APPENDIX B15: NARAMATA CREEK

Flow standards and periodicity – Okanagan Tennant analysis for Naramata Creek

Week Ending	Life Stage/ Week	Rainbow						Kokanee				Ecological Flows	
		Adult migration	Spawning	Incubation	Rearing	Juvenile migration	Over-wintering	Adult migration	Spawning	Incubation	Juvenile migration	Wetland, side channel linkage, flushing and channel maintenance flow	Cottonwood ecosystems
Jan							20%			20%			
Feb							20%			20%			
Mar							20%			20%			
1-Apr	13				20%						50%	☑	
8-Apr	14				20%						50%	☑	
15-Apr	15	288%			20%						50%	☑	
22-Apr	16	288%			20%						50%	☑	
29-Apr	17	288%			20%						50%	☑	
6-May	18	288%			20%	50%					50%	☑	
13-May	19	288%	40%		20%	50%					50%	☑	
20-May	20	288%	40%		20%	50%					50%	☑	
27-May	21	288%	40%	20%	20%	50%					50%	480%	
3-Jun	22	288%	40%	20%	20%	50%						480%	
10-Jun	23	288%	40%	20%	20%	50%						☑	100%
17-Jun	24	288%	40%	20%	20%	50%						☑	100%
24-Jun	25	288%	40%	20%	20%	50%							100%
1-Jul	26	288%	40%	20%	20%	50%							100%
8-Jul	27	288%	40%	20%	20%	50%							100%
15-Jul	28			20%	20%	50%							100%
22-Jul	29			20%	20%								100%
29-Jul	30			20%	20%								100%
5-Aug	31				20%								
12-Aug	32				20%								
19-Aug	33				20%								
26-Aug	34				20%			20%					
2-Sep	35				20%			20%					
9-Sep	36				20%			20%	20%	20%			
16-Sep	37				20%			20%	20%	20%			
23-Sep	38				20%			20%	20%	20%			
30-Sep	39				20%			20%	20%	20%			
7-Oct	40				20%			20%	20%	20%			
14-Oct	41				20%					20%			
21-Oct	42				20%					20%			
28-Oct	43				20%					20%			
Nov							20%			20%			
Dec							20%			20%			

