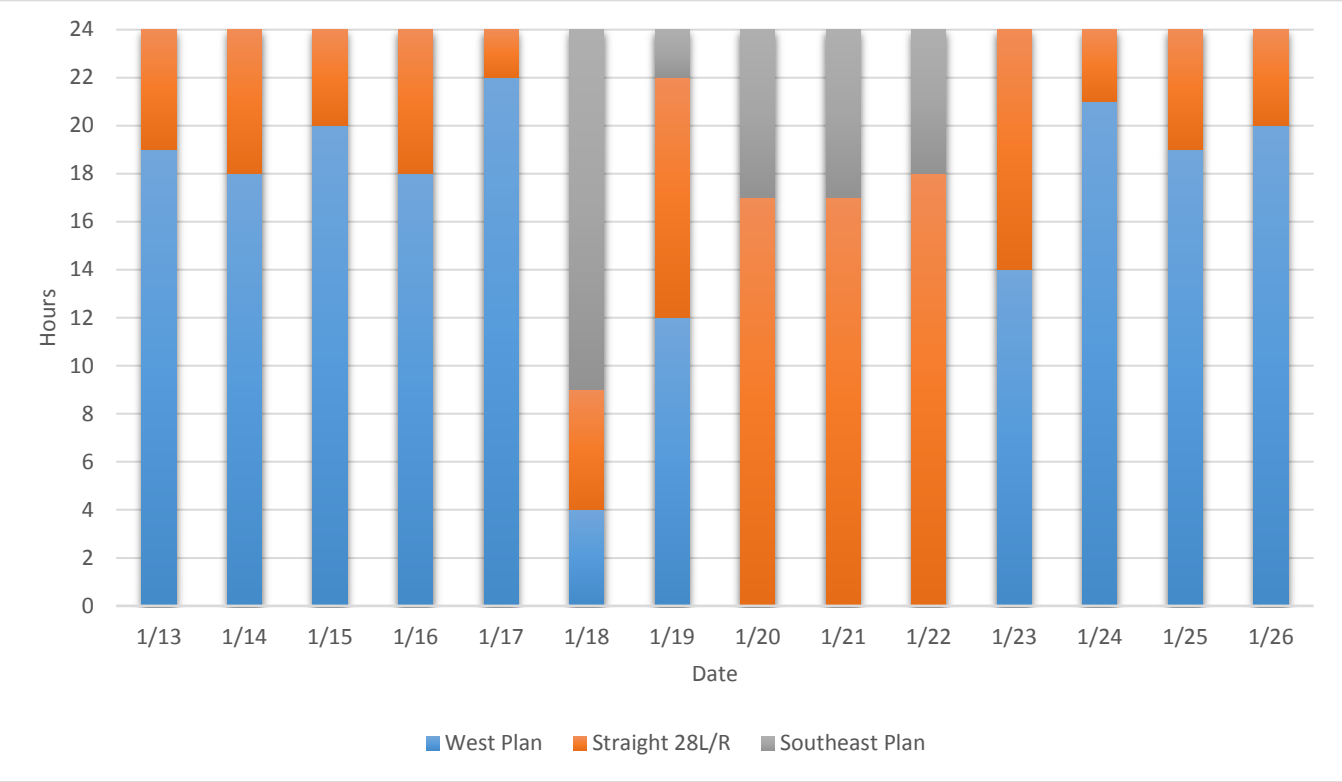


Table 1 – SFO Runway Operations



NOTE: Southeast Plan hours operated: 1/18/2017 – 6:00 a.m. to 9:00 p.m., 1/19/2017 – 10:00p.m. to 11:59 p.m., 1/20/2017 – 12:00 a.m. to 7:00 a.m., 1/21/2017 – 5:00 p.m. to 12:00 a.m. and on 1/22/2017 12:00 a.m. to 6:00 a.m.

Equipment

The equipment used to measure the sound levels were the Environmental Monitor Unit 2200 noise monitors and Type 41DM-2 microphones manufactured by Brüel & Kjær. The measurements consisted of monitoring A-weighted as well as C-weighted decibels (dBC) in accordance with procedures and equipment, which comply with International Electro-Technical Commission and measurement standards, established by the American National Standards Institute for Type I instrumentation. The microphones were calibrated prior to the start of the measurement. The portable monitors were housed in a weatherproof case and powered by available electrical outlets. The microphones were mounted on a tripod at a height of 7 feet (see Figure 1). The sound levels at the sites were continuously monitored, stored on the onboard memory and transferred to a removable memory stick for decoding. The decoded noise data was then processed in the Airport Noise and Operations Management System (ANOMS) for identification, noise to flight track matching and Community Noise Equivalent Level (CNEL) noise metric calculations.

Aircraft Noise Analysis

This Brisbane Aircraft Noise Monitoring Report evaluates the period of January 13-26, 2017, as this is when all four portable monitors were simultaneously deployed. Noise measurements were performed in five locations in Brisbane (Figure 2). At the request of those requesting the monitoring, four portable noise monitors measured noise at the pre-defined sound level threshold of 55dBA and the permanent site at 65dBA. These noise threshold settings help to differentiate aircraft from community noise events and are the reason not every aircraft over Brisbane creates a noise event. During the monitoring period a total of 14,745 noise events were recorded. There were 9,849 (67%) aircraft noise events of which 8,134 (83%) were correlated to SFO operations (SFO Events) and 1,715 (17%) correlated to other Bay Area airports (Non-SFO Events). The average aircraft generated Maximum Noise Level (Lmax) was 67dBA, the average Sound Exposure Level (SEL) was 77dBA, and the average aircraft noise event duration was 26 seconds. The event counts (SFO Events, Non SFO Events and Community) in Table 2 are presented as daily averages.

Table 2 - Noise Event Averages by Site

			Average						Average						Average		
Date	Noise Monitor	SFO Events[1]	SEL (dBA)[2]	Lmax (dBA)[3]	CNEL (dBA)[4]	Altitude	SFO Flow Pattern	Non-SFO Events	SEL (dBA)	Lmax (dBA)	CNEL (dBA)	Altitude	OAK Flow Pattern	Community Events	SEL (dBA)	Lmax (dBA)	CNEL (dBA)
	Average	**188**	**78**	**68**	**55**	**4,492**		**44**	**74**	**64**	**45**	**7,619**		**63**	**78**	**72**	**55**
	Site 7	72	81	71	56	3,492	West	1	75	66	35	7,786	West	2	82	77	60
	Site 966	199	77	66	53	4,756	West	53	72	60	45	8,018	West	29	67	60	51
01/13/2017	Site 988	268	78	66	56	4,697	West	64	74	63	47	7,410	West	214	74	64	57
	Site 989	211	77	67	53	5,159	West	58	74	65	46	7,461	West	47	75	68	50
	Site 990	189	78	69	55	4,358	West	45	72	61	44	7,420	West	22	78	73	51
	Average	**109**	**78**	**68**	**53**	**4,149**		**21**	**72**	**64**	**40**	**3,920**		**26**	**71**	**65**	**54**
	Site 7	52	80	70	55	3,461	West	3	75	68	33	1,439	West	-	-	-	58
	Site 966	119	77	66	50	4,565	West	30	71	61	41	5,040	West	8	68	63	50
01/14/2017	Site 988	131	77	66	53	4,031	West	28	71	60	41	4,056	West	27	71	62	55
	Site 989	125	76	66	50	4,688	West	20	72	63	40	4,580	West	35	71	64	49
	Site 990	119	78	68	53	4,000	West	25	71	64	40	4,486	West	34	72	69	48
	Average	**113**	**78**	**68**	**52**	**4,572**		**24**	**72**	**62**	**38**	**7,404**		**18**	**71**	**68**	**53**
	Site 7	37	81	72	54	3,320	West	-	-	-	0	-	-	-	-	-	57
	Site 966	134	76	65	49	5,113	West	27	71	61	39	7,245	West	9	70	66	49
01/15/2017	Site 988	146	77	65	53	4,685	West	30	71	61	39	7,286	West	17	66	59	54
	Site 989	128	76	65	49	5,225	West	21	73	63	39	7,595	West	21	71	64	49
	Site 990	120	77	67	53	4,518	West	19	72	61	38	7,489	West	24	74	72	48
	Average	**111**	**77**	**66**	**51**	**4,538**		**14**	**72**	**66**	**39**	**4,938**		**42**	**77**	**67**	**55**
	Site 7	26	80	70	52	3,739	West	1	74	66	27	1,445	West	-	-	-	59
	Site 966	131	75	63	49	4,878	West	21	69	59	41	6,304	West	39	82	69	53
01/16/2017	Site 988	165	75	63	53	4,488	West	25	70	60	40	6,663	West	94	70	58	56
	Site 989	126	74	64	49	5,204	West	13	74	69	38	6,005	West	25	73	67	50
	Site 990	108	76	66	52	4,380	West	9	73	67	41	4,274	West	11	70	67	50
	Average	**130**	**77**	**67**	**53**	**4,485**		**16**	**72**	**66**	**35**	**5,948**		**57**	**72**	**66**	**54**
	Site 7	30	80	71	54	3,132	West	3	76	69	32	1,154	West	-	-	-	58
	Site 966	139	76	64	50	4,959	West	13	68	58	33	7,872	West	15	68	61	51
01/17/2017	Site 988	211	76	64	54	4,584	West	33	69	69	39	7,089	West	159	75	64	56
	Site 989	153	76	66	51	5,280	West	18	70	61	36	6,742	West	41	72	65	50
	Site 990	115	76	66	53	4,472	West	12	70	64	33	6,885	West	14	72	70	48
	Average	**25**	**77**	**68**	**49**	**4,146**		**4**	**71**	**61**	**26**	**11,930**		**210**	**79**	**67**	**55**
	Site 7	7	81	72	49	2,614	West	-	-	-	0	-	-	52	85	72	59
	Site 966	18	75	65	47	5,502	West/Southeast	5	68	58	25	11,400	West	331	68	59	53
01/18/2017	Site 988	50	75	64	51	2,437	West/Southeast	5	71	58	28	12,396	West	248	72	63	56
	Site 989	26	73	64	44	5,674	West/Southeast	2	74	65	28	12,123	West	258	74	65	54
	Site 990	23	77	68	50	4,503	West/Southeast	3	68	59	24	11,801	West	160	72	64	51
	Average	**126**	**78**	**68**	**49**	**5,022**		**36**	**72**	**63**	**38**	**9,261**		**57**	**75**	**68**	**54**
	Site 7	23	81	71	46	3,996	West	-	-	-	0	-	-	4	79	70	56
	Site 966	149	76	66	49	5,392	West/Southeast	42	70	60	39	9,531	West/Southeast	31	66	60	51
01/19/2017	Site 988	190	77	66	51	5,194	West	42	72	61	40	9,300	West/Southeast	166	74	63	56
	Site 989	140	77	67	50	5,333	West	28	73	63	39	9,009	West/Southeast	55	73	66	51
	Site 990	127	76	67	48	5,196	West	33	72	65	39	9,202	West/Southeast	28	76	72	50
	Average	**62**	**77**	**69**	**49**	**4,197**		**37**	**77**	**67**	**42**	**10,093**		**158**	**81**	**73**	**62**
	Site 7	49	82	74	54	2,960	West	1	83	72	35	9,624	West	24	83	77	61
	Site 966	36	73	63	41	4,419	West	44	72	62	43	10,332	West/Southeast	131	78	70	60
01/20/2017	Site 988	115	75	65	49	4,230	West/Southeast	56	72	62	44	11,162	West/Southeast	278	78	69	62
	Site 989	27	72	63	41	5,587	West/Southeast	35	73	62	43	9,527	West	221	79	72	62
	Site 990	83	77	69	49	3,788	West	47	73	63	43	9,819	West/Southeast	136	83	73	64

[1] *SFO Events are Single SFO Aircraft, Multiple SFO Aircraft, Simultaneous SFO and Non-SFO Aircraft and Simultaneous Community and SFO Aircraft.*

[2] *SEL - Sound Exposure Level of a noise event is measured over time between the initial and final points when the noise level exceeds a predetermined threshold* and its energy is compressed into one second.

[3] Lmax - Maximum Noise Level is a measurement of the peak level of a noise events.

[4] CNEL - Community Noise Equivalent Level - Average sound level over a 24-hour period.

Table 2 - Noise Event Averages by Site (cont.)

			Average						Average						Average		
Date	Noise Monitor	SFO Events[1]	SEL (dBA)[2]	Lmax (dBA)[3]	CNEL (dBA)[4]	Altitude	SFO Flow Pattern	Non-SFO Events	SEL (dBA)	Lmax (dBA)	CNEL (dBA)	Altitude	OAK Flow Pattern	Community Events	SEL (dBA)	Lmax (dBA)	CNEL (dBA)
	Average	**36**	**76**	**67**	**48**	**4,090**		**20**	**72**	**63**	**42**	**9,270**		**42**	**73**	**67**	**56**
01/21/2017	Site 7	27	80	72	52	2,727	West	2	74	66	36	9,280	West	6	77	71	61
	Site 966	25	70	61	41	5,783	West/Southeast	28	69	61	42	9,427	West/Southeast	64	67	61	51
	Site 988	67	73	63	49	3,167	West/Southeast	25	71	62	43	9,094	West/Southeast	38	68	60	55
	Site 989	19	72	65	40	5,548	West/Southeast	21	73	65	43	9,259	West/Southeast	77	72	65	53
	Site 990	41	75	66	48	3,226	West	23	70	60	41	9,292	West/Southeast	27	75	70	51
	Average	**56**	**78**	**69**	**50**	**3,400**		**31**	**71**	**61**	**41**	**9,313**		**124**	**78**	**69**	**59**
01/22/2017	Site 7	41	81	73	53	2,813	West	-	-	-	0	-	-	29	80	73	61
	Site 966	40	75	65	44	3,719	West/Southeast	37	70	60	40	9,298	West/Southeast	128	74	67	57
	Site 988	97	78	69	51	3,106	West/Southeast	30	70	60	42	8,988	West/Southeast	82	79	70	60
	Site 989	41	74	65	44	3,654	West/Southeast	22	71	62	40	9,510	West/Southeast	227	75	65	59
	Site 990	60	77	67	49	3,709	West	36	73	62	43	9,456	West/Southeast	154	77	68	59
	Average	**192**	**78**	**68**	**56**	**4,638**		**37**	**73**	**62**	**45**	**8,863**		**54**	**77**	**70**	**56**
01/23/2017	Site 7	75	81	71	58	3,284	West	-	-	-	0	-	-	1	79	73	59
	Site 966	208	77	66	53	5,176	West	47	72	61	46	8,945	West	45	79	67	52
	Site 988	254	78	66	56	4,737	West	31	74	61	46	8,651	West	98	69	59	56
	Site 989	191	78	67	52	5,250	West	35	72	62	45	8,704	West	100	74	67	55
	Site 990	232	77	67	56	4,744	West	35	72	64	45	9,151	West	26	79	72	54
	Average	**173**	**78**	**67**	**54**	**5,085**		**28**	**73**	**63**	**44**	**7,915**		**58**	**74**	**68**	**55**
01/24/2017	Site 7	38	81	71	52	3,978	West	1	75	67	36	6,744	West	1	78	74	59
	Site 966	204	76	65	54	5,451	West	37	71	60	45	8,312	West	39	68	62	51
	Site 988	274	77	65	55	5,207	West	34	74	62	46	8,040	West	178	74	63	56
	Site 989	202	76	66	54	5,619	West	35	73	62	44	7,768	West	65	72	65	50
	Site 990	148	77	67	53	5,170	West	31	73	61	45	8,711	West	9	69	65	49
	Average	**132**	**78**	**68**	**53**	**4,580**		**20**	**74**	**64**	**40**	**6,115**		**43**	**75**	**69**	**54**
01/25/2017	Site 7	42	81	71	54	3,476	West	1	75	66	33	1,417	West	3	78	72	58
	Site 966	157	76	65	51	4,999	West	24	69	60	39	7,268	West	30	70	63	51
	Site 988	196	77	66	54	4,700	West	30	77	65	44	6,551	West	112	76	65	56
	Site 989	138	77	66	51	5,155	West	21	70	62	38	7,366	West	51	71	65	49
	Site 990	125	77	67	52	4,569	West	22	73	64	39	7,972	West	17	74	72	48
	Average	**175**	**78**	**68**	**53**	**4,646**		**38**	**74**	**64**	**43**	**6,685**		**70**	**72**	**65**	**55**
01/26/2017	Site 7	66	81	71	54	3,680	West	1	77	69	28	1,491	West	-	-	-	59
	Site 966	202	77	65	51	5,107	West	52	71	60	44	8,064	West	36	67	60	51
	Site 988	251	78	66	55	4,589	West	59	72	60	45	7,500	West	165	73	63	57
	Site 989	185	76	66	51	5,178	West	36	73	63	42	7,977	West	65	74	69	51
	Site 990	171	78	67	53	4,676	West	44	72	62	44	8,391	West	13	69	65	49
Total	**Total**	**8,134**						**1,715**						**4,896**			

[1] *SFO Events are Single SFO Aircraft, Multiple SFO Aircraft, Simultaneous SFO and Non-SFO Aircraft and Simultaneous Community and SFO Aircraft.*

[2] *SEL - Sound Exposure Level of a noise event is measured over time between the initial and final points when the noise level exceeds a predetermined threshold* and its energy is compressed into one second.

[3] Lmax - Maximum Noise Level is a measurement of the peak level of a noise events.

[4] CNEL - Community Noise Equivalent Level - Average sound level over a 24-hour period.

Table 3 – SFO Events by Date

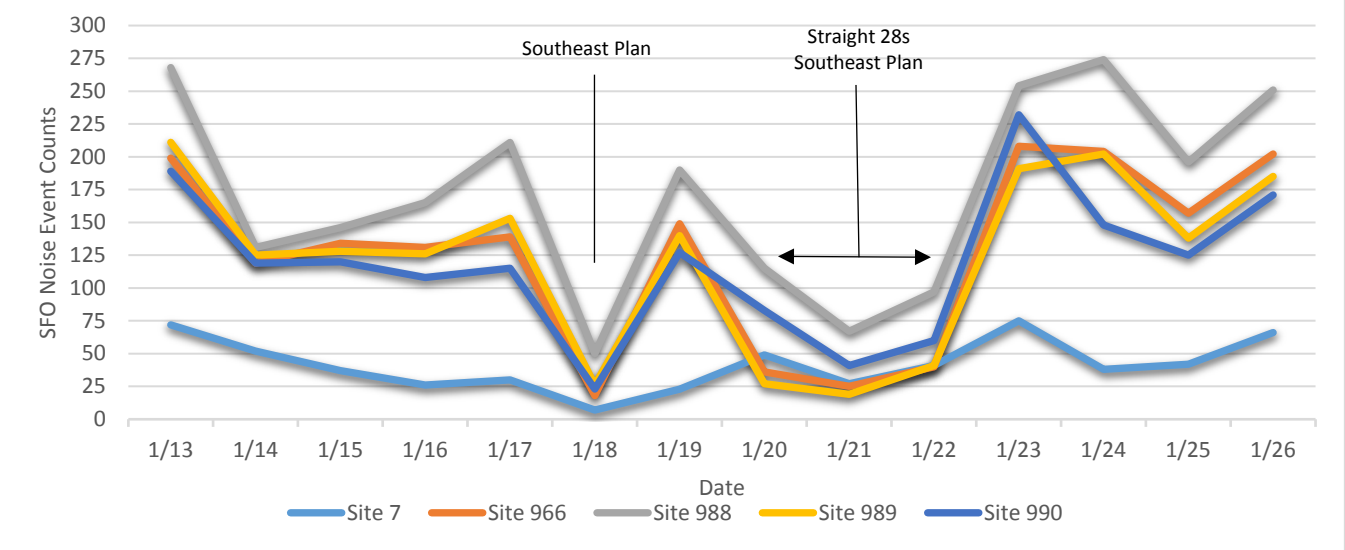


Table 4 – Average Lmax of SFO Aircraft by Date

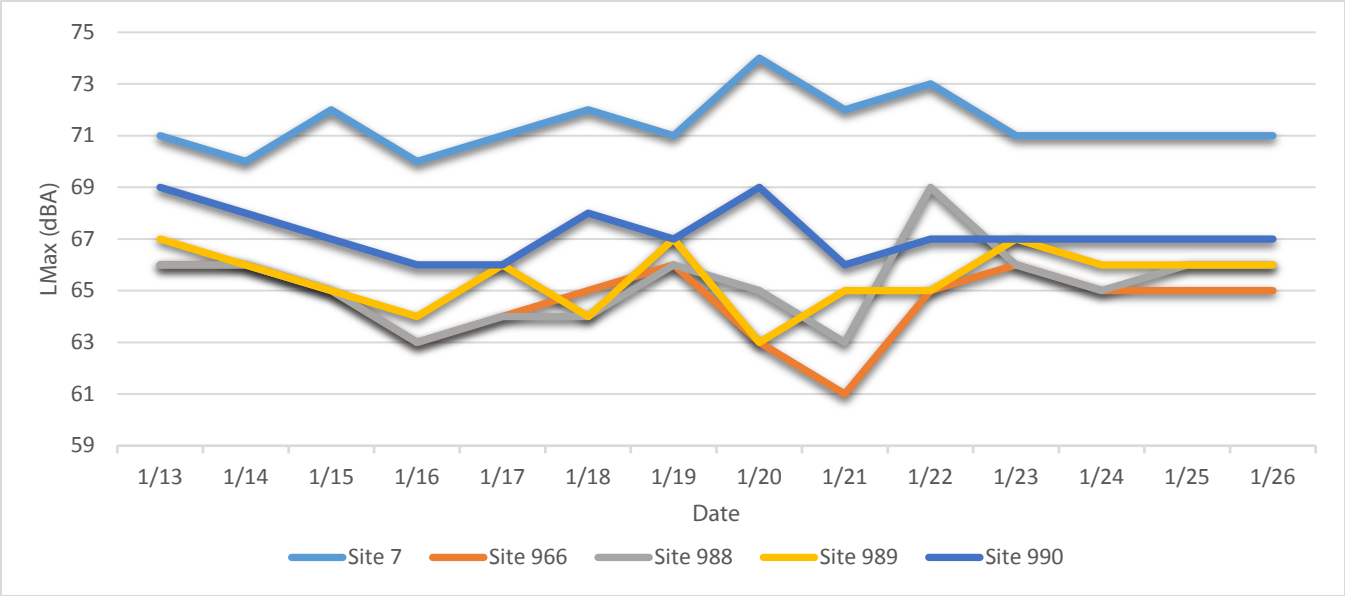
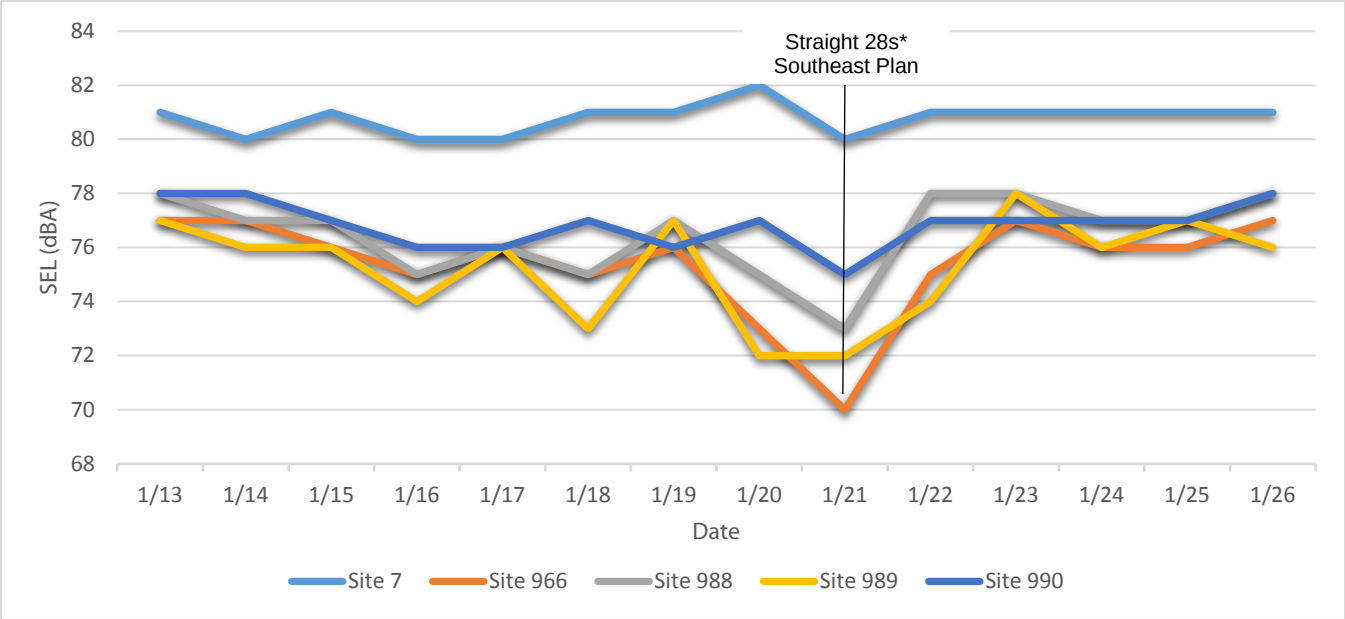


Table 5 – Average SEL of SFO Aircraft by Date



*Straight 28s – SFO arriving and departing traffic are utilizing Runways 28L/R only. Occurs when the winds are strong from the west or the crosswind component for departures from Runways 01L/R are exceeded or when OAK is operating in Southeast Plan, where their departing traffic is using Runway 12.

Table 6 shows a graphic comparison between the SEL of SFO Events and the SEL of Community Events. The SEL of SFO Events is the average value for all five monitoring locations. On January 20th, the community SEL peaked at 81 dBA. On further investigation it was found that this was caused by unsettled weather patterns. Weather reports showed wind throughout the day that varied considerably from calm to gusts as high as 49 Knots, thunder and a significant rain accumulation of ¾ inch over 1.5 hours in the late afternoon. The sounds of rain, wind and thunder collected by the monitors were grouped as Community Events. On January 23rd, the five monitoring sites averaged 192 SFO Events for the day in comparison with 54 Community Events for the same period, however aircraft were on average one decibel higher than community.

Table 6 – SEL Comparison of Daily Averages

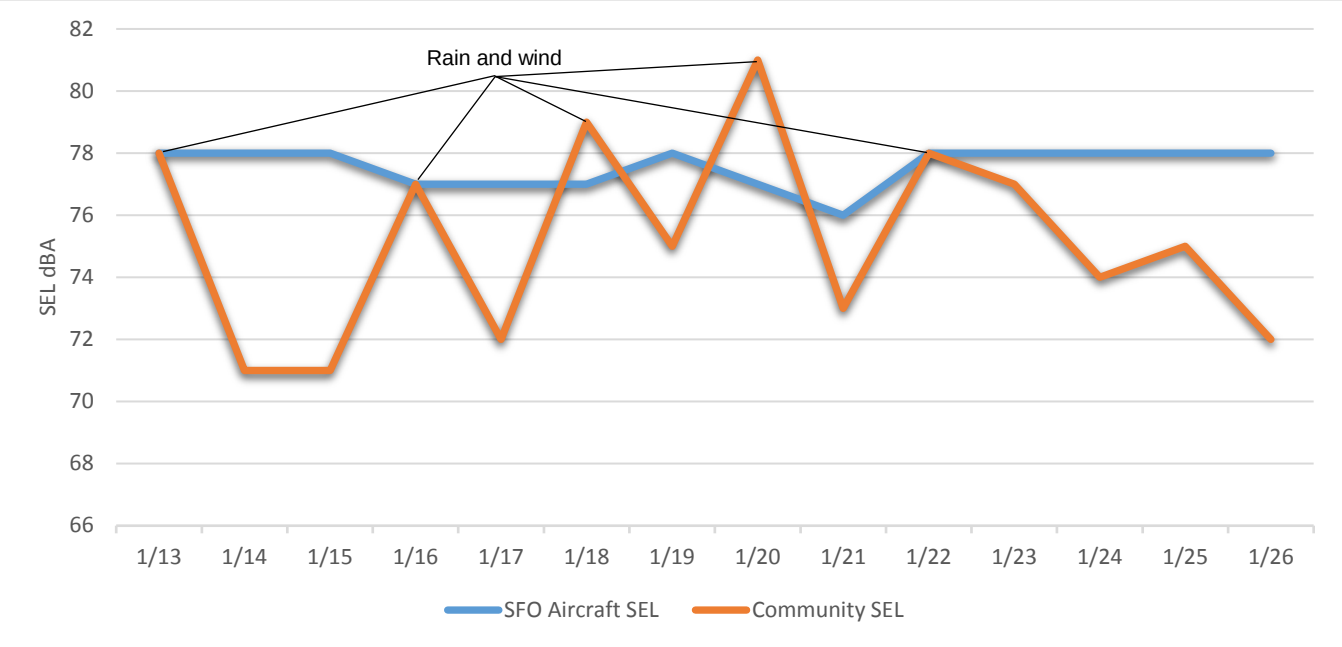
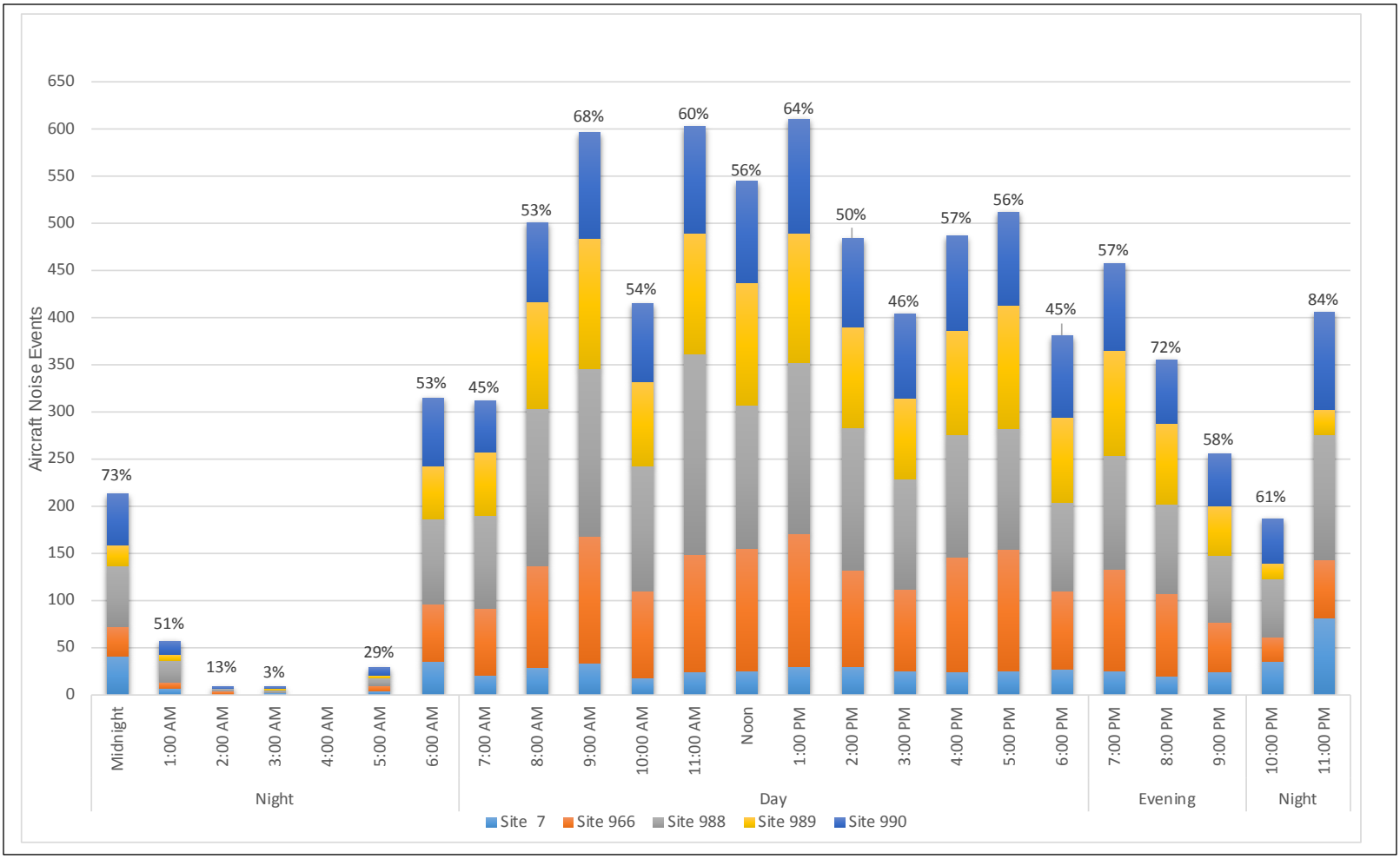


Table 7 – Total SFO Aircraft Noise Events by Hour of the Day



Note: The percent is the percentage of SFO aircraft noise events in that hour.

Table 8 – Total SFO Events by Daytime, Evening and Nighttime Hours

SFO Aircraft Noise Data (Single Noise Events)			Lowest (dBA)	Highest (dBA)	Average (dBA)
Day (7:00 a.m.- 7:00 p.m.)	5,847 Events (72%)	Lmax	55	84	67
		SEL	55	95	77
		Duration	1 sec.	120 sec.	31 sec.
Evening (7:00 p.m.- 10:00 p.m.)	1,067 Events (13%)	Lmax	55	78	67
		SEL	61	87	77
		Duration	5 sec.	72 sec.	31 sec.
Night (10:00 p.m.- 7:00 a.m.)	1,220 Events (15%)	Lmax	55	79	67
		SEL	62	89	77
		Duration	5 sec.	120 sec.	25 sec.

Table 9 below provides the resulting CNELs for this measurement period. The computed levels for the average **Aircraft CNEL** was 53dBA, the average **Community CNEL** was 56dBA, and the **Total CNEL** was 58dBA.

Table 9 – Community Noise Equivalent Level

Average Community Noise Equivalent Level (CNEL)	Lowest (dBA)	Highest (dBA)	Average (dBA)
Aircraft (All)	49	56	53
Community	53	62	56
Total	55	62	58

Aircraft Operations

All aircraft which flew within a cylindrical airspace, known as a Point of Closest Approach (PCA), centered on each measurement location four miles in diameter and 15,000 feet in height were evaluated during this measurement period. A daily average of 364 flights penetrated this airspace. Due to their close proximity the majority of sites experienced similar numbers in the number of PCA overflights; however, the greatest variation in the values would be between site 989 and site 7 as they were our furthest north and south monitoring locations respectively. Table 10 shows the daily ratio of overflights to noise events, along with the resulting aircraft noise climates for each monitoring site.

Table 10 – Aircraft Overflights versus Noise Events

Date	Monitor Location	Amount of PCA Overflights[3]	Amount of Aircraft Noise Events[4]	Aircraft CNEL (dBA)[5]	Range (dBA)		SFO Flow Pattern[8]
					Lmax[6]	SEL[7]	
01/13/2017 [1]							
	7	454	73	56	66-77	72-87	West
	966	486	252	54	55-73	61-83	West
	988	488	332	57	55-77	62-86	West
	989	485	269	54	56-84	64-89	West
	990	470	234	56	55-82	61-91	West
01/14/17							
	7	359	55	55	66-77	74-86	West
	966	363	149	51	55-72	62-82	West
	988	378	159	54	56-73	62-86	West
	989	354	145	50	57-72	64-83	West
	990	367	144	54	56-77	62-85	West
01/15/17							
	7	368	37	54	66-79	73-89	West
	966	397	161	49	55-71	61-82	West
	988	388	176	53	55-75	61-85	West
	989	394	149	49	56-72	64-82	West
	990	380	139	53	55-77	61-86	West
01/16/17							
	7	414	27	52	66-76	74-85	West
	966	461	152	50	55-71	61-86	West
	988	446	190	53	55-73	61-84	West
	989	463	139	49	56-79	64-83	West
	990	427	117	53	55-78	62-84	West

Table 10 – Aircraft Overflights versus Noise Events (cont.)

Date	Monitor Location	Amount of PCA Overflights[3]	Amount of Aircraft Noise Events[4]	Aircraft CNEL (dBA)[5]	Range (dBA)		SFO Flow Pattern[8]
					Lmax[6]	SEL[7]	
01/17/17							
	7	343	33	54	65-78	71-86	West
	966	387	152	50	56-73	62-83	West
	988	375	244	54	55-72	61-85	West
	989	383	171	51	56-81	64-88	West
	990	360	127	53	55-77	62-85	West
01/18/17							
	7	50	7	49	69-75	76-84	West & Southeast
	966	65	23	47	56-76	62-85	West & Southeast
	988	55	55	51	56-78	63-89	West & Southeast
	989	79	28	44	56-72	64-82	West & Southeast
	990	53	26	50	56-77	63-87	West & Southeast
01/19/17							
	7	326	23	46	65-76	72-86	West & Southeast
	966	358	191	49	55-74	61-84	West & Southeast
	988	347	232	51	55-74	62-85	West & Southeast
	989	362	168	50	56-74	64-85	West & Southeast
	990	334	160	48	55-78	61-85	West & Southeast
01/20/17							
	7	379	50	54	67-79	74-87	West & Southeast
	966	250	80	45	55-72	61-81	West & Southeast
	988	303	171	50	55-76	61-85	West & Southeast
	989	235	62	45	56-68	65-79	West & Southeast
	990	350	130	50	55-79	60-86	West & Southeast
01/21/17							
	7	236	29	52	66-78	72-86	West & Southeast
	966	156	53	45	55-70	61-79	West & Southeast
	988	200	92	50	56-70	62-80	West & Southeast
	989	152	40	45	55-73	63-79	West & Southeast
	990	219	64	49	55-75	60-84	West & Southeast
01/22/17							
	7	305	41	53	66-80	72-88	West & Southeast
	966	213	77	45	56-79	62-89	West & Southeast
	988	251	127	52	55-87	61-95	West & Southeast
	989	200	63	45	56-75	64-85	West & Southeast
	990	287	96	50	55-76	61-86	West & Southeast

Table 10 – Aircraft Overflights versus Noise Events (cont.)

Date	Monitor Location	Amount of PCA Overflights[3]	Amount of Aircraft Noise Events[4]	Aircraft CNEL (dBA)[5]	Range (dBA)		SFO Flow Pattern[8]
					Lmax[6]	SEL[7]	
01/23/17							
	7	517	75	58	65-76	73-86	West
	966	488	255	54	55-75	61-86	West
	988	529	285	57	55-77	61-86	West
	988	470	226	53	56-75	64-85	West
	990	526	267	57	55-78	61-86	West
01/24/17							
	7	422	39	52	65-77	73-86	West
	966	486	241	54	55-74	62-84	West
	988	465	308	56	55-76	55-90	West
	989	488	237	54	56-73	64-83	West
	990	443	179	54	56-78	62-86	West
01/25/17							
	7	446	43	54	65-77	73-86	West
	966	436	181	51	55-72	61-83	West
	988	448	226	54	55-80	61-87	West
	989	429	159	52	56-73	65-83	West
	990	446	147	53	55-75	60-84	West
01/26/2017 [2]							
	7	476	67	54	66-77	73-86	West
	966	503	254	52	55-74	61-84	West
	988	517	310	55	55-74	60-86	West
	989	495	221	51	56-75	64-84	West
	990	499	215	54	55-77	62-86	West
Daily Average		**364**	**141**	**53** [5]			

[1] 1/13/17 First Aircraft Noise Events for this survey were measured at:
Site 7 - 12:02 a.m.; Site 966 - 12:07 a.m.; Site 988 - 12:02 a.m.; Site 989 - 12:07 a.m.; Site 990 - 12:02 a.m.

[2] 1/26/17 Last Aircraft Noise Events for this survey were measured at:
Site 7 - 11:46 p.m.; Site 966 - 11:47 p.m.; Site 988 - 11:47 p.m.; Site 989 - 11:32 p.m.; Site 990 - 11:46 p.m.

[3] The Amount of PCA Overflights through a defined cylindrical airspace for a 24-hour period starting at midnight to 11:59:59 p.m. The cylindrical airspace was four miles in diameter and 15,000 feet in elevation, centered on each monitor location.

[4] Aircraft Noise Events include all SFO Aircraft, Multiple SFO Aircraft, Non-SFO Aircraft, and Simultaneous SFO & Non-SFO Aircraft.

[5] This value is an energy average.

[6] Lmax - The maximum noise level is a measurement of the peak level of a noise event.

[7] SEL - Sound Exposure Level of a noise event is measured over time between the initial and final points when the noise level exceeds a predetermined threshold and it's energy is compressed into one second.

[8] Flow Pattern is the general flight pattern used by arriving and departing aircraft based on wind speed and direction.

See Appendices 1 and 2 for San Francisco Bay Area Major Jet Arrival and Departure patterns: West Flow Plan and Southeast Flow Plan.