EFNs and critical flows for Naramata Creek

Week Ending	Okanagan Tennant EFN					FINAL EFN		CRITICAL FLOWS (m³/s)			
	EFN - all factors (%LTMAD)	EFN based on flow standards (m³/s)	Residual median weekly Q (m³/s)	Discharge m³/s	%LTMAD	Value (m³/s)	Dominant Species / Life Stage	Rainbow trout rearing & over wintering	Kokanee spawning	Rainbow trout migration & spawning	FINAL
Jan	20%	0.035	0.009	0.009	5%	0.028	overwintering egg incubation	0.009			0.009
Feb	20%	0.035	0.008	0.008	4%	0.028	overwintering egg incubation	0.009			0.009
Mar	20%	0.035	0.008	0.008	5%	0.028	overwintering egg incubation	0.009			0.009
1-Apr	50%	0.086	0.017	0.017	10%	0.017	KO juvenile migration	0.009			0.009
8-Apr	50%	0.086	0.021	0.021	12%	0.021	KO juvenile migration	0.009			0.009
15-Apr	288%	0.498	0.046	0.046	27%	0.046	RB adult migration	0.009		0.046	0.046
22-Apr	288%	0.498	0.120	0.120	69%	0.120	RB adult migration	0.009		0.086	0.086
29-Apr	288%	0.498	0.297	0.297	172%	0.297	RB adult migration	0.009		0.086	0.086
6-May	288%	0.498	0.381	0.381	221%	0.381	RB adult migration	0.009		0.086	0.086
13-May	288%	0.498	0.384	0.384	222%	0.384	RB adult migration	0.009		0.086	0.086
20-May	288%	0.498	0.765	0.498	288%	0.498	RB spawning	0.009		0.086	0.086
27-May	480%	0.830	1.064	0.830	480%	0.830	Ecosystem	0.009		0.086	0.086
3-Jun	480%	0.830	0.904	0.830	480%	0.830	Ecosystem	0.009		0.086	0.086
10-Jun	288%	0.498	0.625	0.498	288%	0.498	RB spawning	0.009		0.086	0.086
17-Jun	288%	0.498	0.486	0.486	281%	0.486	RB spawning	0.009		0.086	0.086
24-Jun	288%	0.498	0.337	0.337	195%	0.337	RB spawning	0.009		0.086	0.086
1-Jul	288%	0.498	0.165	0.165	95%	0.165	RB spawning	0.009		0.086	0.086
8-Jul	288%	0.498	0.150	0.150	87%	0.150	RB spawning	0.009		0.086	0.086
15-Jul	100%	0.173	0.139	0.139	80%	0.139	RB incubation	0.009			0.009
22-Jul	100%	0.173	0.122	0.122	70%	0.122	RB incubation	0.009			0.009
29-Jul	100%	0.173	0.097	0.097	56%	0.097	RB incubation	0.009			0.009
5-Aug	20%	0.035	0.096	0.035	20%	0.096	RB parr rearing	0.009			0.009
12-Aug	20%	0.035	0.092	0.035	20%	0.092	RB parr rearing	0.009			0.009
19-Aug	20%	0.035	0.087	0.035	20%	0.087	RB parr rearing	0.009			0.009
26-Aug	20%	0.035	0.091	0.035	20%	0.091	RB parr rearing, KO migration	0.009			0.009
2-Sep	20%	0.035	0.088	0.035	20%	0.088	RB parr rearing, KO migration	0.009			0.009
9-Sep	20%	0.035	0.056	0.056	32%	0.056	KO Spawning	0.009	0.017		0.017
16-Sep	20%	0.035	0.055	0.055	32%	0.055	KO Spawning	0.009	0.017		0.017
23-Sep	20%	0.035	0.059	0.059	34%	0.059	KO Spawning	0.009	0.017		0.017
30-Sep	20%	0.035	0.059	0.059	34%	0.059	KO Spawning	0.009	0.017		0.017
7-Oct	20%	0.035	0.029	0.029	17%	0.029	KO Spawning	0.009	0.017		0.017
14-Oct	20%	0.035	0.032	0.032	18%	0.032	RB parr rearing	0.009			0.009
21-Oct	20%	0.035	0.036	0.035	20%	0.035	RB parr rearing	0.009			0.009
28-Oct	20%	0.035	0.033	0.033	19%	0.033	RB parr rearing	0.009			0.009
Nov	20%	0.035	0.016	0.016	9%	0.028	overwintering egg incubation	0.009			0.009
Dec	20%	0.035	0.009	0.009	5%	0.028	overwintering egg incubation	0.009			0.009