Table 11 – Aircraft Overflights versus Noise Events by Site

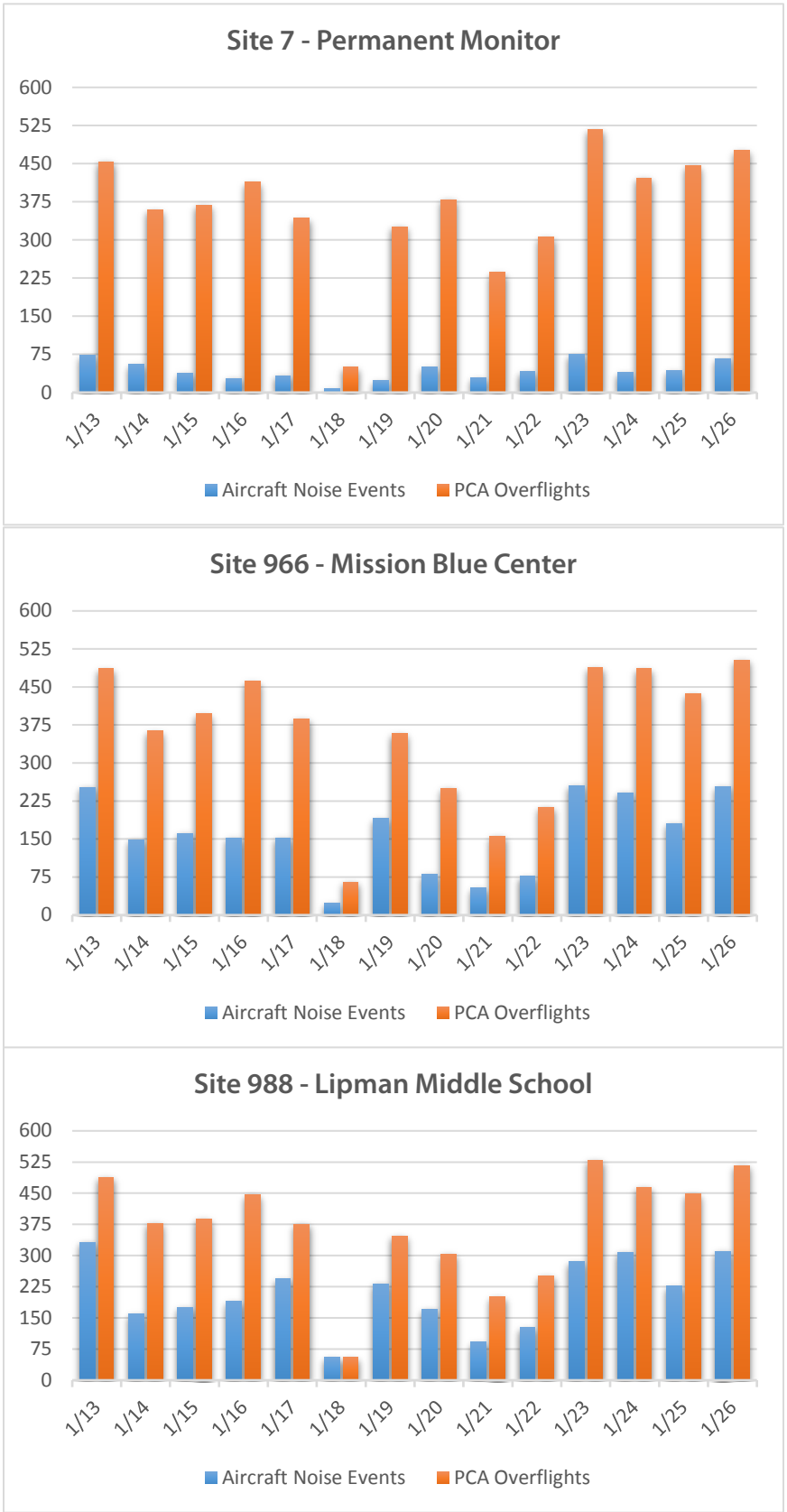


Table 11 – Aircraft Overflights versus Noise Events by Site (cont.)

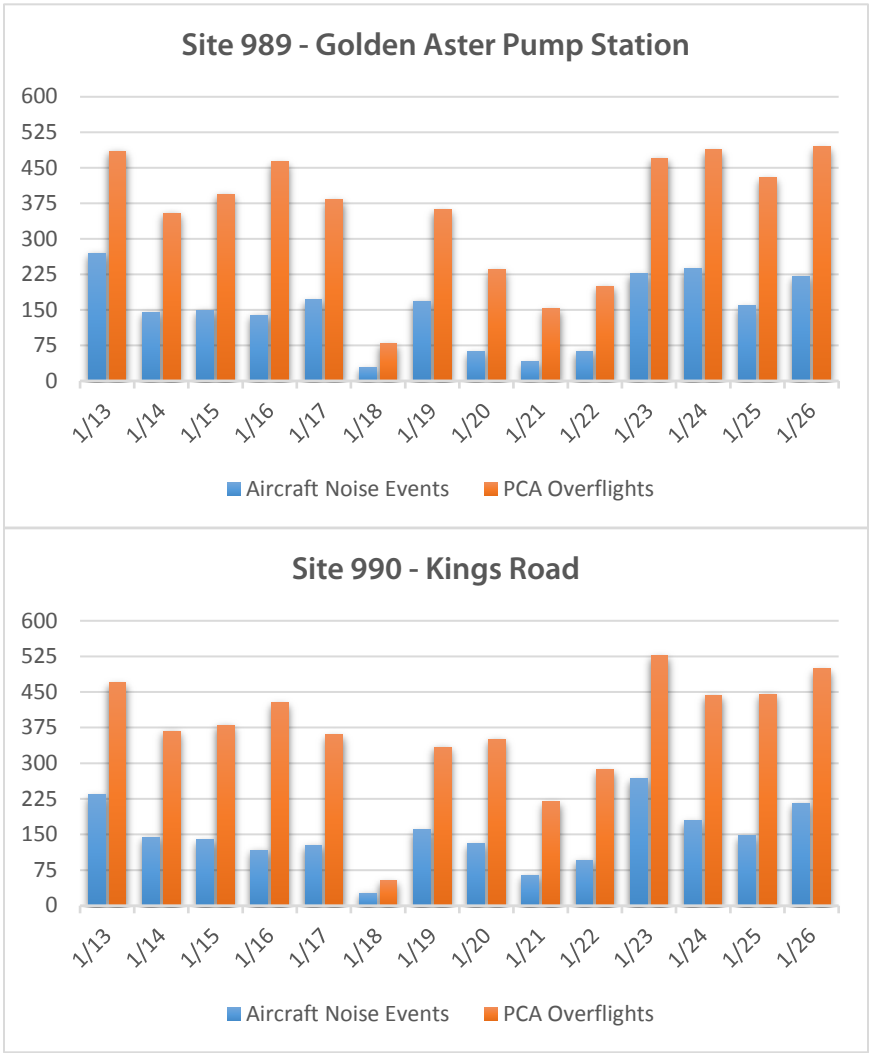
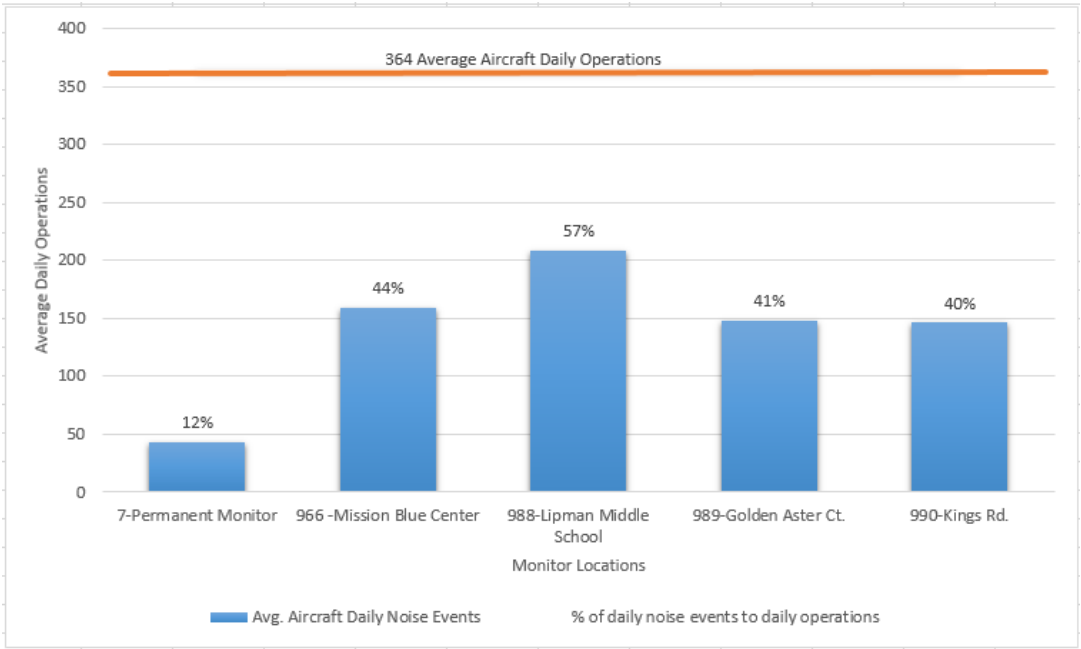
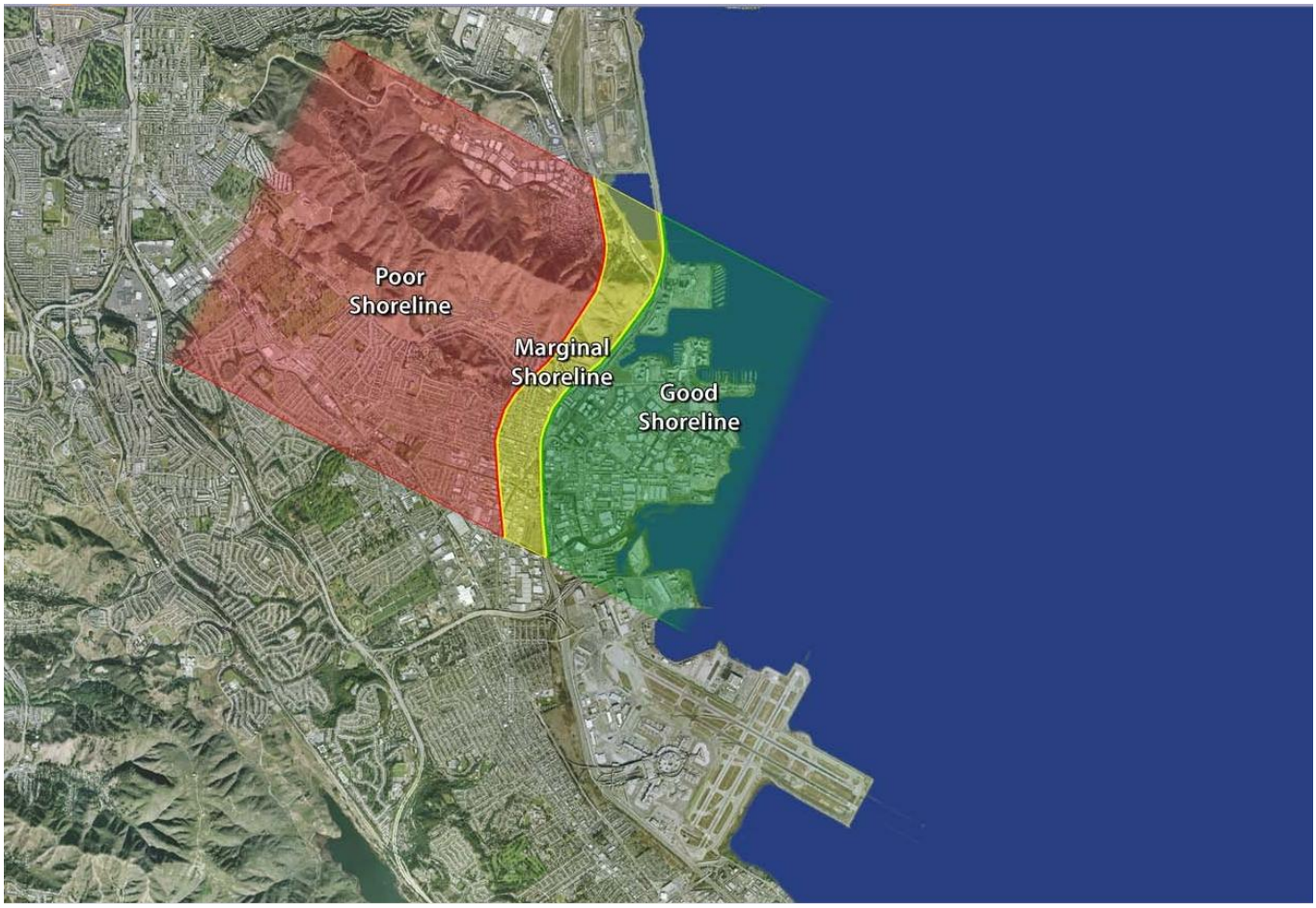


Table 12 – Daily Average of All Aircraft Operations versus Aircraft Noise Events



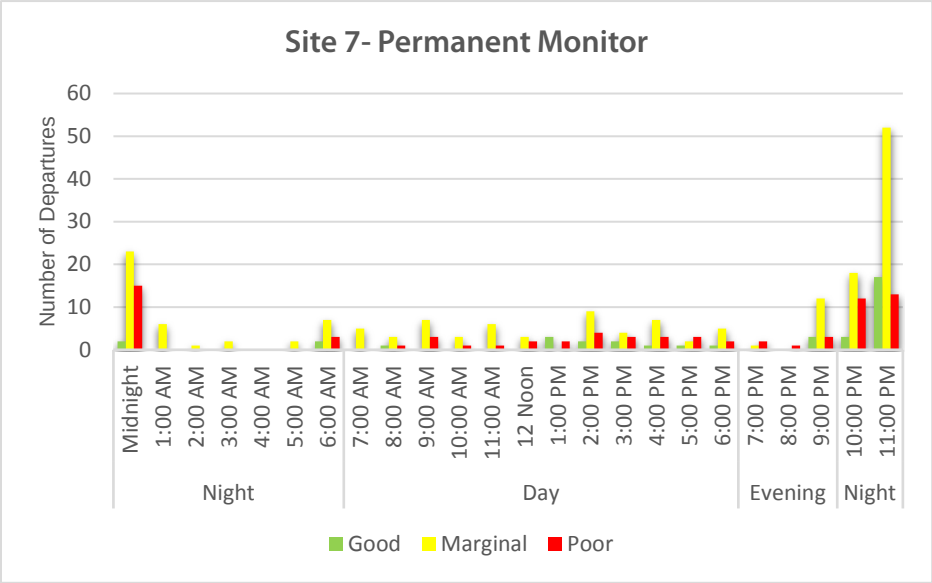
Runway 28L/R Departure Procedure Impact on Brisbane

Aircraft departing from Runways 28L/R that are assigned the TRUKN RNAV Departure (formerly the SHORELINE Departure) or the NIITE RNAV Departure perform a right turn after reaching a minimum altitude of 520 feet. As the aircraft performs the right turn that is called for within the procedure, the aircraft is graded on how well it performs the turn. The results are published quarterly within the Fly Quiet Report under the Shoreline Departure Rating. These departures are graded under three categories: 1) good – aircraft was able to remain east of Highway 101 throughout the turn 2) marginal – aircraft flew partly over Highway 101 3) poor – aircraft flew west of Highway 101 during the turn. The image below depicts the location of the three categories.



In Table 13, each graph represents the amount of Shoreline Departures that registered a noise event and the Fly Quiet grade that would be given at each site broken down by hour. Sites 966 and 989 did not capture the Shoreline Departure noise as much as did Sites 7, 988 and 990. It should be noted that the peaks in the number of departures in the 11:00 p.m. and midnight hours were caused by the combination of weather and late night easterly departures during this monitoring period. Typically, these flights are able to use the NIITE Departure procedure from Runways 01L and 01R proceeding up the bay and away from Brisbane.

Table 13 – Shoreline Departures by Hour and Fly Quiet Grade



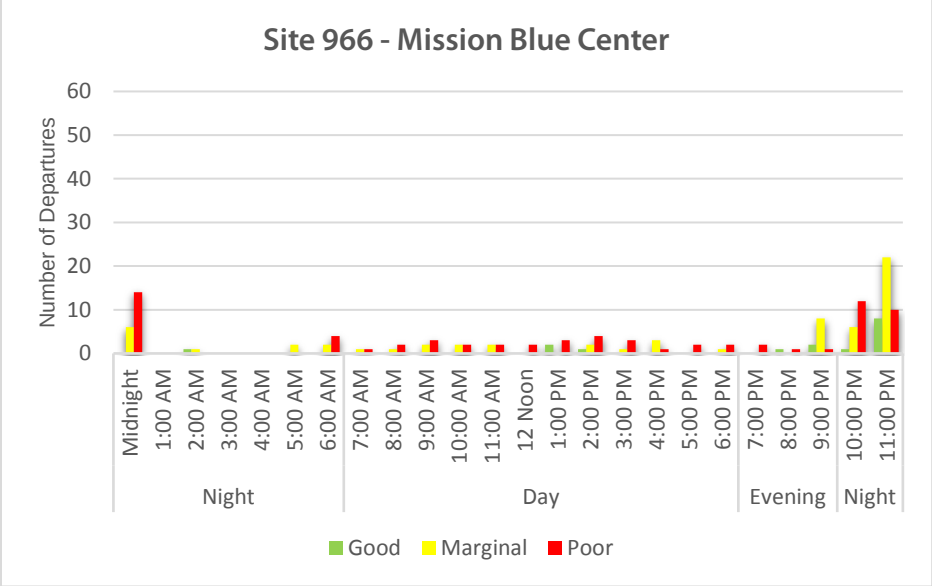
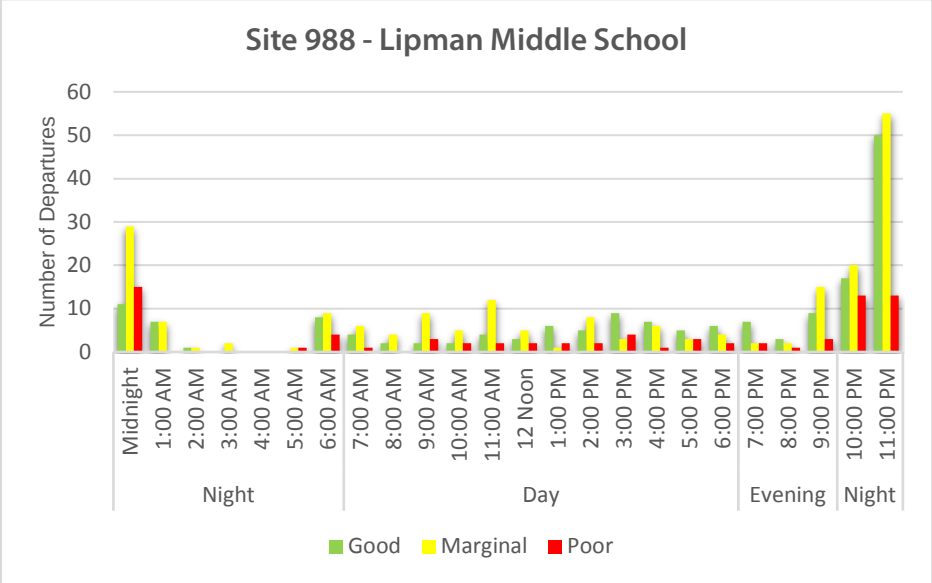
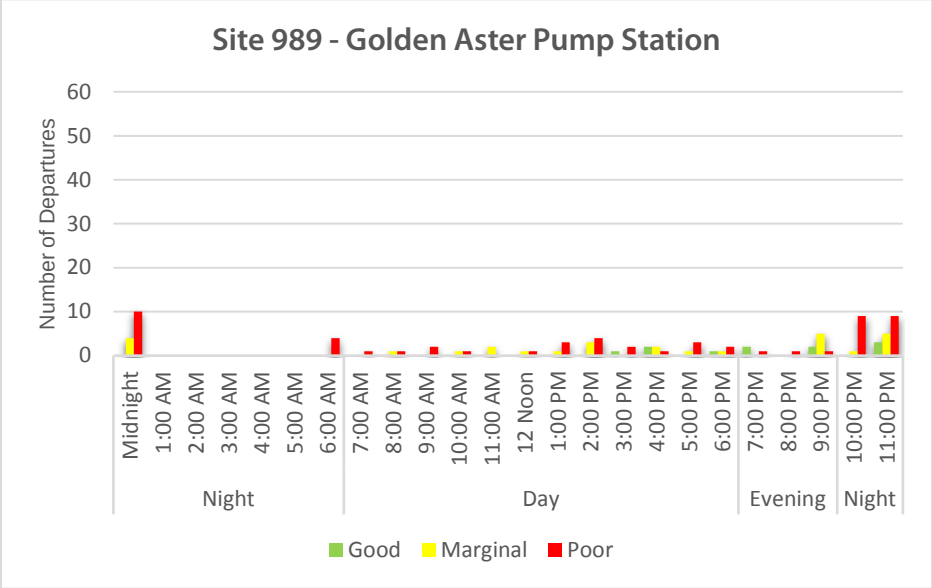
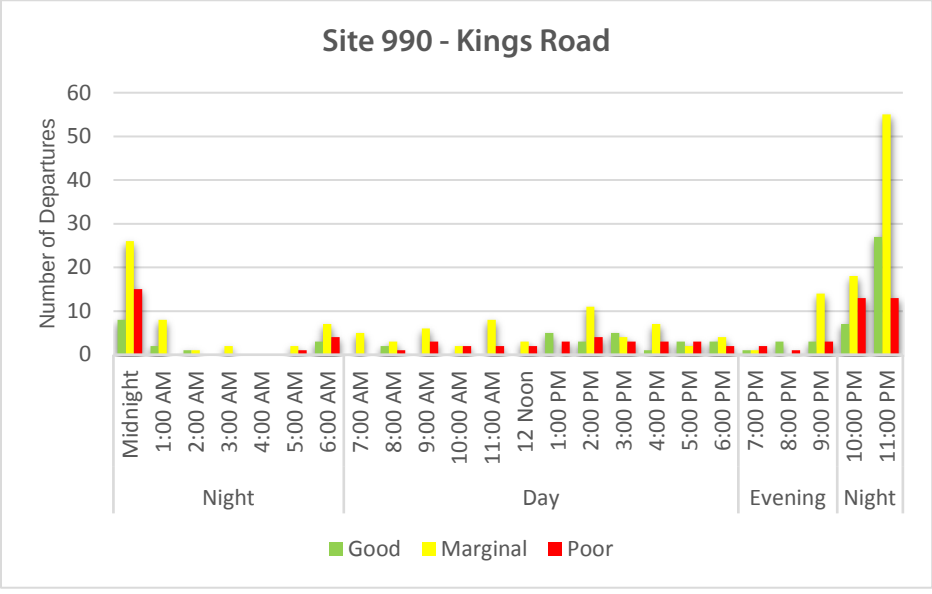


Table 13 – Shoreline Departures by Hour and Fly Quiet Grade (cont.)