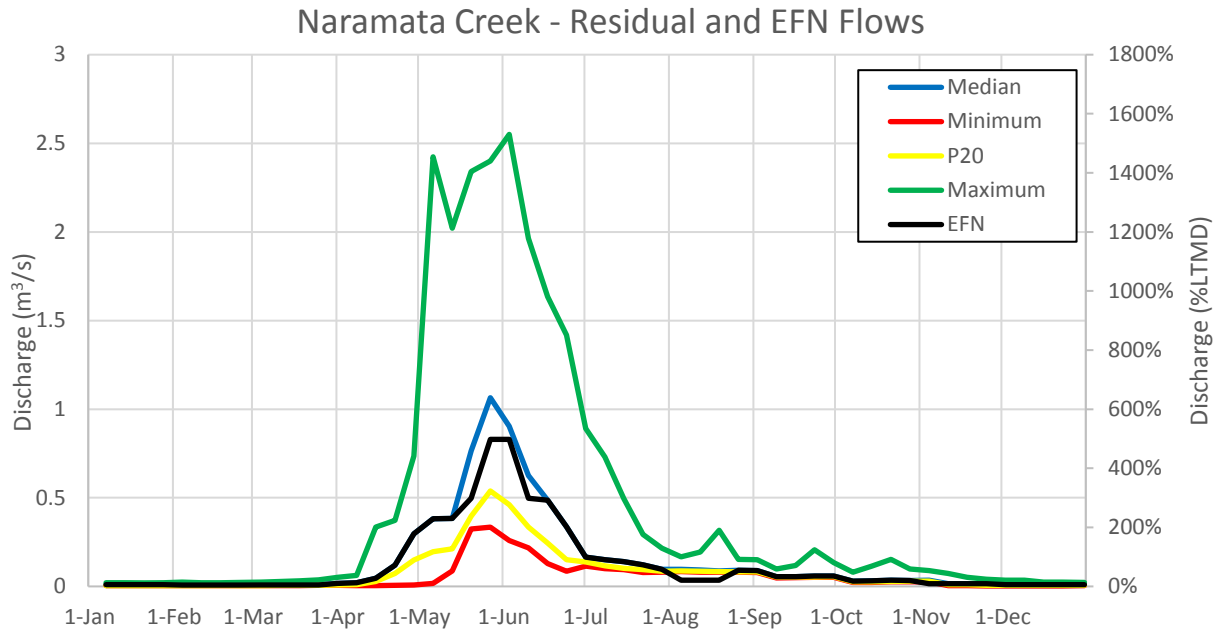## Percentile Flows for Naramata Creek

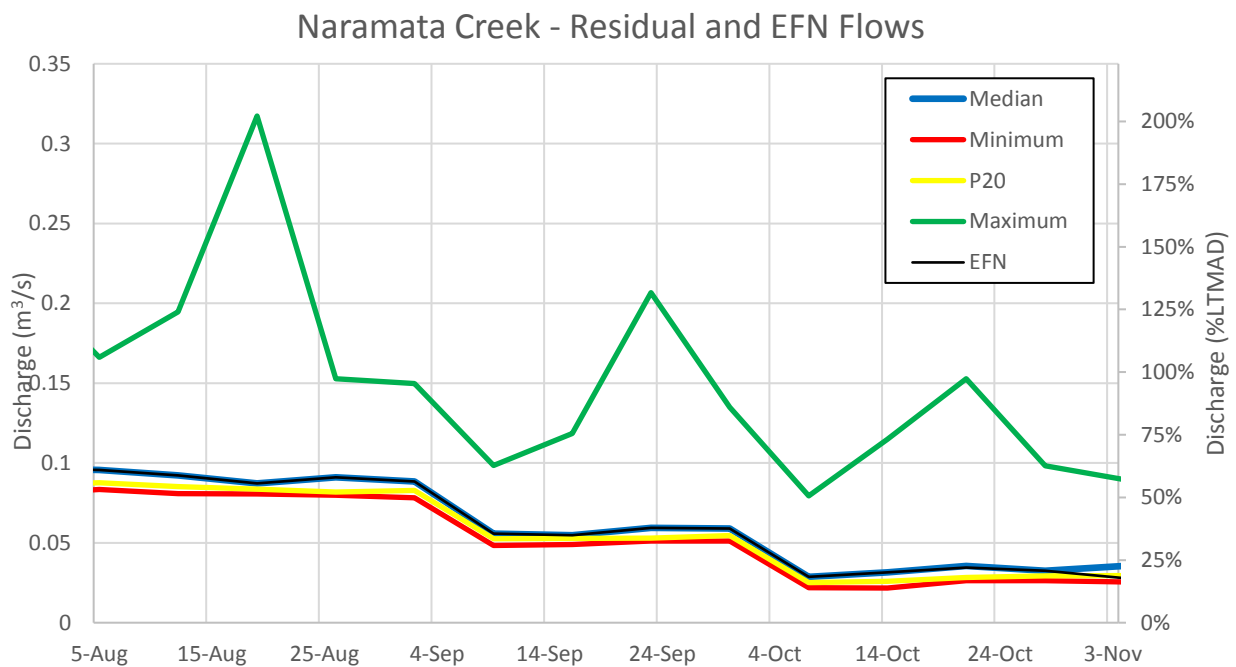**Figure B15-1: Okanagan Tennant EFNs compared to residual flow percentiles for Naramata Creek (Discharge & %LTMAD)**

Figure B15-2: Okanagan Tennant EFNs compared to naturalized flow percentiles for Naramata Creek Aug – Nov (Discharge & % LTMAD)

Naramata Creek naturalized percentile flow data

NATURALIZED FLOW			as m³/s				as %LTMAD			
Week	Ending		Min	P20	Median	Max		Min	P20	Median	Max
01	7-Jan		0.005	0.005	0.009	0.020		3%	3%	6%	13%
02	14-Jan		0.005	0.005	0.011	0.020		3%	3%	7%	13%
03	21-Jan		0.004	0.005	0.010	0.020		3%	3%	6%	13%
04	28-Jan		0.004	0.005	0.009	0.020		3%	3%	5%	13%
05	4-Feb		0.004	0.005	0.007	0.025		2%	3%	5%	16%
06	11-Feb		0.004	0.005	0.007	0.021		2%	3%	5%	14%
07	18-Feb		0.004	0.005	0.008	0.021		2%	3%	5%	14%
08	25-Feb		0.004	0.005	0.008	0.022		3%	3%	5%	14%
09	4-Mar		0.004	0.005	0.008	0.024		3%	3%	5%	16%
10	11-Mar		0.005	0.007	0.008	0.027		3%	4%	5%	17%
11	18-Mar		0.005	0.007	0.009	0.031		3%	4%	5%	20%
12	25-Mar		0.006	0.007	0.010	0.037		4%	4%	6%	23%
13	1-Apr		0.006	0.007	0.017	0.051		4%	5%	11%	33%
14	8-Apr		0.005	0.009	0.021	0.063		3%	6%	14%	40%
15	15-Apr		0.005	0.028	0.047	0.336		3%	18%	30%	214%
16	22-Apr		0.007	0.073	0.121	0.373		5%	47%	77%	238%
17	29-Apr		0.009	0.150	0.298	0.738		6%	96%	190%	471%
18	6-May		0.017	0.197	0.383	2.425		11%	126%	244%	1547%
19	13-May		0.088	0.212	0.385	2.023		56%	135%	246%	1290%
20	20-May		0.326	0.398	0.767	2.342		208%	254%	489%	1494%
21	27-May		0.337	0.541	1.065	2.402		215%	345%	680%	1532%
22	3-Jun		0.261	0.462	0.905	2.552		166%	295%	577%	1628%
23	10-Jun		0.218	0.336	0.626	1.965		139%	214%	399%	1253%
24	17-Jun		0.130	0.246	0.489	1.637		83%	157%	312%	1045%
25	24-Jun		0.089	0.153	0.339	1.419		57%	98%	216%	905%
26	1-Jul		0.076	0.121	0.169	0.892		49%	77%	108%	569%
27	8-Jul		0.046	0.078	0.120	0.734		30%	50%	77%	468%
28	15-Jul		0.029	0.037	0.074	0.498		18%	24%	47%	318%
29	22-Jul		0.014	0.030	0.057	0.298		9%	19%	37%	190%
30	29-Jul		0.016	0.022	0.032	0.151		10%	14%	20%	97%
31	5-Aug		0.009	0.012	0.020	0.091		5%	8%	13%	58%
32	12-Aug		0.005	0.010	0.017	0.117		3%	6%	11%	75%
33	19-Aug		0.005	0.009	0.012	0.240		3%	6%	7%	153%
34	26-Aug		0.004	0.006	0.014	0.076		3%	4%	9%	49%
35	2-Sep		0.002	0.007	0.013	0.072		1%	4%	8%	46%
36	9-Sep		0.001	0.006	0.010	0.050		1%	4%	6%	32%
37	16-Sep		0.001	0.004	0.008	0.069		1%	3%	5%	44%
38	23-Sep		0.003	0.005	0.011	0.158		2%	3%	7%	101%
39	30-Sep		0.003	0.006	0.010	0.086		2%	4%	6%	55%
40	7-Oct		0.003	0.006	0.009	0.060		2%	4%	6%	38%
41	14-Oct		0.002	0.006	0.012	0.095		1%	4%	8%	61%
42	21-Oct		0.007	0.008	0.016	0.133		4%	5%	10%	85%
43	28-Oct		0.006	0.009	0.013	0.078		4%	6%	8%	50%
44	4-Nov		0.006	0.010	0.016	0.070		4%	6%	10%	45%
45	11-Nov		0.004	0.011	0.016	0.073		3%	7%	10%	46%
46	18-Nov		0.005	0.010	0.016	0.051		3%	6%	10%	33%
47	25-Nov		0.003	0.007	0.013	0.040		2%	4%	8%	25%
48	2-Dec		0.003	0.006	0.011	0.035		2%	4%	7%	22%
49	9-Dec		0.003	0.006	0.010	0.035		2%	4%	6%	22%
50	16-Dec		0.003	0.006	0.010	0.025		2%	4%	6%	16%
51	23-Dec		0.003	0.006	0.009	0.025		2%	4%	6%	16%
52	31-Dec		0.004	0.006	0.008	0.023		3%	4%	5%	15%