Of concern to Brisbane residents during nighttime is the NIITE Departure procedure (formerly known as "Shoreline"). In addition to NIITE the TRUKN Departure procedure is typically used during daytime to route the traffic to the east from Runways 28L/R. Both procedures are virtually identical in their initial turn and how they impact Brisbane. The NIITE Departure procedure is used during the nighttime hours (10:00 p.m. – 7:00 a.m.) in order to reduce aircraft noise over the peninsula and maximize over water use. Instead of departing straight out Runway 28L/R aircraft will turn right, clip the south part of Brisbane and continue their flight north over the middle portion of the bay (see NIITE designation on the map). Almost all aircraft which flew the NIITE procedure registered noise events. During the noise monitoring period there were on average 45 departures each night using these procedures. During the 2010 and 2015 noise monitoring period average was 4 and 10, respectively. The increase of flights occurred primarily between 10:00 p.m. and Midnight (Table 15).

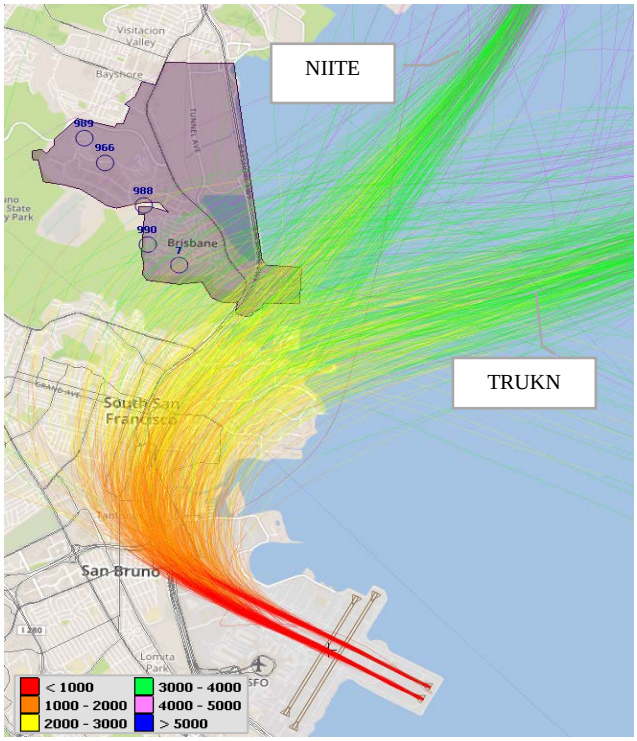
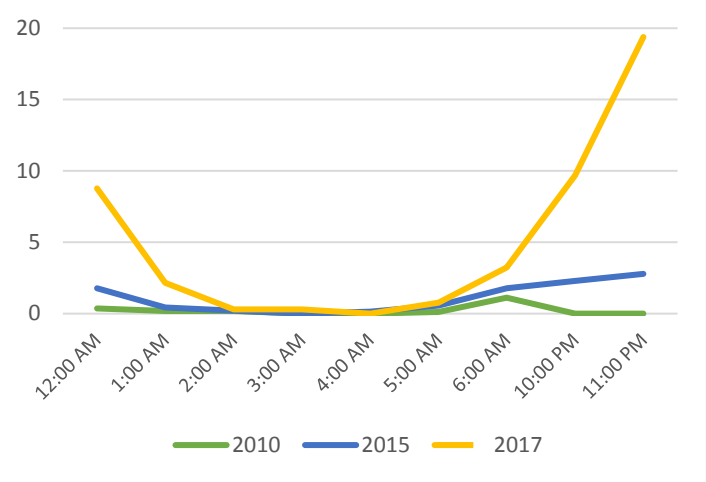


Table 14 – Shoreline Departures

1/13-1/26*	NIITE/TRUKN
7 a.m. – 7 p.m.	**300**
AVG	23
7 p.m. – 10 p.m.	**91**
AVG	7
10 p.m. – 7 a.m.	**580**
AVG	45

*No flights on 1/19, due to Oakland operating in Southeast Plan while SFO was operating in West Plan.

Table 15 – All Nighttime "Shoreline" Departures Hourly Average during each noise monitoring period



Although a daily average of 364 flights penetrated the airspace above Brisbane, 2,806 flights were identified to have registered at least one noise event at one of the noise monitor site during this measurement period. SFO operations represented 79% of this air traffic, followed by OAK (17%), then general aviation (4%) and San Jose International Airport (1%). Departure operations represented 90% of these flights, while Arrival operations accounted for 9%, and Overflights only 1%. The top four aircraft types were the Boeing 737 – Next Gen Family (35%), the Airbus A320 Family (28%), the Embraer E-jets Family (12%) and the Bombardier CRJ Family (7%). Please reference Appendix 4 - Aircraft Type Reference Sheet

Table 16 – Aircraft Operations

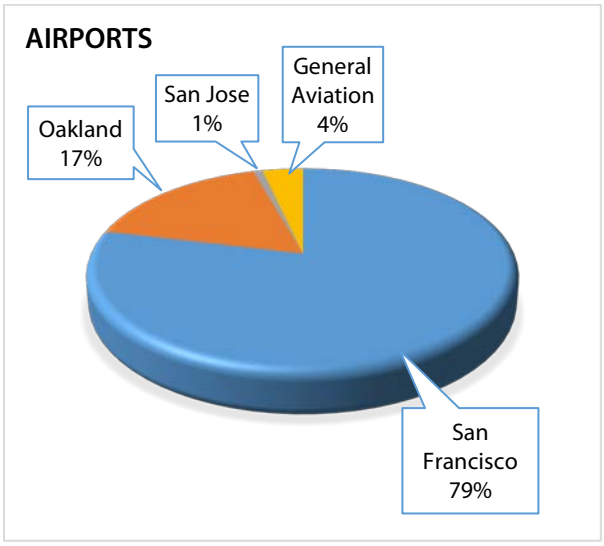


Table 17 – Aircraft Operations

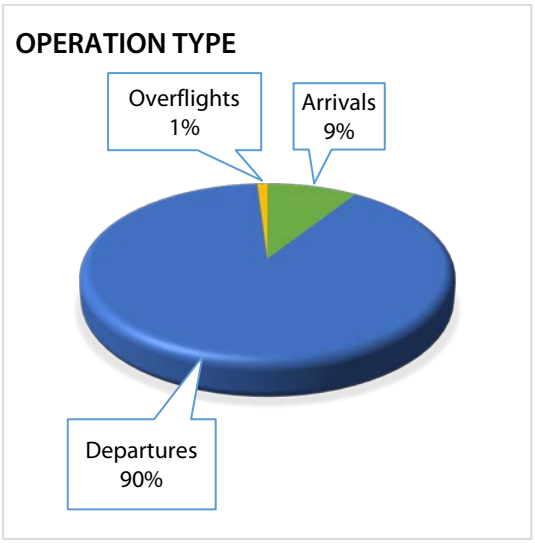
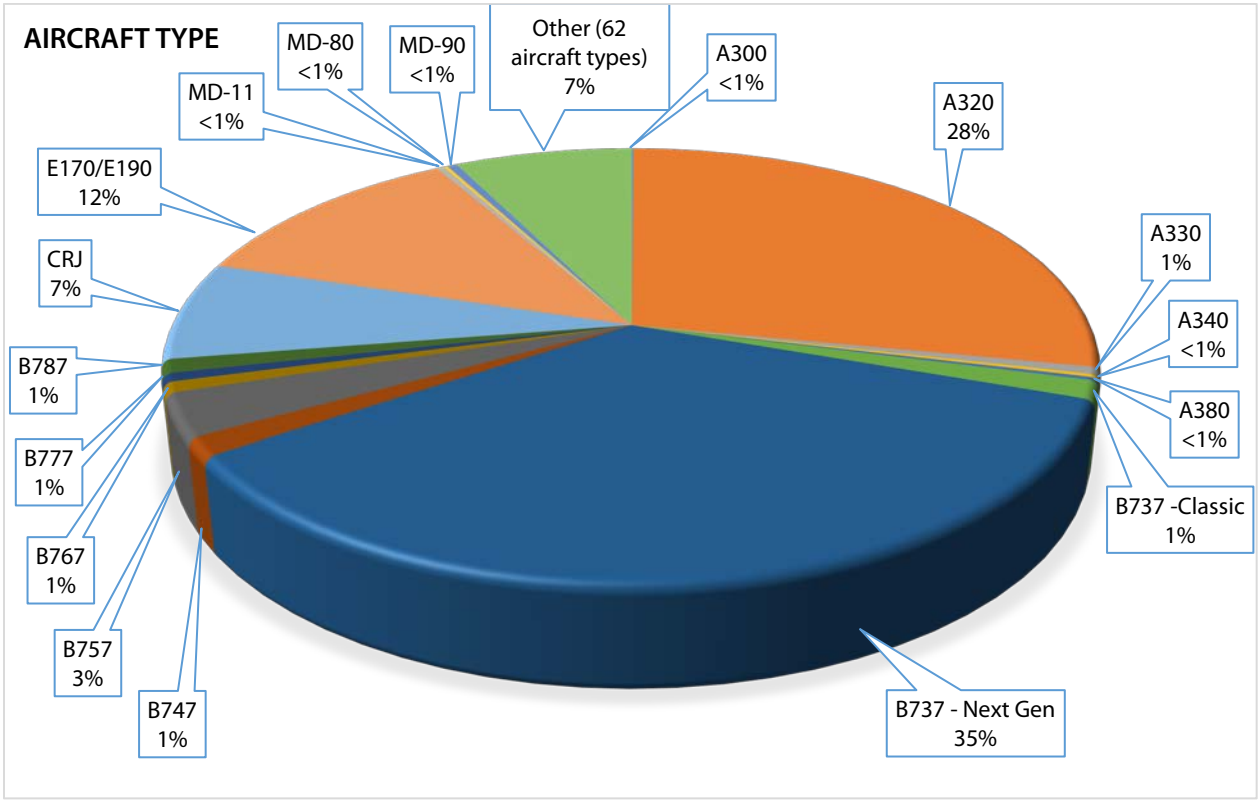
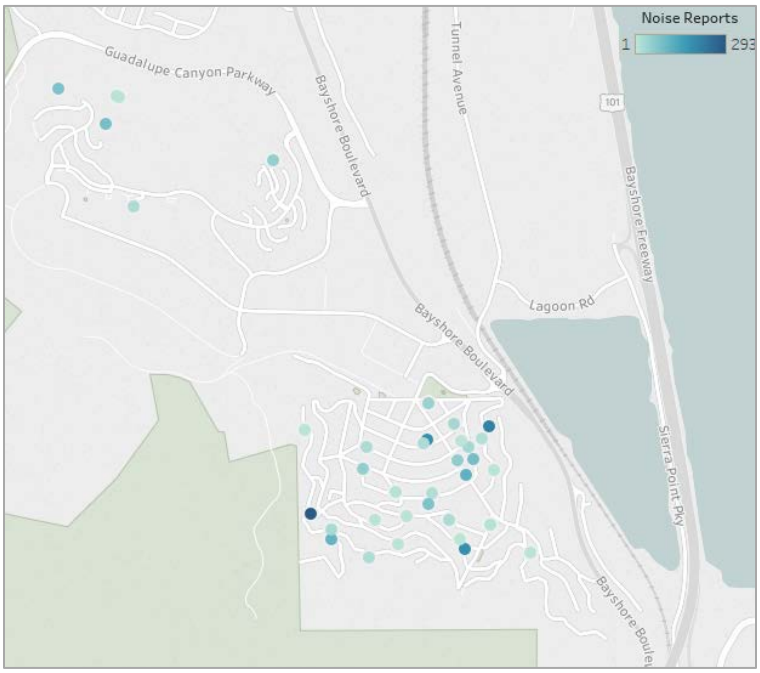


Table 18 – Aircraft Operations



Noise Reporters

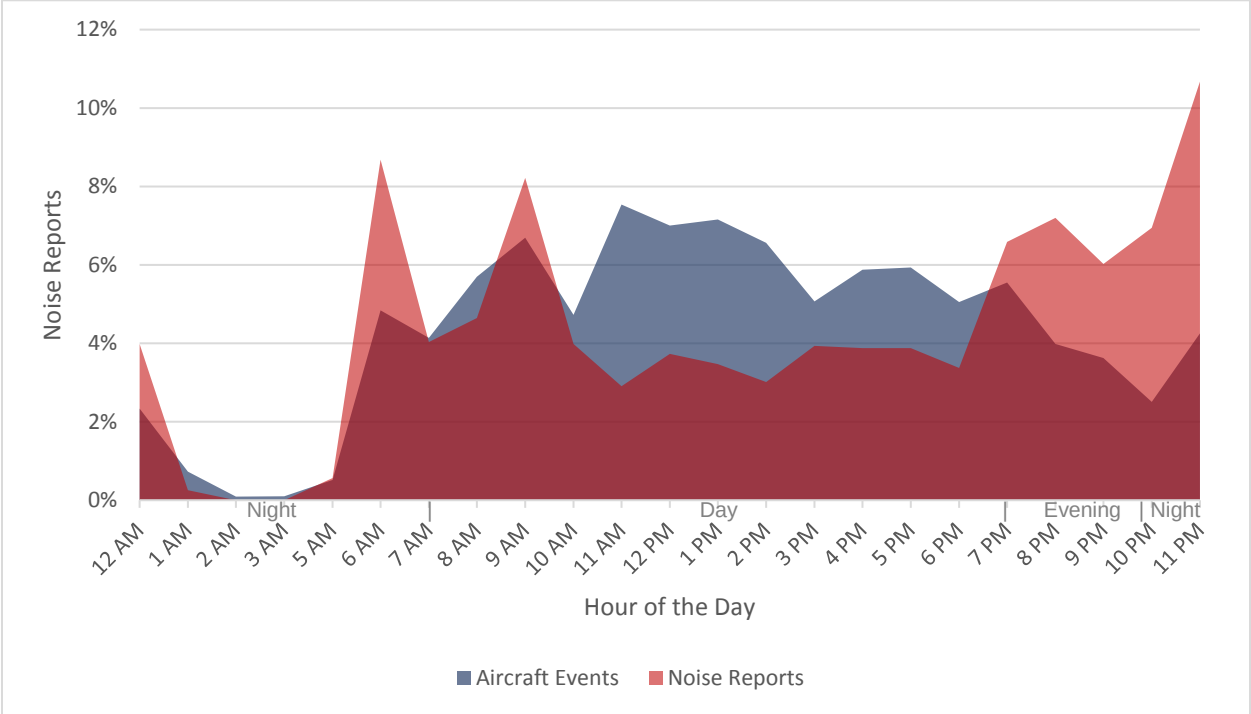
All noise reports received during the aircraft noise monitoring period were reviewed and correlated to aircraft noise events. Correlations are done using the Airport Noise Monitoring and Management System. Based on the reporters provided home address latitude and longitude, the system will look for flights within a 2-mile radius. The system will then assign a correlation ID to the noise report and any flight that matches closely to the disturbance time provided by the reporter. In summary, the correlations are done based on a disturbance time and location given by the reporter, and matched to the nearest flight at that time/location.



There were 1,958 noise reports from 38 noise reporters residing primarily in the southern portion of Brisbane (closest to the airport). Nighttime reports between 10:00 p.m. and 7:00 a.m. account for 31% of all submitted noise reports.

Table 19 depicts percentage of aircraft noise events and noise reports by hour of the day. During the evening hours there is a noticeable spike of noise reports disproportionate with aircraft noise events. All things considered, it seems reasonable to assume that the evening, night and early morning hours are most disturbing to noise reporters due to lower ambient noise levels and higher disturbance levels because of sleep.

Table 19 – Noise Reporters versus Aircraft Events



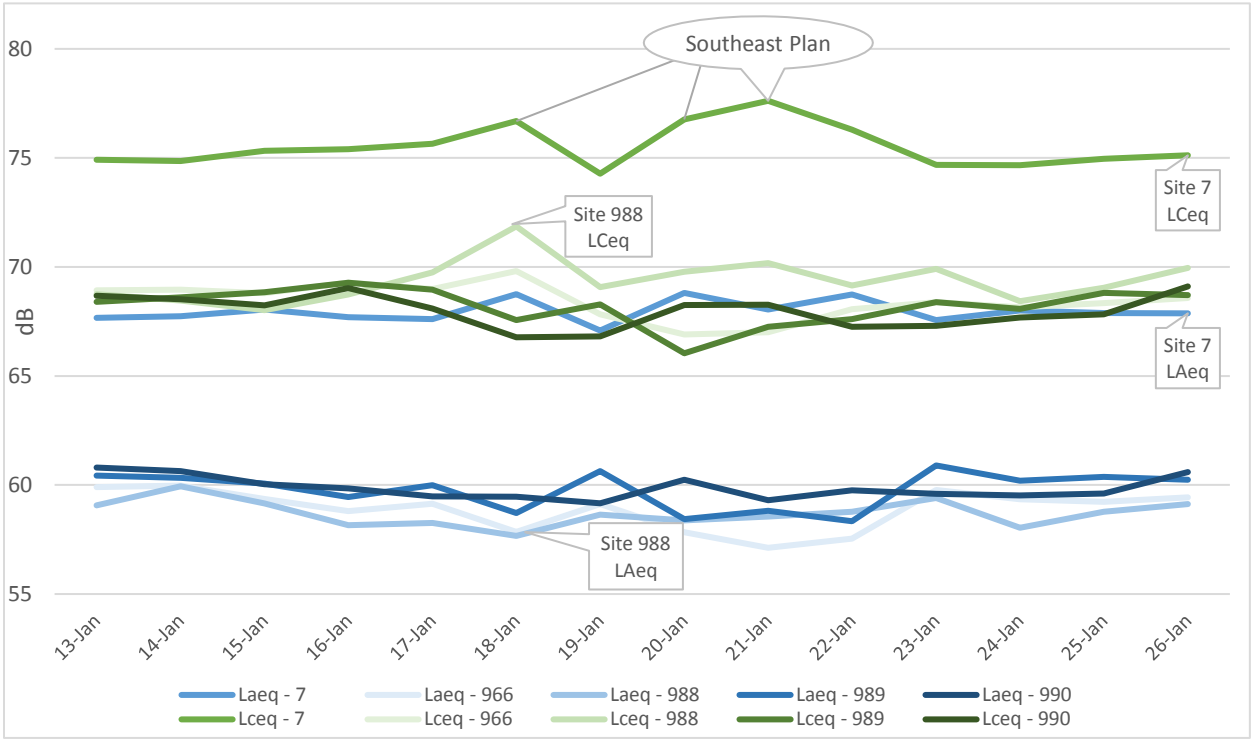
Low Frequency Noise Levels

In addition to A-weighted frequency, the Aircraft Noise Abatement office measured C-weighted frequency at the request of the City of Brisbane to determine impact of aircraft back-blast noise in Brisbane. Living close to the runway ends (Site 7 is located just 4 miles northwest of SFO) one may be impacted by back-blast noise under a certain set of conditions. These conditions are primarily when aircraft are departing Runway 10L/R, which occurs when SFO operates on a Southeast Plan (5% of the year) or during Nighttime Preferential Runway use; about half a dozen flights each night between midnight and 6:00 a.m. Although San Bruno Mountain is between the Airport and Brisbane, the Wyle Acoustics Group's "Status of Low-Frequency Aircraft Noise Research and Mitigation" report from August 15, 2001 explains that the low-frequency noise radiated by a jet engine is concentrated in a cone at about 45 degrees to the rear axis of the aircraft. Other factors such as wind, and temperature also impact sound propagation. During the noise monitoring period SFO operated on a Southeast Plan on January 18th, 20th, 21st. There is a slight increase in the C-weighted frequency on those days especially at Site 7 and 988.

The Wyle Acoustics Group study conducted at SFO in 2001 suggests that C-weighting is preferred over A-weighting to describe back-blast noise. Noise measurements from aircraft overflights typically use A-weighted decibels that measure sound levels in the mid to high frequencies. In the event of low frequency noise (airplane take-off, engine run-up) the duration and spectral content of the event is different from that of an aircraft overflight. The reduction of noise from air and ground absorption is small (Wyle, 2001). The same study also suggests that removing aircraft with LBPR (low bypass ratio engines) would be a mitigation measure to consider. Noise radiated to the rear of the aircraft is reduced significantly in the HBPR (high bypass ratio engines) installed on Stage 3 aircraft or greater. Consequently, SFO has phased out Stage 2 aircraft (Appendix 4).

During the monitoring period aircraft departing Runway 10 L/R created noise events at Site 988 (32) and 966, 989 (5 each). Site 988 had the majority of the events on the 18th (Southeast Plan). Others were during the Nighttime Preferential Runway Use hours. In consideration of the close proximity of Brisbane to SFO and its geographic location, we conclude that the back-blast noise does not significantly impact Brisbane residents.

Table 20 – A (LAeq) and C (LCeq) comparison of weighted equivalent sound pressure level (dB)



*LEQ describes sound levels that vary over time, resulting in a single decibel value which takes into account the entire energy of the aircraft noise event. The above graph allows comparison between A and C – weighted frequency.