Naramata Creek residual percentile flow data

RESIDUAL FLOW			as m³/s				as %LTMAD			
Week	Ending		Min	P20	Median	Max		Min	P20	Median	Max
01	7-Jan		0.005	0.005	0.009	0.020		3%	3%	6%	13%
02	14-Jan		0.005	0.005	0.011	0.020		3%	3%	7%	13%
03	21-Jan		0.004	0.005	0.010	0.020		3%	3%	6%	13%
04	28-Jan		0.004	0.005	0.008	0.020		3%	3%	5%	13%
05	4-Feb		0.004	0.005	0.007	0.025		2%	3%	5%	16%
06	11-Feb		0.004	0.005	0.007	0.021		2%	3%	5%	14%
07	18-Feb		0.003	0.005	0.008	0.021		2%	3%	5%	14%
08	25-Feb		0.004	0.005	0.008	0.022		3%	3%	5%	14%
09	4-Mar		0.004	0.005	0.008	0.024		3%	3%	5%	16%
10	11-Mar		0.005	0.007	0.008	0.027		3%	4%	5%	17%
11	18-Mar		0.005	0.007	0.009	0.031		3%	4%	5%	20%
12	25-Mar		0.006	0.007	0.010	0.037		4%	4%	6%	23%
13	1-Apr		0.006	0.007	0.017	0.051		4%	5%	11%	32%
14	8-Apr		0.004	0.009	0.021	0.063		3%	6%	14%	40%
15	15-Apr		0.005	0.028	0.046	0.336		3%	18%	29%	214%
16	22-Apr		0.007	0.072	0.120	0.373		4%	46%	76%	238%
17	29-Apr		0.009	0.149	0.297	0.736		6%	95%	189%	470%
18	6-May		0.017	0.196	0.381	2.423		11%	125%	243%	1545%
19	13-May		0.087	0.211	0.384	2.021		55%	135%	245%	1289%
20	20-May		0.324	0.396	0.765	2.340		206%	253%	488%	1493%
21	27-May		0.334	0.538	1.064	2.400		213%	343%	679%	1531%
22	3-Jun		0.259	0.461	0.904	2.550		165%	294%	577%	1627%
23	10-Jun		0.217	0.335	0.625	1.963		138%	214%	399%	1252%
24	17-Jun		0.128	0.244	0.486	1.635		82%	156%	310%	1043%
25	24-Jun		0.086	0.150	0.337	1.418		55%	96%	215%	904%
26	1-Jul		0.114	0.138	0.165	0.891		73%	88%	105%	568%
27	8-Jul		0.099	0.116	0.150	0.730		63%	74%	96%	466%
28	15-Jul		0.094	0.102	0.139	0.495		60%	65%	89%	316%
29	22-Jul		0.079	0.094	0.122	0.293		50%	60%	78%	187%
30	29-Jul		0.080	0.086	0.097	0.216		51%	55%	62%	138%
31	5-Aug		0.083	0.088	0.096	0.166		53%	56%	61%	106%
32	12-Aug		0.081	0.085	0.092	0.195		52%	54%	59%	124%
33	19-Aug		0.081	0.084	0.087	0.317		51%	53%	56%	202%
34	26-Aug		0.080	0.082	0.091	0.153		51%	52%	58%	97%
35	2-Sep		0.078	0.083	0.088	0.150		50%	53%	56%	96%
36	9-Sep		0.048	0.053	0.056	0.098		31%	34%	36%	63%
37	16-Sep		0.049	0.053	0.055	0.119		31%	34%	35%	76%
38	23-Sep		0.051	0.053	0.059	0.207		33%	34%	38%	132%
39	30-Sep		0.051	0.054	0.059	0.135		33%	35%	38%	86%
40	7-Oct		0.022	0.025	0.029	0.079		14%	16%	18%	51%
41	14-Oct		0.022	0.026	0.032	0.115		14%	17%	20%	73%
42	21-Oct		0.026	0.028	0.036	0.153		17%	18%	23%	97%
43	28-Oct		0.026	0.029	0.033	0.098		17%	19%	21%	63%
44	4-Nov		0.025	0.030	0.036	0.090		16%	19%	23%	57%
45	11-Nov		0.004	0.011	0.016	0.073		3%	7%	10%	46%
46	18-Nov		0.005	0.010	0.016	0.051		3%	6%	10%	33%
47	25-Nov		0.003	0.007	0.013	0.040		2%	4%	8%	25%
48	2-Dec		0.003	0.006	0.011	0.035		2%	4%	7%	22%
49	9-Dec		0.003	0.006	0.010	0.035		2%	4%	6%	22%
50	16-Dec		0.003	0.006	0.010	0.025		2%	4%	6%	16%
51	23-Dec		0.003	0.006	0.009	0.025		2%	4%	6%	16%
52	31-Dec		0.004	0.006	0.008	0.023		3%	4%	5%	15%