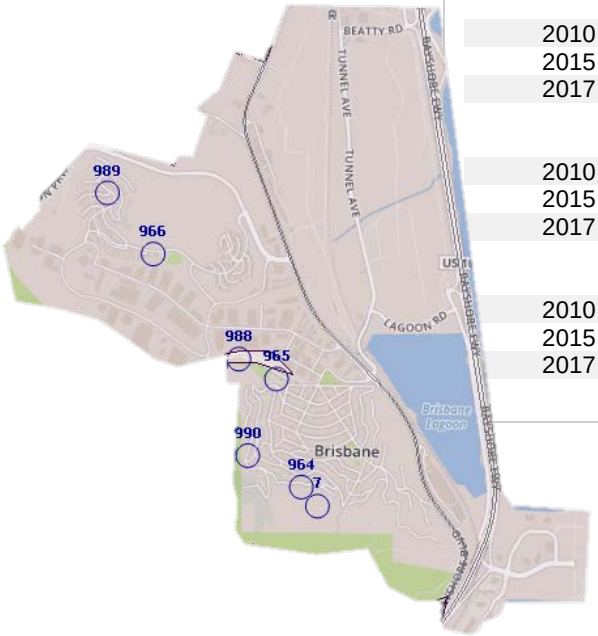
Noise Monitor Site Comparison

Table to the right shows the results of each monitoring period and noise sites in Brisbane. Site 7 is located permanently in Brisbane, while all others were done using portable monitoring units. Site 7 and 966 allows comparison for all three monitoring periods.

It is important to point out that aircraft noise event counts detected by the monitor are dependent on the pre-set threshold. As the portable noise monitor thresholds were set to a very low 55dBA in the 2015 and 2017 monitoring periods the Community levels and Aircraft levels are very close to each other and begin to merge into one another becoming extremely difficult to discern one from the other.

Table 21 – Noise Monitor Site Comparison (Daily Averages)

Site Number	7	964	965	966	988	989	990
Monitor Threshold (dBA)	65	64	64	62/64 – 2010 55 – 2015, 2017	55	55	55
Aircraft – CNEL							
2010	50		50	46			50
2015	49			52			
2017	54			51	54	50	53
Community CNEL							
2010	57		56	53			54
2015	61			53			
2017	59			53	57	55	55
Total CNEL							
2010	58		57	54			55
2015	61			56			
2017	60			55	59	56	57
Aircraft Noise Events AVG							
2010	46	51	58	36			
2015	25			140			
2017	43			157	214	148	145
SEL (dBA)							
2010	79	78	78	77			
2015	79						
2017	80			72	73	74	73
Lmax (dBA)							
2010	69	69	68	67			
2015	70			64			
2017	70			62	62	64	63
Duration (Sec)							
2010	17	16	17	14			
2015	14			30			
2017	16			28	35	28	26
Night SFO Events							
2010							
2015				14			
2017	16			14	27	10	23
Altitude (feet)							
2010	3,654	3,785	4,098	4,493			
2015	3,612			4,525			
2017	3,798			5,129	4,775	5,681	4,612



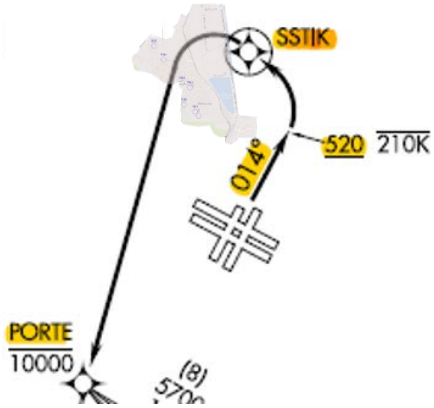
Site 7- Kings Road
Site 964 - Kings Road
Site 965 - Solana Ave
Site 966 - Mission Blue
Site 988 - Lipman Middle School
Site 989 - Golden Aster Pump Station
Site 990 - Kings Road

Aircraft Noise Measurement Periods:
2010 noise measurement: 10/28/2010 – 11/18/2010
2015 noise measurement: 4/29/2015 – 5/13/2015
2017 noise measurement: 1/13/2017 – 1/26/2017

SFO Runway 01L/R Departures – SSTIK Procedure

SFO Runway 01L/R departing aircraft that overfly Brisbane typically use the SSTIK Instrument Departure Procedure (SID). This departure route has been in place for several years (see Appendix 3 for the current procedure map) and is designed to assist in meeting air traffic capacity needs and provide obstacle clearance. SSTIK SID uses area navigation (RNAV) which increases flight accuracy.

The City of Brisbane is located inside the terminal airspace of San Francisco International Airport (see image on the right for Brisbane location compared to SSTIK procedure). Furthermore, San Francisco Bay Area airspace is very complex, with traffic from several major airports, smaller regional airports and military activity. All arrival and departure procedures within the airspace are interconnected, interdependent and were designed to improve safety and efficiency. Having said this, the Federal Aviation Administration Air Traffic Controller's primary responsibility is the safe and expeditious flow of aircraft. This is important to mention, as it relates to departure procedures in great detail. These procedures are designed to expedite aircraft through the terminal area. This also explains why not all aircraft continue all the way to PORTE. If there is a more efficient way to clear traffic outside the Bay Area air traffic control will do so.



As departing aircraft are in a left climbing turn over Brisbane, the ground path of each aircraft varies for several reasons; aircraft type and performance, weather (wind), speed, angle of bank, pilot or autopilot use and other aircraft traffic, etc.

In addition to SSTIK procedure, there is the OFFSHORE Departure procedure that uses a radio navigation aid (VOR) as a primary navigational tool. The OFFSHORE procedure has been largely reduced because the SSTIK SID uses new RNAV technology to guide aircraft on the procedure. Regardless of which procedure is used both waypoints off the coast of Brisbane are less than half a mile apart.

SSTIK Procedure

Does use of more SSTIK procedure reduce noise in Brisbane?

Aircraft departures off Runway 01L, which flew within one-fourth of a mile of SSTIK (Table 22), were evaluated for this measurement period. The daily average of 01L departures that flew within one-fourth of a mile of SSTIK was 44%, compared to 40% from the 2016 Brisbane Report (page 2, bottom table). An average of 65% of those operations registered a noise event at the noise monitor.

Data collected at Site 966 In 2015 was evaluated similarly on the SSTIK. The table below compares daily averages for both measurement periods.

Noise Monitoring Period Site 966	01L Departures	SSTIK	% of 1L Departure	Noise Events	%	SEL (dBA)	Lmax (dBA)	Duration	Altitude (ft.)
2015	145	57	40	37	64	75	65	32	4,951
2017	180	79	44	61	77	76	64	31	5,480

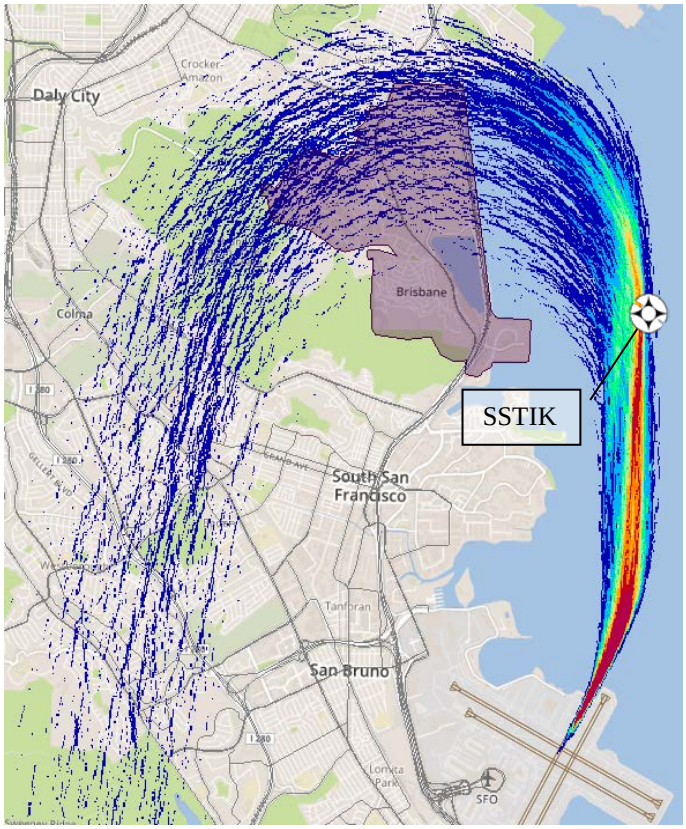
Table 22 – SSTIK Flights that created a Noise Event

Date	Flight Operations			SSTIK Noise Events						
	01L/R Departure	SSTIK (0.25 mi)	% of 01L/R Departure	Site	Count	Flight (%)	SEL (dBA)	Lmax (dBA)	Duration (Seconds)	Altitude (ft.)
1-13	193	67	35%	7	2	3%	77	67	13	4,455
				966	64	96%	76	64	31	5,293
				988	77	115%	74	63	31	5,096
				989	60	90%	77	67	32	5,295
				990	41	61%	74	66	24	5,025
1-14	140	52	37%	7	-	-	-	-	-	-
				966	33	63%	76	65	31	5,383
				988	29	56%	75	63	27	5,158
				989	41	79%	76	66	28	5,448
				990	21	40%	73	67	23	5,296
1-15	167	83	50%	7	-	-	-	-	-	-
				966	52	63%	76	64	32	5,556
				988	52	63%	74	62	27	5,375
				989	58	70%	76	65	30	5,585
				990	36	43%	73	64	22	5,526
1-16	208	90	43%	7	-	-	-	-	-	-
				966	49	54%	75	63	25	5,300
				988	52	58%	72	60	24	4,914
				989	46	51%	75	65	24	5,362
				990	17	19%	72	62	21	4,912
1-17	193	105	54%	7	1	1%	71	65	6	2,044
				966	68	65%	75	64	31	5,351
				988	99	94%	75	63	41	5,429
				989	82	78%	77	67	27	5,459
				990	40	38%	73	63	25	5,401
1-19	146	81	55%	7	2	2%	77	69	11	5,671
				966	74	91%	76	65	36	5,458
				988	97	120%	77	65	44	5,660
				989	73	90%	77	67	36	5,617
				990	62	77%	75	66	29	5,940
1-23	169	86	51%	7	1	1%	85	74	28	3,930
				966	80	93%	78	66	39	5,416
				988	89	103%	76	65	36	5,422
				989	82	95%	78	68	34	5,410
				990	70	81%	75	65	29	5,362
1-24	212	99	47%	7	1	1%	78	72	7	2,801
				966	82	83%	75	63	31	5,695
				988	118	119%	75	62	37	5,276
				989	84	85%	76	66	30	5,813
				990	42	42%	73	62	23	5,538
1-25	154	57	37%	7	-	-	-	-	-	-
				966	50	88%	74	64	28	5,703
				988	53	93%	76	66	35	5,341
				989	48	84%	76	66	29	5,884
				990	26	46%	71	62	18	5,660
1-26	214	72	34%	7	2	3%	78	72	9	3,636
				966	54	75%	75	64	32	5,647
				988	65	90%	76	64	46	5,428
				989	54	75%	76	65	31	5,549
				990	32	44%	74	63	28	5,662
Daily AVG	**180**	**79**	**44%**			**65%**	**75**	**65**	**28**	**5,221**

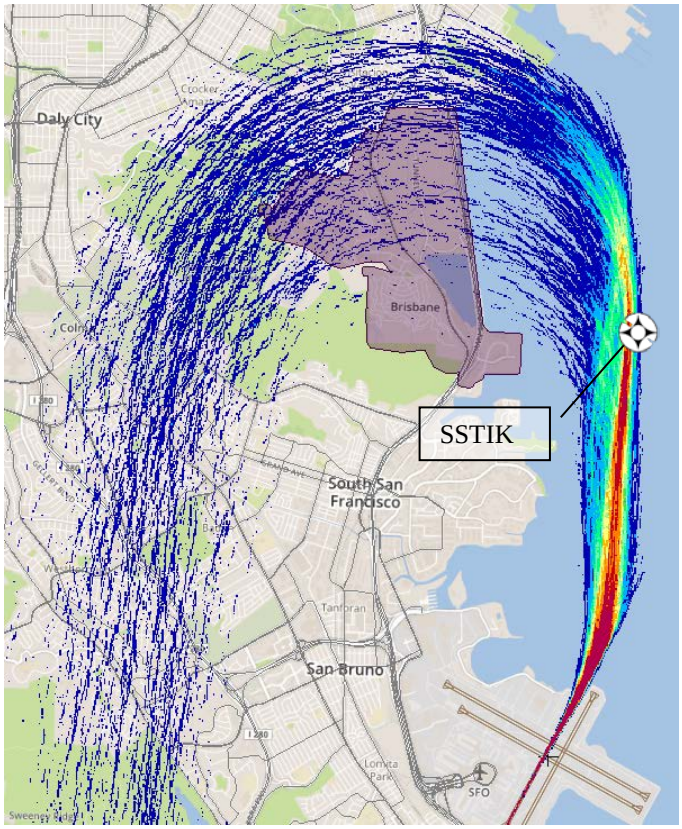
January 18, 20-22 did not have any 01L/R departures therefore no SSTIK overflights.

SSTIK Instrument Departure Procedure (SID) Track Density comparing flights during the 2015 and 2017 noise-monitoring period.

2015



2017

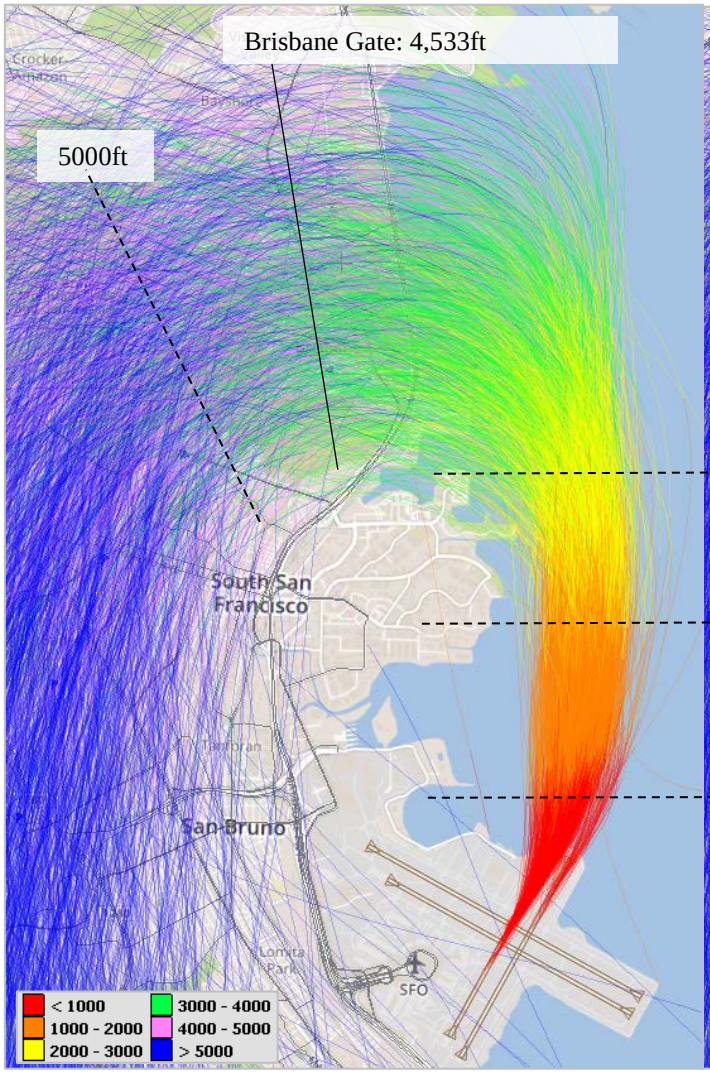


A track density plot is a grid, displayed over the map, and colored according to the number of flights that have passed through each grid point. It shows the density of flights using the same route in 2015 and 2017 with no discernable change to the route of flight. The warmer colors (red) indicate higher flight counts per grid versus the cooler colors (blue) that show fewer flights per grid.

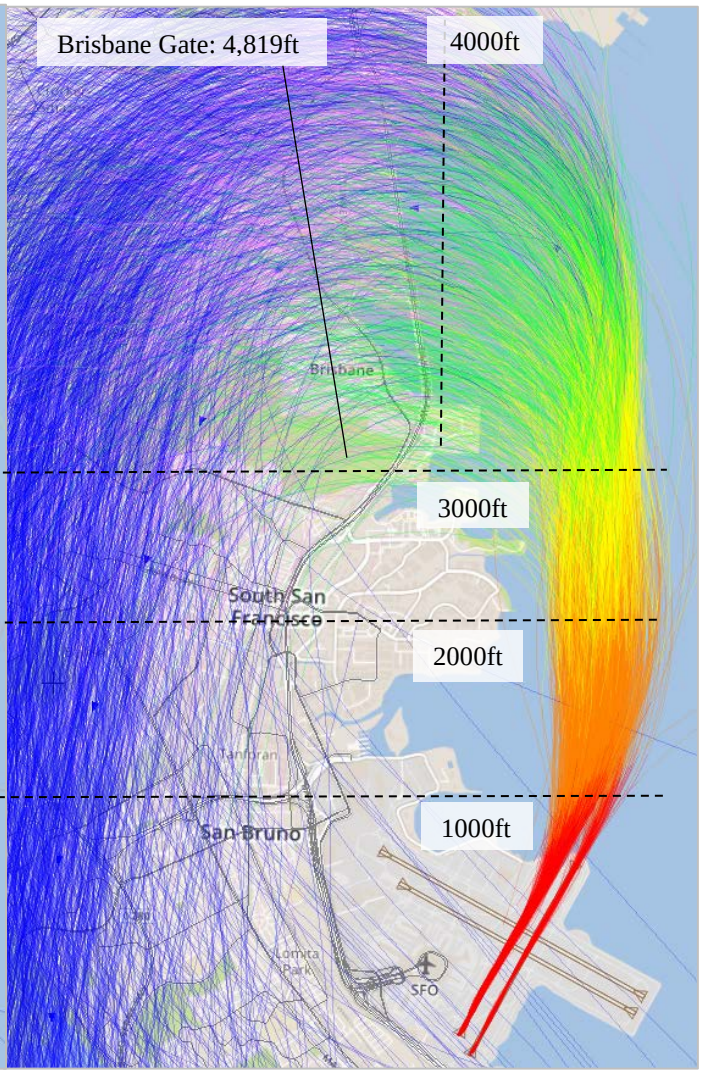
Before the SSTIK procedure was introduced on January 8, 2015 as part of the Northern California FAA Metroplex airspace redesign program the standard instrument departure procedure in place was the PORTE Departure. Comparing both procedures initial stages as they relate to Brisbane, we identified initial waypoints (SEPDY, SSTIK) off the coast of Brisbane which are less than half a mile apart and we found that the climb performance of the new SSTIK procedure does not increase the noise over Brisbane due to waypoint change and minimal altitude variances. In fact, flights that created noise events during the 2017 monitoring period were on average 300ft higher.

Both procedures have similar take off minimum climb rates. The minimum climb rate for PORTE is 535 feet per nautical mile (NM) and for the SSTIK is 500 feet per NM. Comparing flights that created a noise event during 2010 and 2017 noise monitoring period by altitude, we notice that the flights in 2017 are higher over Brisbane then they were in 2010. The rate of climb and noise footprint size of the newly introduced procedure does not negatively impact Brisbane.

2010

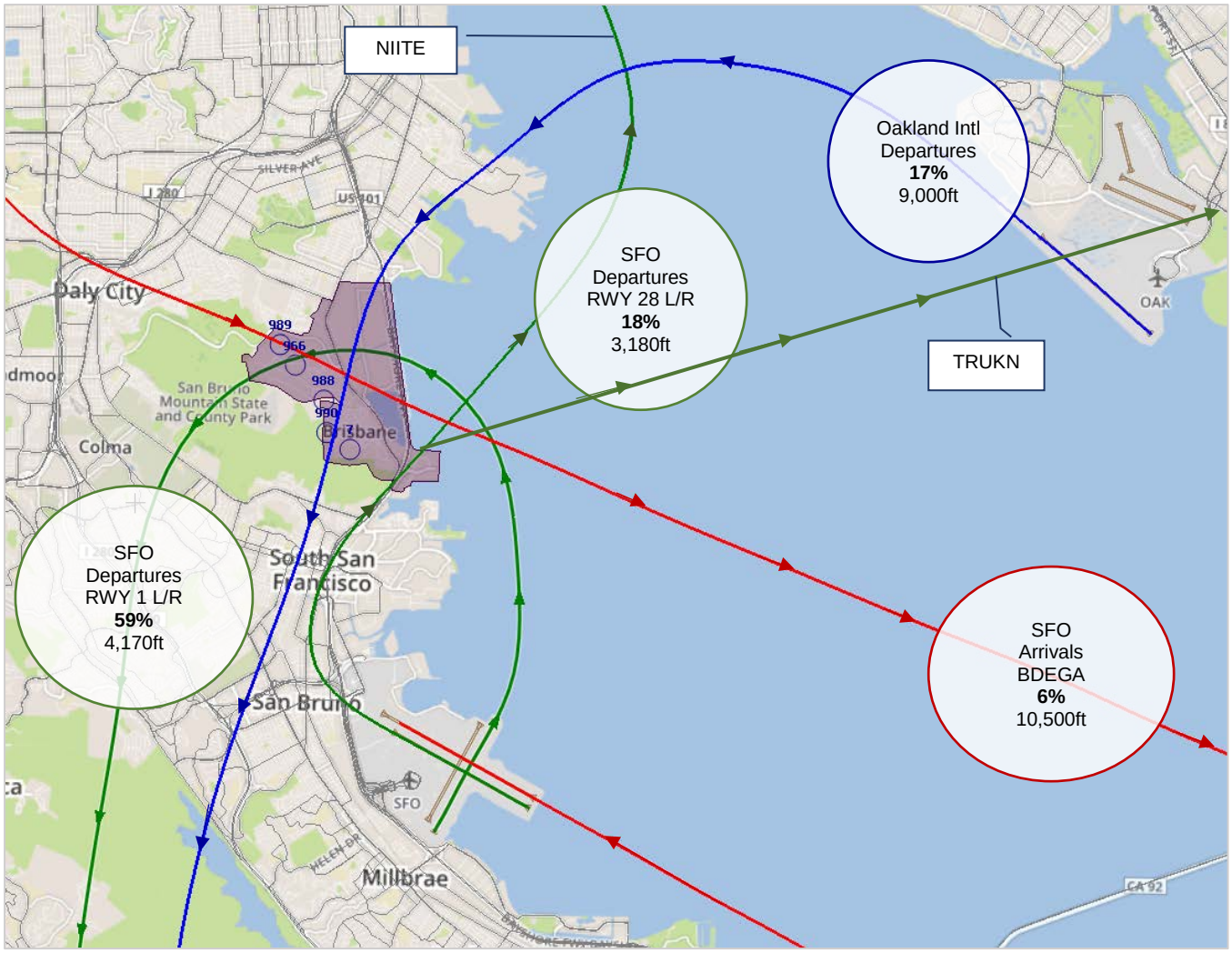


2017



Pathways and Altitudes over Brisbane

Flights that created a noise event at a minimum of one monitoring site were studied based on each of the four flight paths over Brisbane. Major flight paths over Brisbane are: SFO Runway 01 L/R departures turning left over Brisbane, SFO Runway 28 L/R departures turning right over Brisbane, Oakland Departures heading south and SFO BDEGA East arrivals. The map below depicts these paths together with the percentage of each flight path and average altitude over Brisbane.



Conclusion

Aircraft noise levels were measured in the City of Brisbane, California, an urban community approximately 4.5 miles from SFO. Flights above Brisbane consist primarily of departing SFO aircraft as SFO accounts for 79% of all aircraft noise events. During inclement weather when SFO operates in the Southeast Plan aircraft CNEL drops considerably while community CNEL increases due to wind and rain. The computed levels for the average **Aircraft CNEL** was 53dBA, and the average **Community CNEL** was 56dBA for all sites. Overall aircraft noise measurements contribute 1.5dBA additional noise to the total cumulative average noise level of 58dBA CNEL.

Table 23 – CNEL

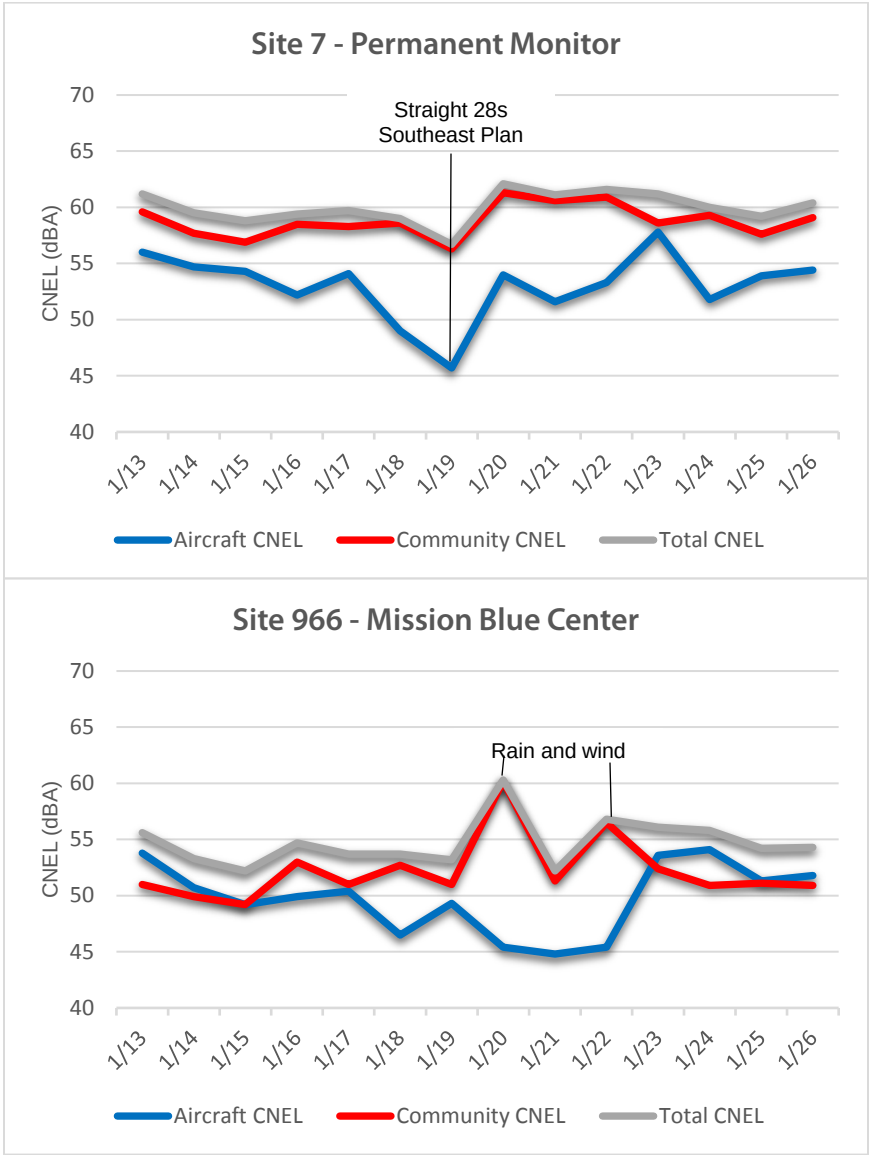
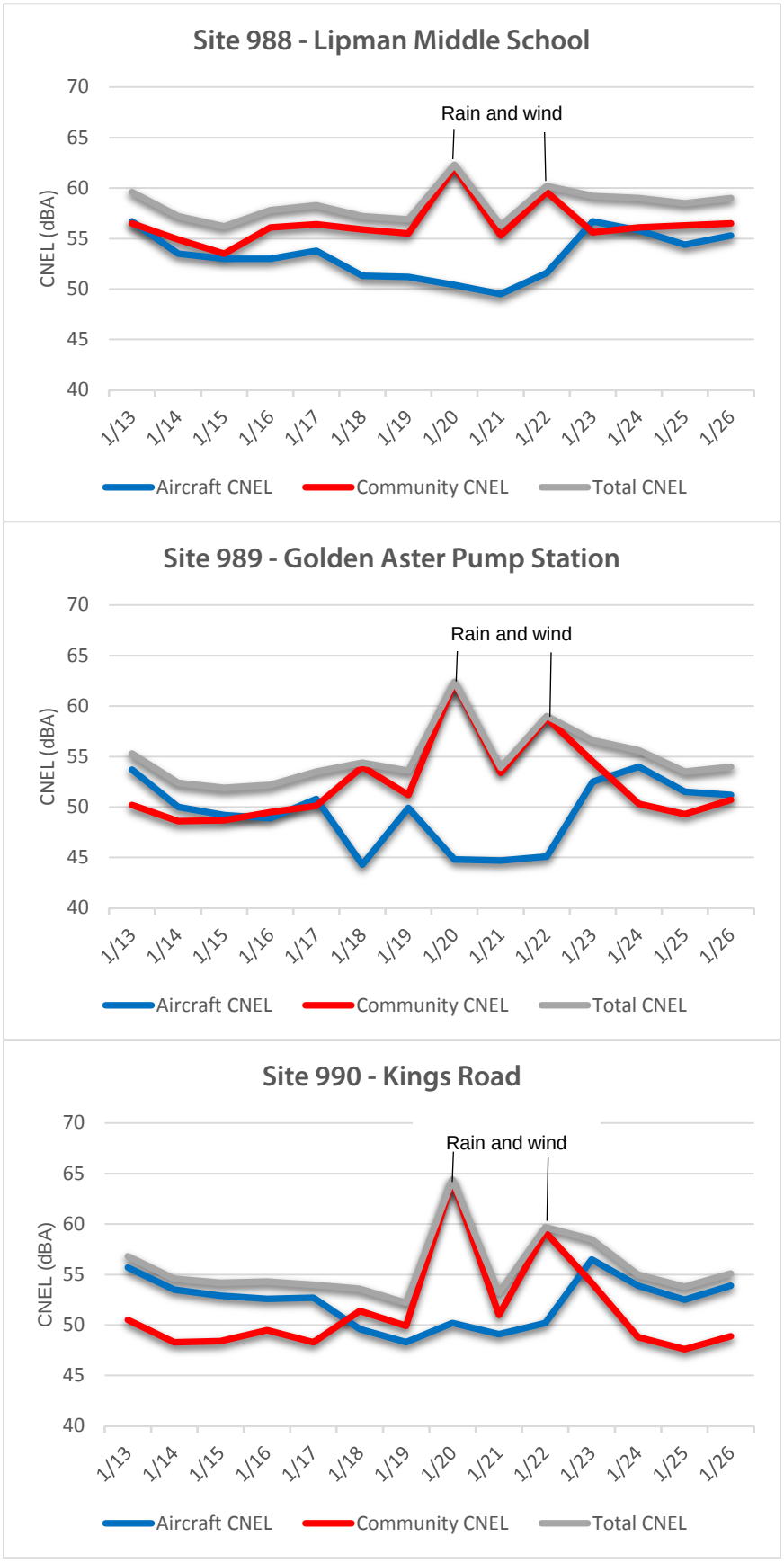
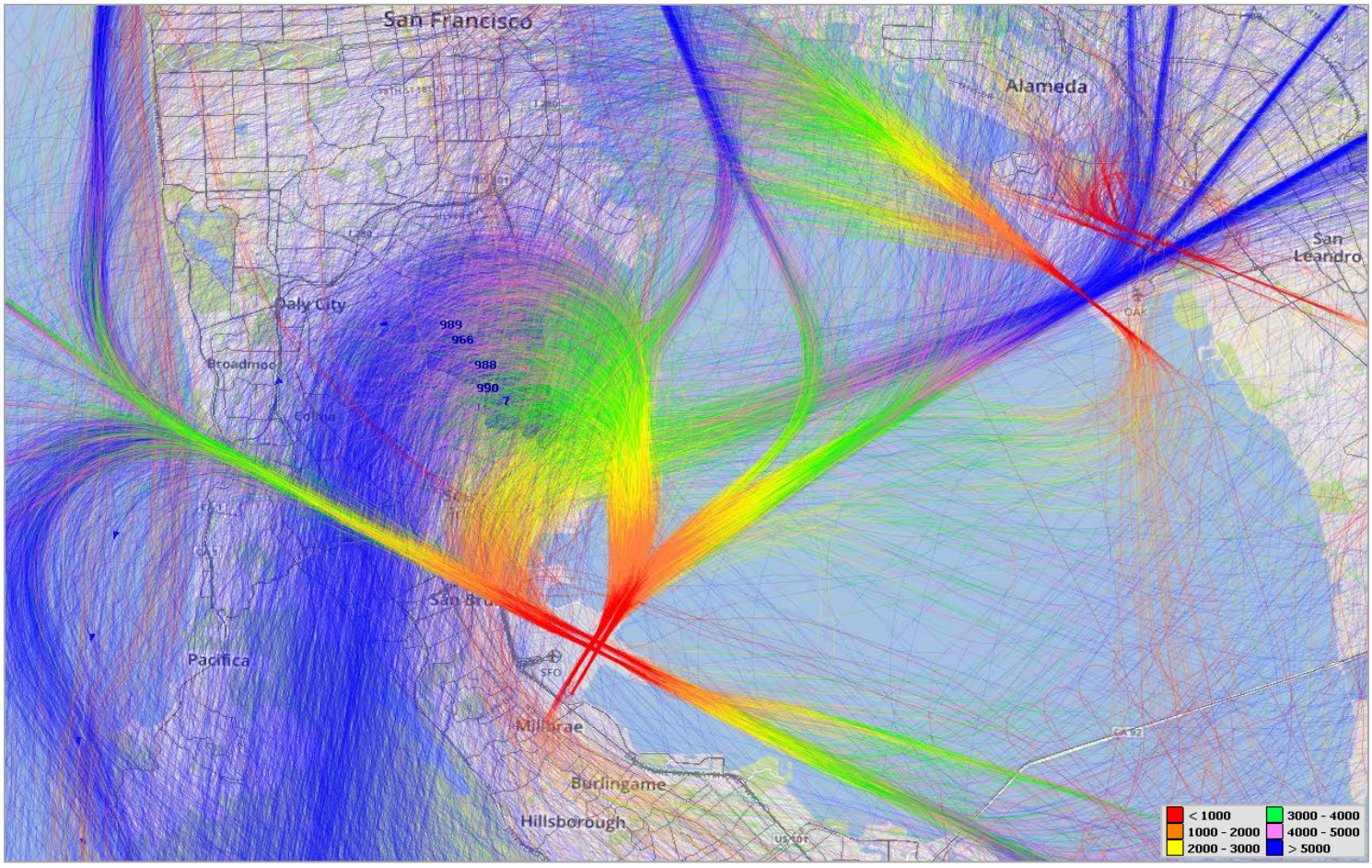


Table 23 – CNEL (cont.)



The California Code of Federal Regulations, Title 21, Division 2.5, Chapter 6, paragraph 5012 states, “The standard for the acceptable level of aircraft noise for persons living in the vicinity of airports is hereby established to be a community noise equivalent level of 65 decibels.” Since the average Aircraft CNEL was measured at 53dBA for Brisbane, this residential area has an acceptable level of aircraft noise as defined by state law. The extent of the 65dBA CNEL noise impact contour at SFO is shown in Appendix 5. This noise contour was generated using Federal Aviation Administration’s Integrated Noise Model (version 7.0d). The Federal Aviation Administration accepted this map as part of the Noise Exposure Map update under Federal Aviation Regulations Part 150 on January 29, 2016. The results of the field monitoring validate the extent of the 65dBA CNEL noise impact boundary confirming Aircraft CNEL is less than 65dBA CNEL for this community.

Table 24 – All flights that created noise events during the 2017 Brisbane Noise Monitoriong Period.
Color represents the flight altitude.



Note: Altitude coloration in 1,000 foot groupings.

Figure 1 – Microphones/Tripods in Brisbane


Site 7 – Permament Monitor


Site 966 – Mission Blue Center


Site 988 – Lipman Middle School


Site 989 –Golden Aster Pump Station


Site 990 – Kings Road

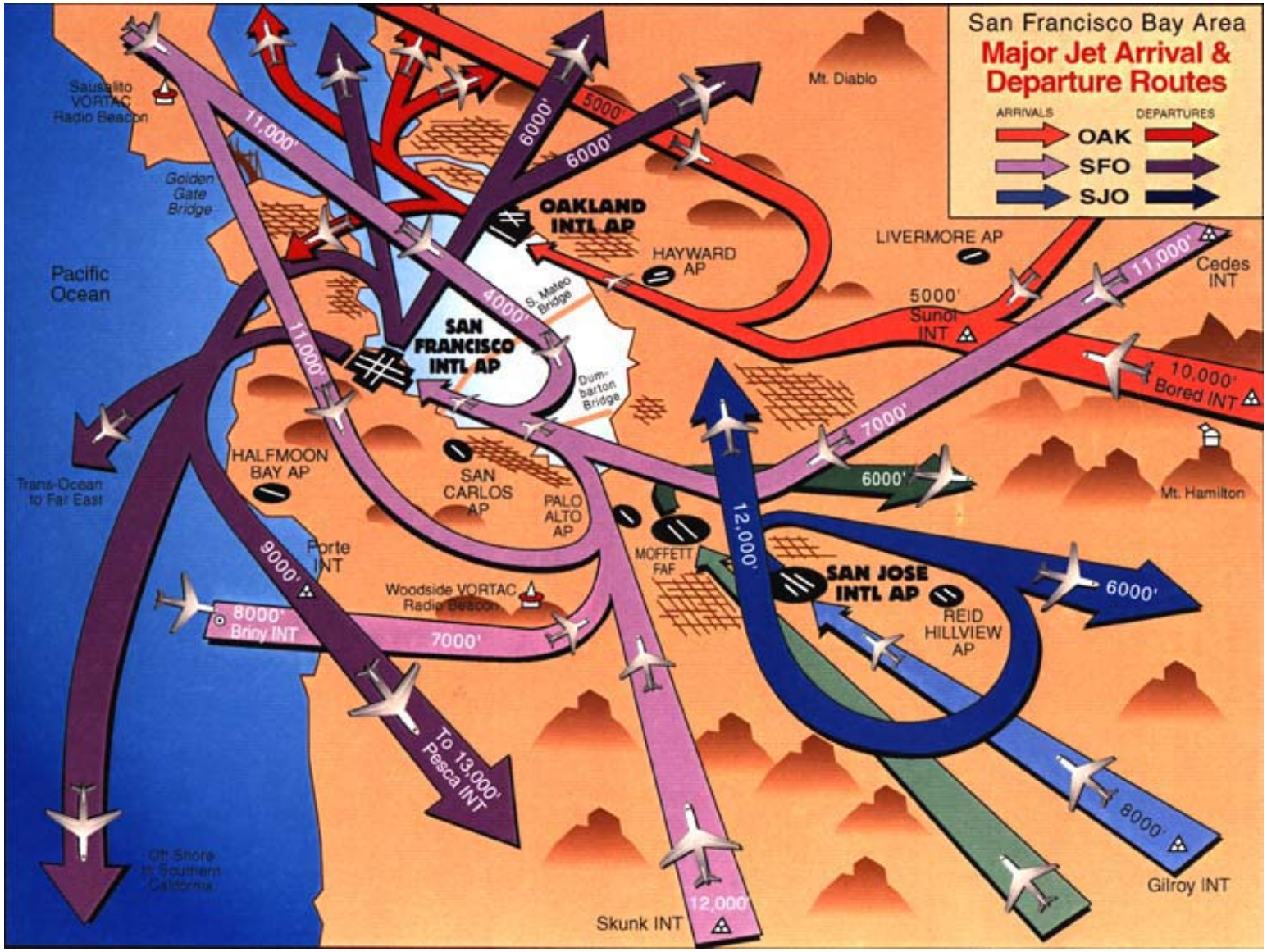
Figure 2 - Monitoring Locations

Table 24 – Noise Measurement Days

Sites	Location	Date	Number of monitoring days
7	Permanent-Margaret Tank	1/1/17 – 2/2/17	33
966	Mission Blue Center	1/8/17 – 1/26/17	19
988	Lipman Middle School	1/1/17 – 2/2/17	33
989	Golden Aster Pump Station	1/13/17 – 1/26/17	14
990	Kings Road	1/7/17 – 1/26/17	20