Naramata Creek maximum licensed percentile flow data

MAX LICENSED FLOW			as m³/s				as %LTMAD			
Week	Ending		Min	P20	Median	Max		Min	P20	Median	Max
01	7-Jan		0.004	0.005	0.008	0.020		3%	3%	5%	13%
02	14-Jan		0.004	0.005	0.011	0.020		3%	3%	7%	13%
03	21-Jan		0.004	0.005	0.010	0.020		3%	3%	6%	13%
04	28-Jan		0.004	0.005	0.008	0.020		2%	3%	5%	13%
05	4-Feb		0.004	0.005	0.007	0.025		2%	3%	5%	16%
06	11-Feb		0.003	0.005	0.007	0.021		2%	3%	5%	13%
07	18-Feb		0.003	0.005	0.007	0.021		2%	3%	5%	13%
08	25-Feb		0.004	0.005	0.007	0.022		2%	3%	5%	14%
09	4-Mar		0.004	0.005	0.008	0.024		2%	3%	5%	15%
10	11-Mar		0.005	0.006	0.007	0.027		3%	4%	5%	17%
11	18-Mar		0.005	0.006	0.008	0.031		3%	4%	5%	20%
12	25-Mar		0.005	0.007	0.009	0.036		3%	4%	6%	23%
13	1-Apr		0.006	0.007	0.016	0.051		4%	4%	10%	32%
14	8-Apr		0.001	0.009	0.021	0.062		1%	6%	13%	40%
15	15-Apr		0.000	0.027	0.038	0.335		0%	17%	24%	214%
16	22-Apr		0.004	0.064	0.103	0.363		3%	41%	66%	231%
17	29-Apr		0.001	0.141	0.277	0.711		1%	90%	177%	453%
18	6-May		0.002	0.176	0.368	2.397		1%	112%	235%	1529%
19	13-May		0.065	0.194	0.360	1.995		42%	124%	229%	1272%
20	20-May		0.298	0.375	0.749	2.317		190%	239%	478%	1478%
21	27-May		0.301	0.496	1.049	2.358		192%	316%	669%	1504%
22	3-Jun		0.232	0.409	0.863	2.527		148%	261%	550%	1612%
23	10-Jun		0.098	0.292	0.599	1.928		63%	187%	382%	1230%
24	17-Jun		0.000	0.113	0.383	1.539		0%	72%	244%	982%
25	24-Jun		0.000	0.000	0.139	1.389		0%	0%	89%	886%
26	1-Jul		0.000	0.000	0.000	0.876		0%	0%	0%	559%
27	8-Jul		0.000	0.000	0.000	0.450		0%	0%	0%	287%
28	15-Jul		0.000	0.000	0.000	0.138		0%	0%	0%	88%
29	22-Jul		0.000	0.000	0.000	0.000		0%	0%	0%	0%
30	29-Jul		0.000	0.000	0.000	0.000		0%	0%	0%	0%
31	5-Aug		0.000	0.000	0.000	0.000		0%	0%	0%	0%
32	12-Aug		0.000	0.000	0.000	0.000		0%	0%	0%	0%
33	19-Aug		0.000	0.000	0.000	0.000		0%	0%	0%	0%
34	26-Aug		0.000	0.000	0.000	0.000		0%	0%	0%	0%
35	2-Sep		0.000	0.000	0.000	0.000		0%	0%	0%	0%
36	9-Sep		0.000	0.000	0.000	0.021		0%	0%	0%	13%
37	16-Sep		0.000	0.000	0.000	0.116		0%	0%	0%	74%
38	23-Sep		0.000	0.000	0.000	0.203		0%	0%	0%	130%
39	30-Sep		0.000	0.000	0.019	0.112		0%	0%	12%	71%
40	7-Oct		0.000	0.000	0.009	0.067		0%	0%	6%	43%
41	14-Oct		0.019	0.022	0.024	0.110		12%	14%	15%	70%
42	21-Oct		0.025	0.028	0.033	0.150		16%	18%	21%	96%
43	28-Oct		0.026	0.028	0.032	0.097		16%	18%	20%	62%
44	4-Nov		0.025	0.029	0.035	0.089		16%	19%	23%	57%
45	11-Nov		0.004	0.010	0.015	0.072		2%	7%	10%	46%
46	18-Nov		0.004	0.009	0.016	0.051		3%	6%	10%	32%
47	25-Nov		0.003	0.006	0.013	0.040		2%	4%	8%	25%
48	2-Dec		0.002	0.005	0.011	0.034		1%	3%	7%	22%
49	9-Dec		0.002	0.006	0.010	0.035		1%	4%	6%	22%
50	16-Dec		0.002	0.006	0.009	0.024		1%	4%	6%	16%
51	23-Dec		0.003	0.006	0.008	0.024		2%	4%	5%	15%
52	31-Dec		0.004	0.005	0.008	0.023		3%	4%	5%	15%