Appendix 1 – San Francisco Bay Area Major Jet Arrival and Departure Routes

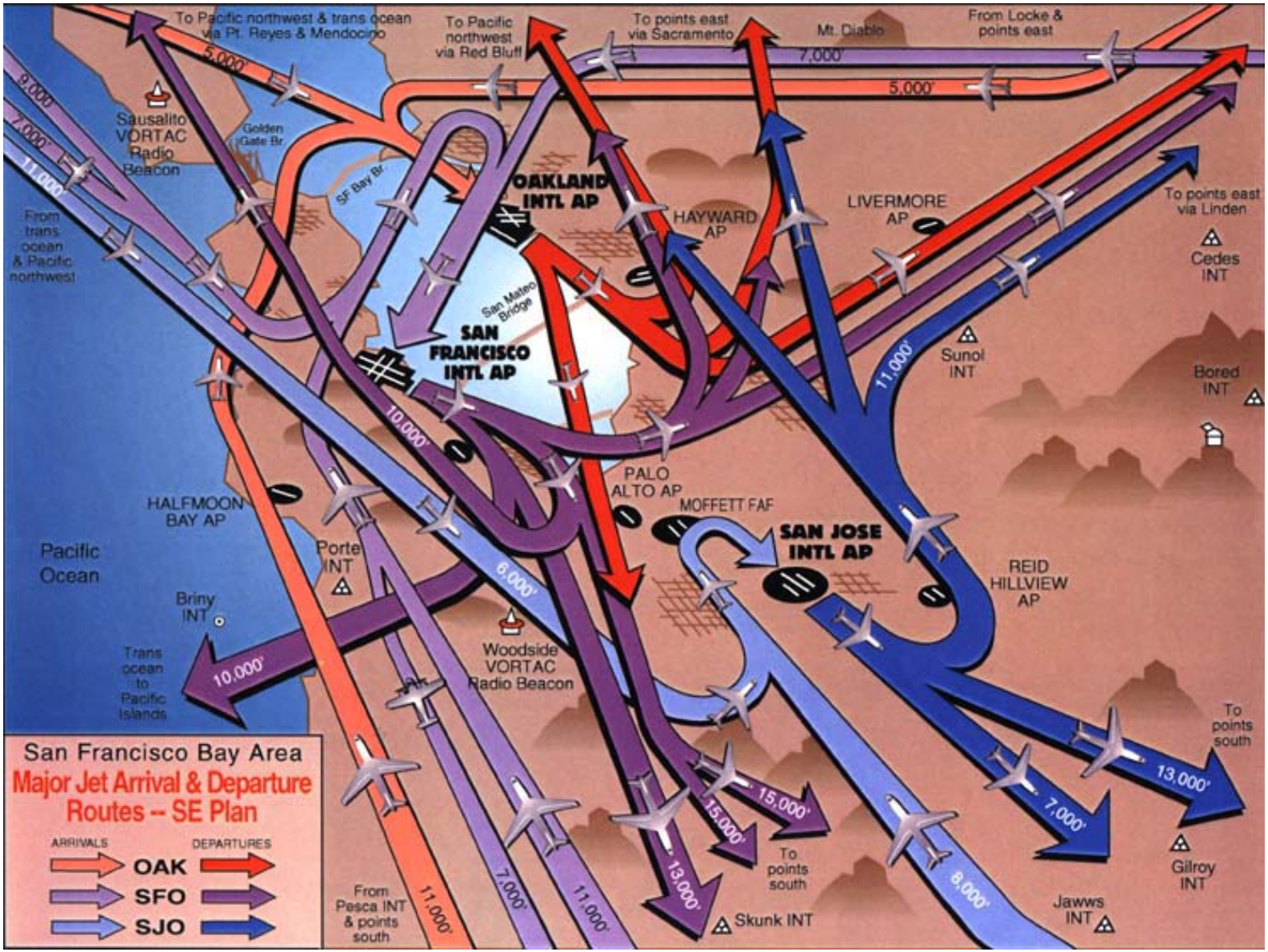
West Flow Plan



*note not all routes shown and image not drawn to scale

Appendix 2 – San Francisco Bay Area Major Jet Arrival and Departure Routes

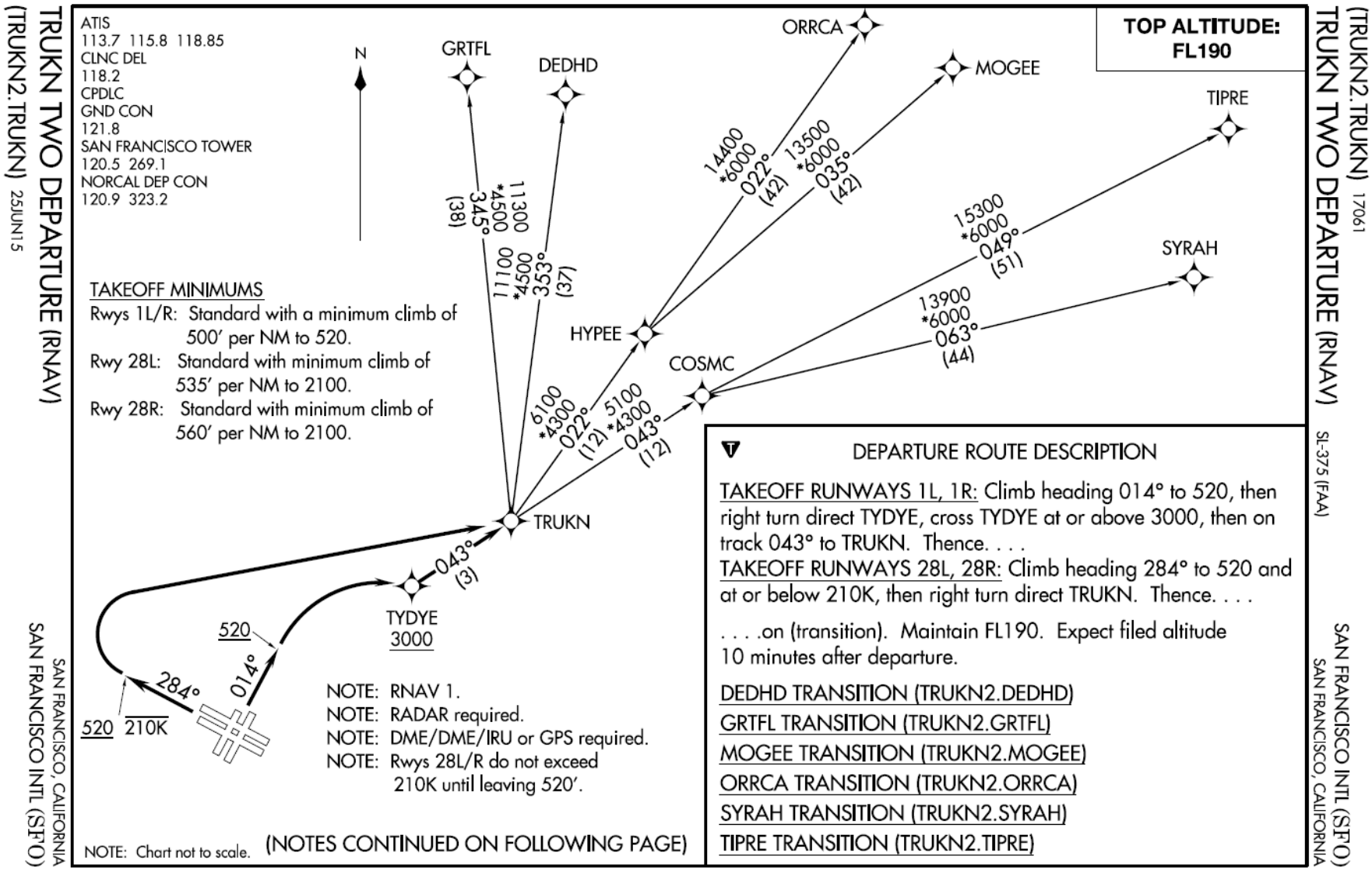
Southeast Flow Plan



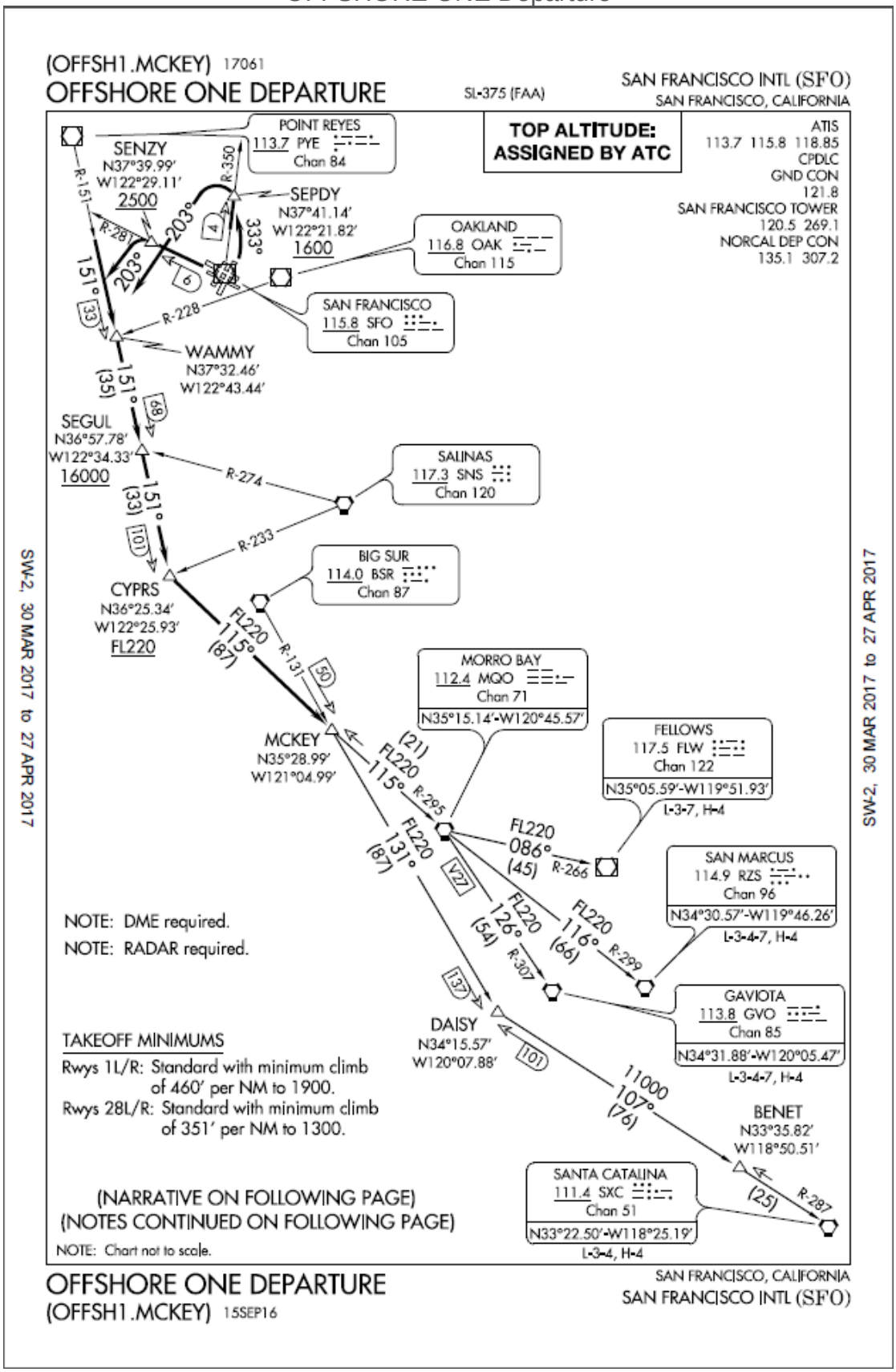
*note not all routes shown and image not drawn to scale

Appendix 3 – Air Navigation Charts
TRUKN TWO (RNAV) Departure

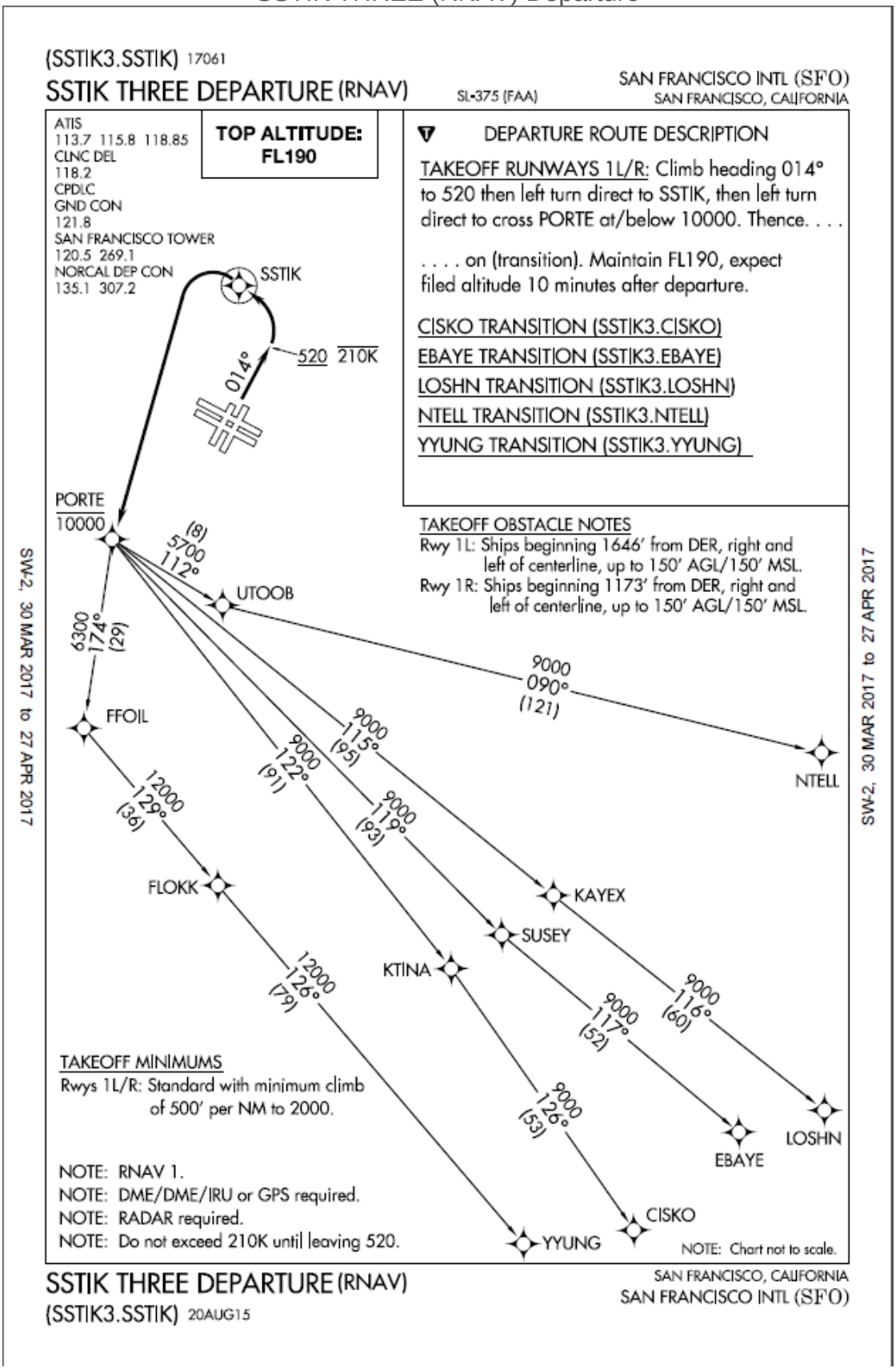
SW-2, 30 MAR 2017 to 27 APR 2017



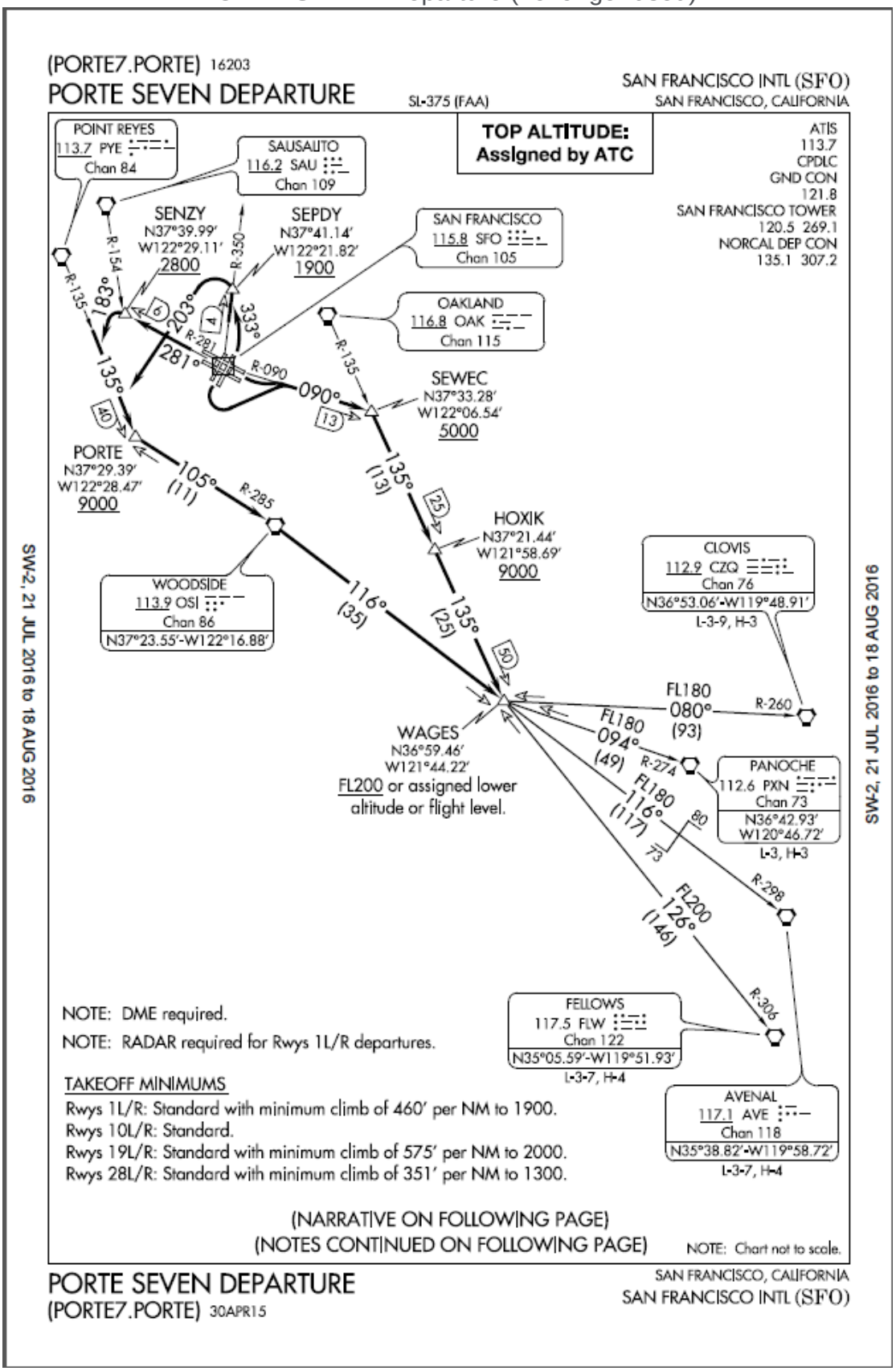
Appendix 3 – Air Navigation Charts
OFFSHORE ONE Departure



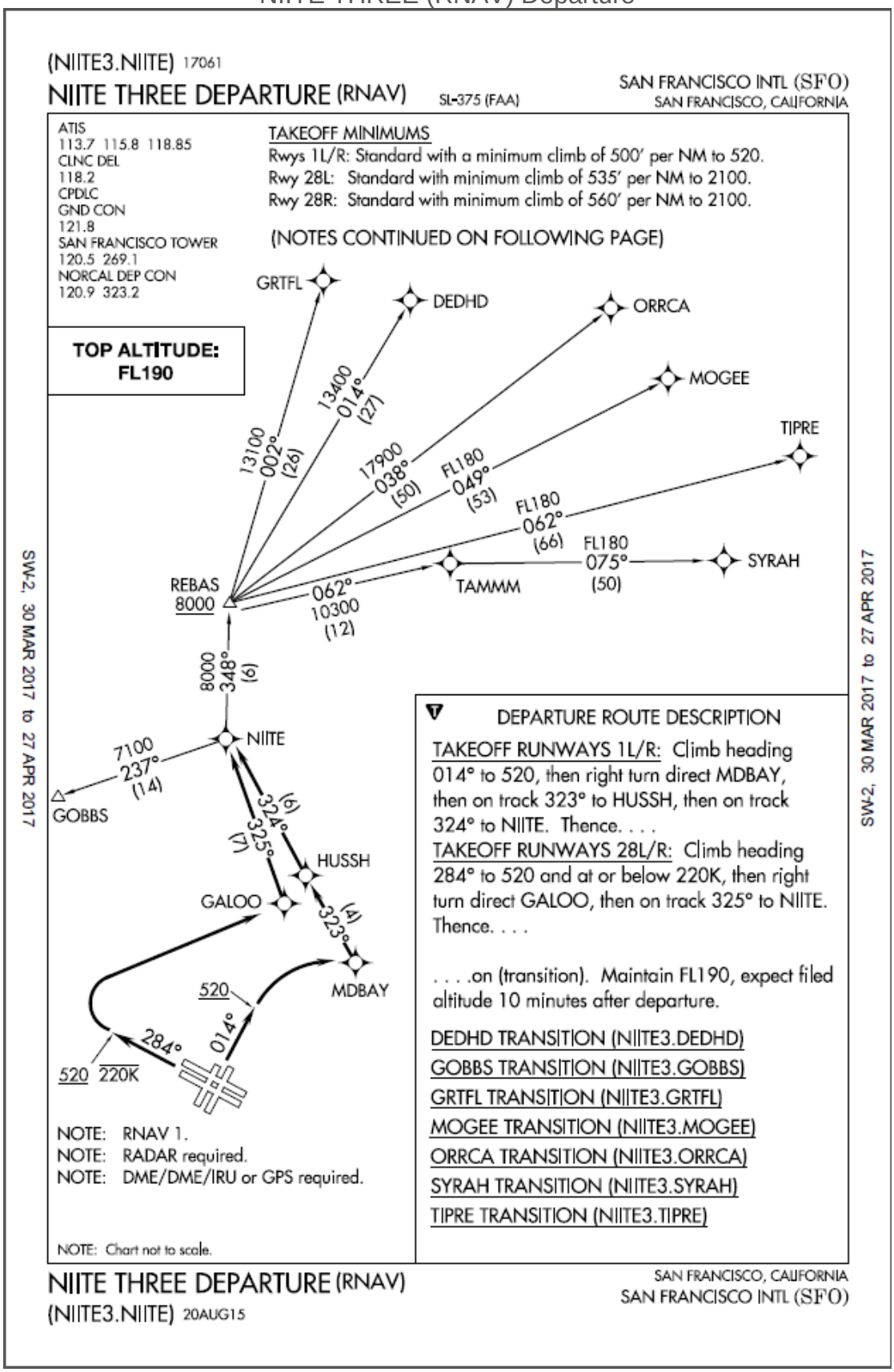
Appendix 3 – Air Navigation Charts
SSTIK THREE (RNAV) Departure



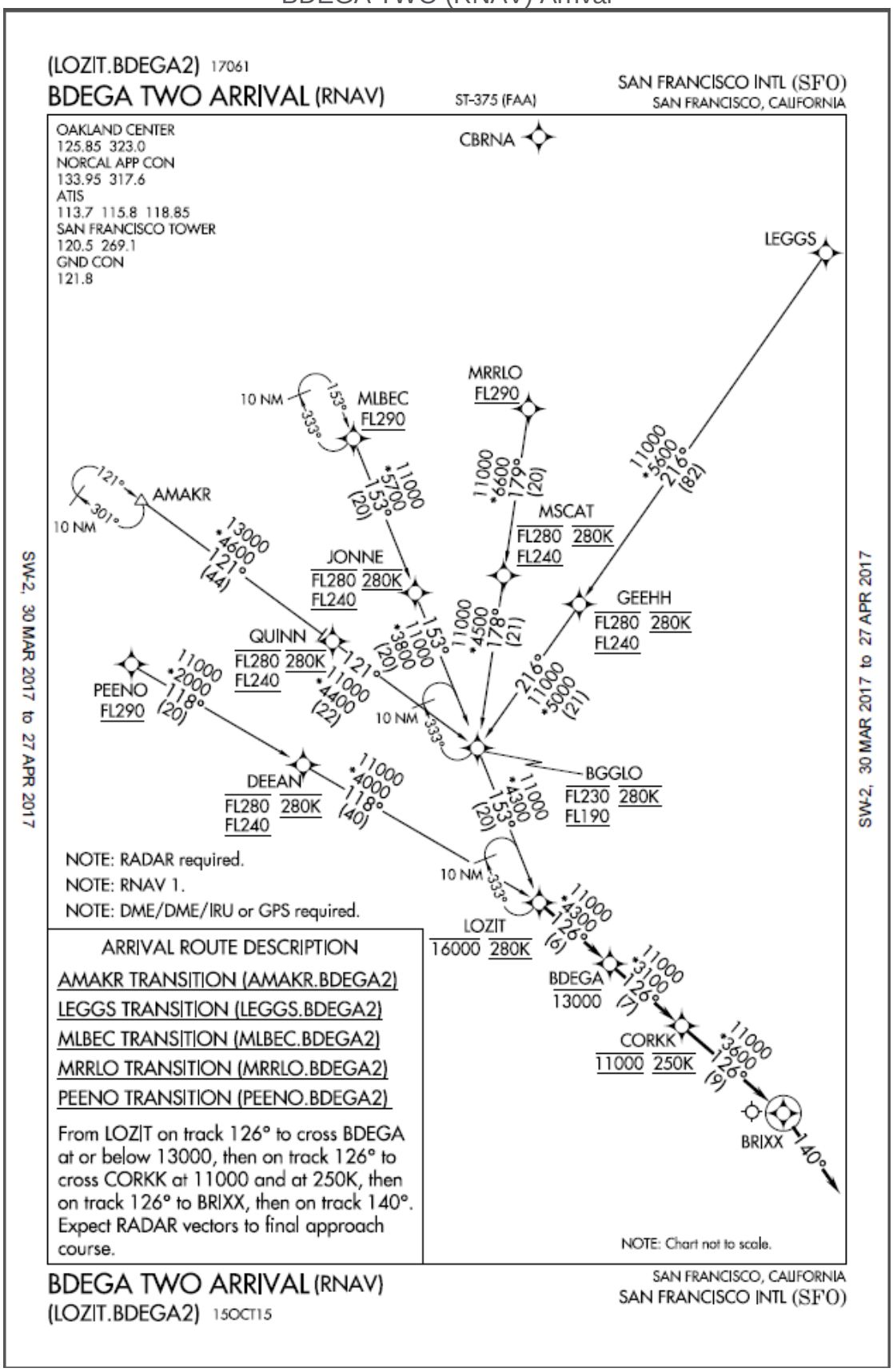
Appendix 3 – Air Navigation Charts
PORTE SEVEN Departure (no longer used)



Appendix 3 – Air Navigation Charts
NIITE THREE (RNAV) Departure

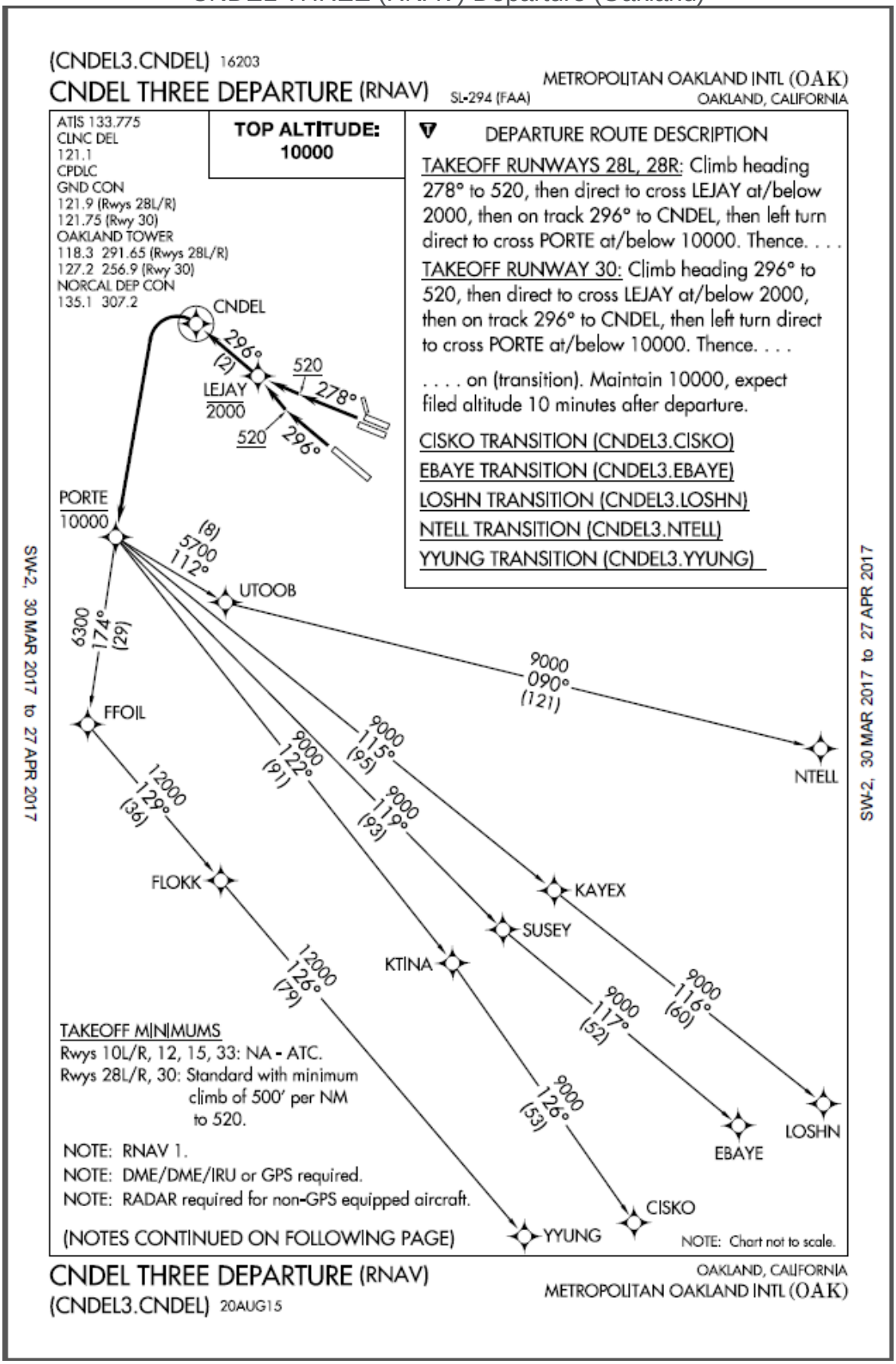


Appendix 3 – Air Navigation Charts
BDEGA TWO (RNAV) Arrival

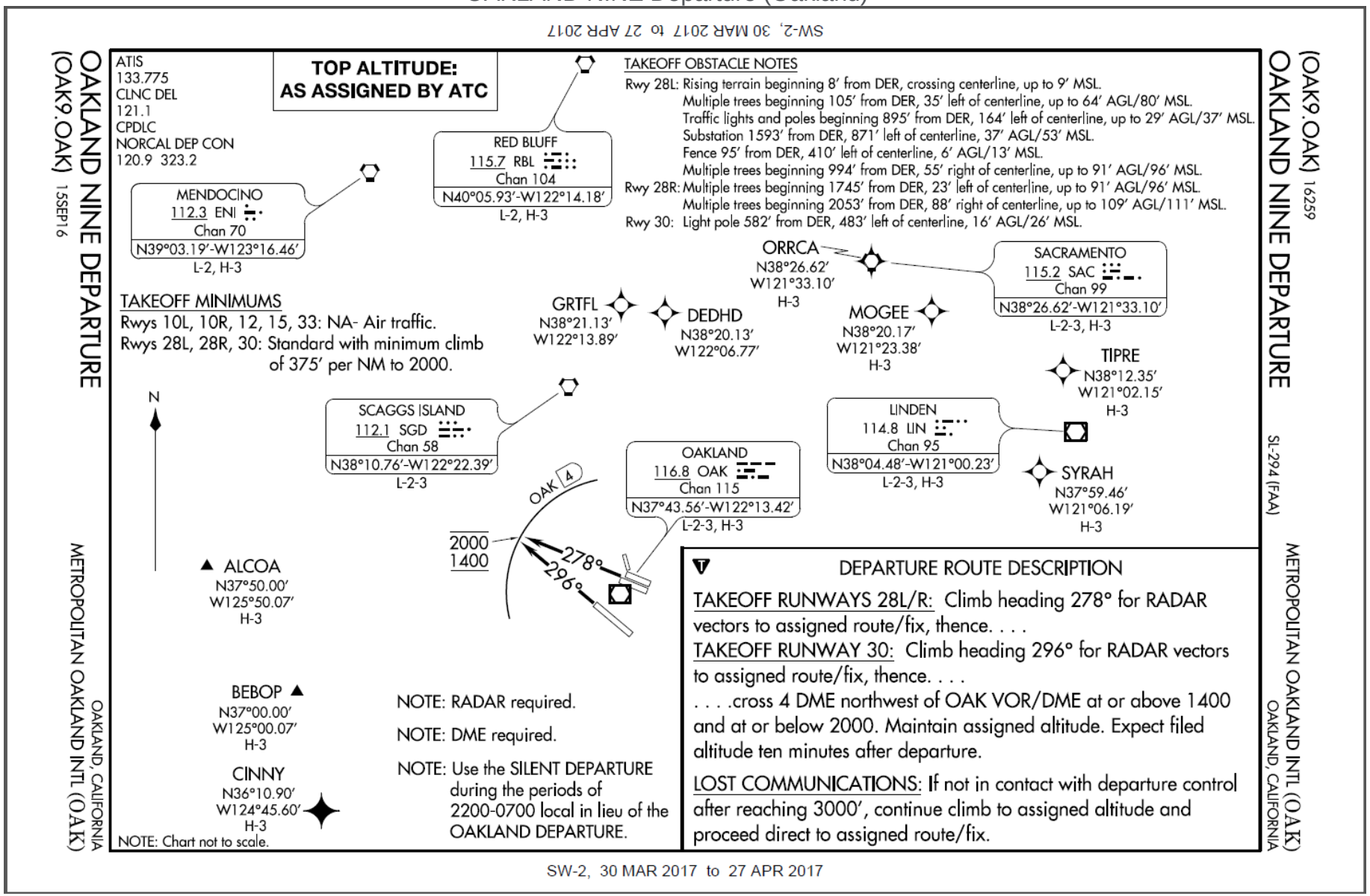


Appendix 3 – Air Navigation Charts

CNDEL THREE (RNAV) Departure (Oakland)



Appendix 3 – Air Navigation Charts
OAKLAND NINE Departure (Oakland)

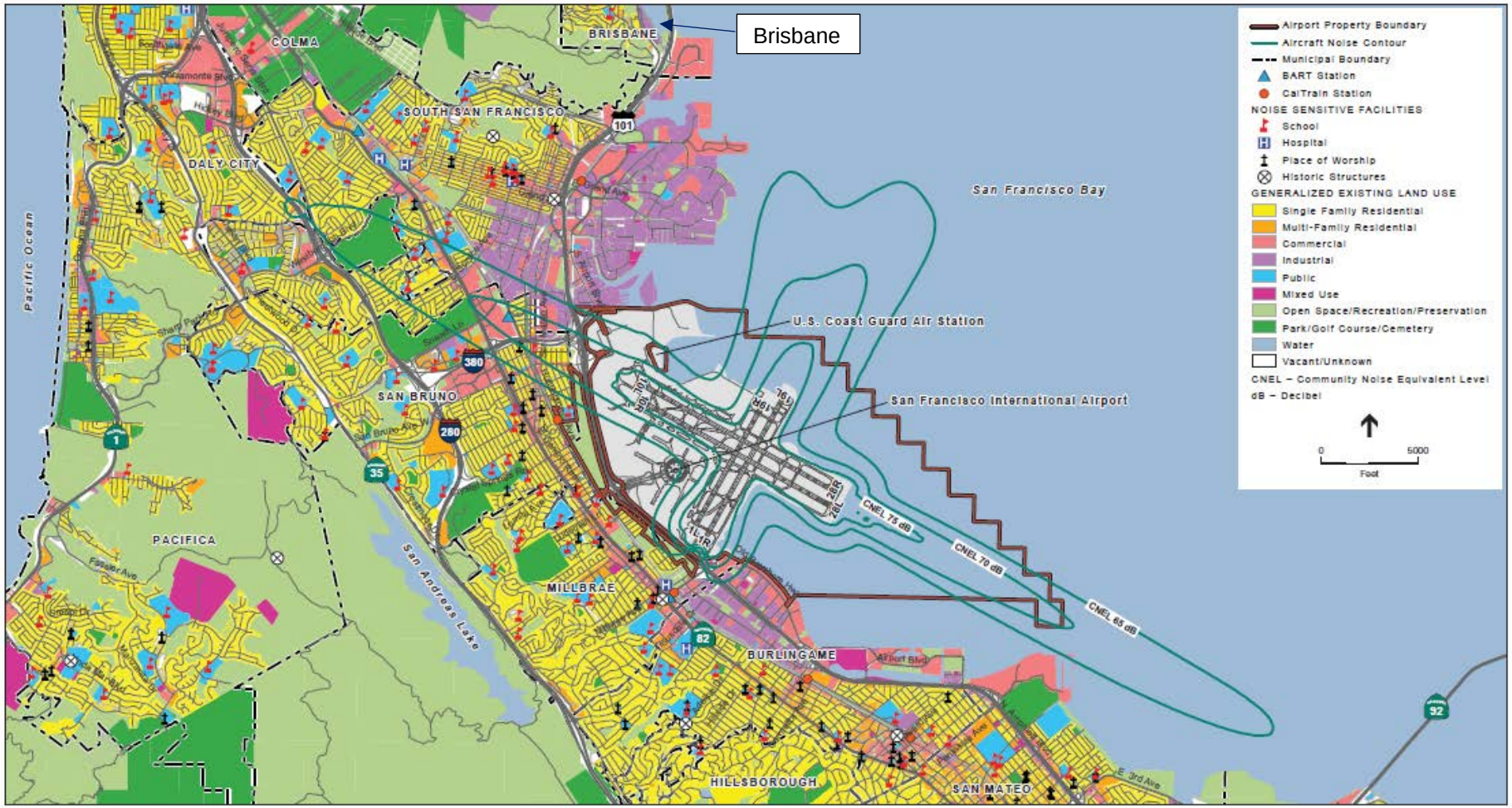


Appendix 4 – Aircraft Type Reference Sheet

Aircraft Code	Description	Aircraft Code	Description	Aircraft Code	Description	Aircraft Code	Description	Aircraft Code	Description
Wide Body Jet		Narrow Body Jet		Helicopter		General Aviation Aircraft		Business Aircraft	
A306	Airbus A300-600	**A319**	Airbus A319	**B206**	Bell Jet Ranger	**BE35**	Beech V35A	**BE20**	Beechcraft 200 King Air
A332	Airbus A330-200	**A320**	Airbus A320	**B407**	Bell Long Ranger	**B350**	Beechcraft King Air 350	**BE40**	Beechcraft Beechjet
A333	Airbus A330-300	**A321**	Airbus A321	**HELO**	Helicopter	**BE36**	Beechcraft 36 Bonanza	**C208**	Cessna 208 Caravan
A343	Airbus A340-300	**B733**	Boeing 737-300	**R44**	Robinson R-44	**BE58**	Beechcraft Baron	**C25A**	Cessna Citation CJ2
A346	Airbus A340-600	**B735**	Boeing 737-500			**C152**	Cessna C152	**C25C**	Cessna Citation CJ4
A388	Airbus A380-800	**B737**	Boeing 737-700			**C172**	Cessna Skyhawk	**C501**	Cessna Citation I
B744	Boeing 747-400	**B738**	Boeing 737-800			**C177**	Cardinal	**C510**	Cessna 510 Citation Mustang
B748	Boeing 747-8	**B739**	Boeing 737-900			**C180**	Cessna C180	**C550**	Cessna Citation II
B762	Boeing 767-200	**B752**	Boeing 757-200			**C182**	Cessna Skylane	**C560**	Cessna Citation V
B763	Boeing 767-300	**B753**	Boeing 757-300			**C206**	Cessna Stationair	**C56X**	Cessna 560XL Citation Excel
B772	Boeing 777-200	**CRJ2**	Bombardier CRJ200			**C210**	Cessna Centurion	**C650**	Cessna Citation III
B77L	Boeing 777-200LR	**CRJ7**	Bombardier CRJ700			**DA40**	Diamond DA-40	**C680**	Cessna 680 Citation Sovereign
B77W	Boeing 777-300ER	**CRJ9**	Bombardier CRJ-900			**DA42**	Diamond DA-42	**C750**	Cessna 750 Citation X
B788	Boeing 787-8	**DC93**	McDonnell Douglas DC-9-30			**EXPR**	Experimental	**CL30**	Bombardier Challenger 300
B789	Boeing 787-9	**DH8D**	DeHavilland Dash 8			**P28A**	Piper 28A Cherokee	**CL35**	Bombardier Challenger 350
MD11	McDonnell Douglas MD-11	**E135**	Embraer ERJ-135			**PA28**	Piper Cherokee 28B	**CL60**	Bombardier Challenger 600
		E170	Embraer E170			**PA28R**	Piper Cherokee	**E50P**	Embraer EMB-500 Phenom 100
		E190	Embraer E190			**SR22**	Cirrus SR-22	**E55P**	Embraer EMB-500 Phenom 300
		E45X	Embraer ERJ-145					**F2TH**	Dassault Falcon 2000
		E75L	Embraer E175					**FA900**	Dassault Falcon 900
		MD83	McDonnell Douglas MD-83					**GLAX**	IAI Gulfstream G200
		MD88	McDonnell Douglas MD-88					**GL5T**	Bombardier Global Express
		MD90	McDonnell Douglas MD-90					**GLEX**	Bombardier Global Express (twin-jet)
								GLF3	Gulfstream III
								GLF4	Gulfstream 4
								GLF5	Gulfstream 5
								HA4T	Hawker 400
								H25B	Raytheon/Hawker 800
								LJ35	Learjet 35
								LJ55	Learjet 55
								PAY2	Piper Cheyenne ii
								PC12	Pilatus PC-12
								PRM1	Beechcraft/Ratheon Premier 1
								FA50	Falcon 50

Wide Body Jet (wide enough for two passenger aisles); **Narrow Body Jet** (wide enough for one passenger aisles); **Business Aircraft** (transportation for small groups of people); **General Aviation Aircraft** (Generally small, propeller-driven aircraft); **Helicopters** (Aircraft operated by rotor blades)

Appendix 5 – 2014 Noise Exposure Map



SOURCE: ESRI, 2014; San Mateo County Planning and Building Department, 2014; ESA Airports, 2014

SFO FAR Part 150 Noise Exposure Map Report . 120832

Exhibit 5-1
2014 Noise Exposure Map – San Francisco International Airport

Addendum

List of changes for Revision 1 – 4/26/2017

Page 5) Corrected field names for “Flow Pattern” and added footnote information to Table 2.

Page 7) Added explanation for Straight 28s operations under Table 5.

Page 8) Provided explanation why Community SEL were higher on certain days. Added “On January 20th, the community SEL peaked at 81 dBA. On further investigation it was found that this was caused by unsettled weather patterns. Weather reports showed wind throughout the day that varied considerably from calm to gusts as high as 49 Knots, thunder and a significant rain accumulation of ¾ inch over 1.5 hours in the late afternoon. The sounds of rain, wind and thunder collected by the monitors were grouped as Community Events.”

Removed SEL table containing data from a different monitoring site.

Page 9) Changed Table 7 to show amounts of aircraft noise events per site versus cumulative total.

Page 10) Added clarification for Table 10 at end paragraph under Aircraft Operations, “Table 10 shows the daily ratio of overflights to noise events, along with the resulting aircraft noise climates for each monitoring site.”

Page 14) Table 12 is now on Page 14. Table 12 shows a line for “364 Average Aircraft Daily Operations” versus a bar graph. An explanation of what the percentage is provided now “% of daily noise events to daily operations.”

Page 16) Added explanation for Table 13. "Sites 966 and 989 did not capture the Shoreline Departure noise as much as did Sites 7, 988 and 990. It should be noted that the peaks in the number of departures in the 11:00 p.m. and midnight hours were caused by the combination of weather and late night easterly departures during this monitoring period. Typically, these flights are able to use the NIITE Departure procedure from Runways01L and 01R proceeding up the bay and away from Brisbane."

Page 19) Clarified first sentence in paragraph to make it less confusing.

Page 28) Added explanation in the conclusion’s first paragraph, "During inclement weather when SFO operates in the Southeast Plan aircraft CNEL drops considerably while community CNEL increases due to wind and rain.”

Page 43) Appendix 4 - Aircraft Type Reference Sheet has been simplified.