

**WASKADA UNIT NO. 9  
WATERFLOOD EOR PROJECT**

**ANNUAL WATERFLOOD PROGRESS REPORT FOR 2015**

**June 30, 2016**

**Tundra Oil and Gas Partnership**

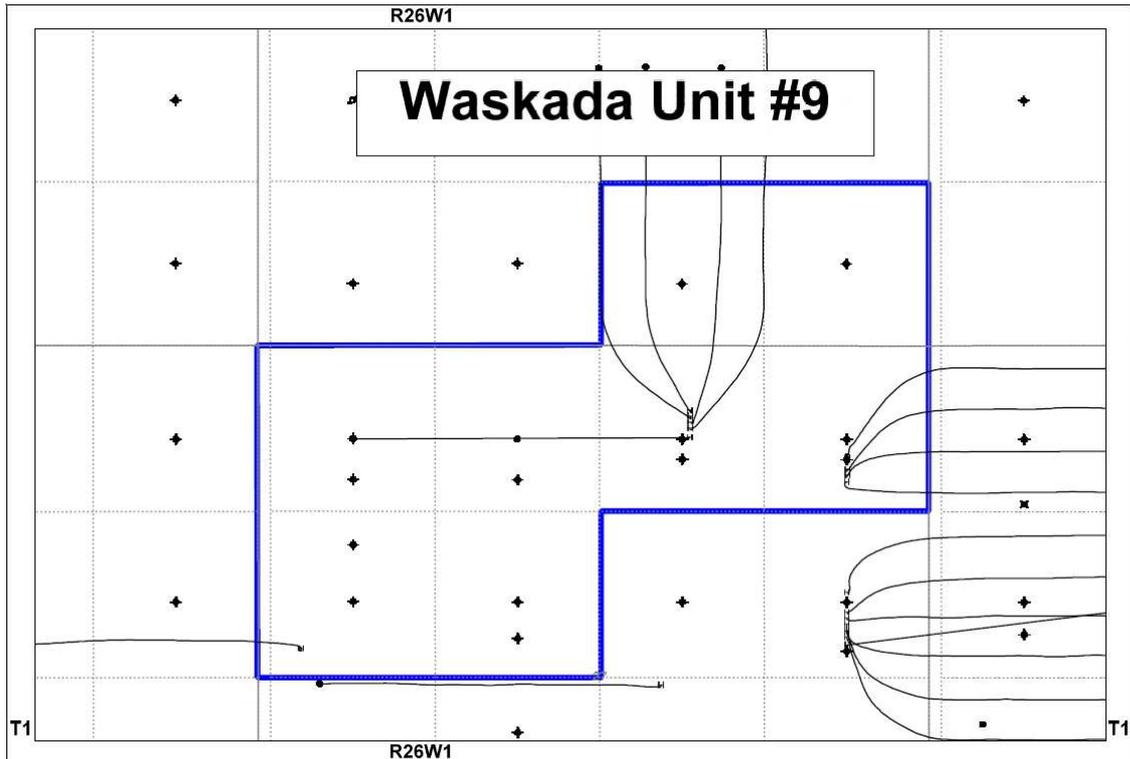
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## **INTRODUCTION**

Waskada Unit No. 9 Enhanced Oil Recovery (EOR) Waterflood Project was approved under Board Order No. PM 49 effective April 1986. The Unit area contains 10 abandoned wells, including 2 abandoned injectors, and 1 producing well in 8 LSDs in Township 1, Range 26 W1 as shown in the figure below.

**Figure 1: Waskada Unit 8 Area Outline**



In accordance with Section 73 of the Manitoba Drilling and Production Regulation, Tundra hereby submits the following 2015 Annual Progress Report for Waskada Unit No. 9.

## DISCUSSION

### Production History

For the wells included in Waskada Unit No. 9, production started in October 1982 with the 00/11-27-001-26W1/0 Vertical well. Average oil production peaked for the first time at 7.6 m<sup>3</sup>/d per well in March 1983. This production was coming from 5 wells and totaled 37.8 m<sup>3</sup>/d for the whole Unit. The production at the end of December 2015 averaged 0.1 m<sup>3</sup>/d per well, totaling 0.1 m<sup>3</sup>/day for the Unit. Water injection commenced in Waskada Unit No. 9 in May 1986 until end of January 1988. The rates and WOR are presented in Figure 2. There was no water injection through 2015, and there are no plans for injector re-activation.

**Figure 2: Waskada Unit 8 Production/Injection Rates and WOR vs Time**

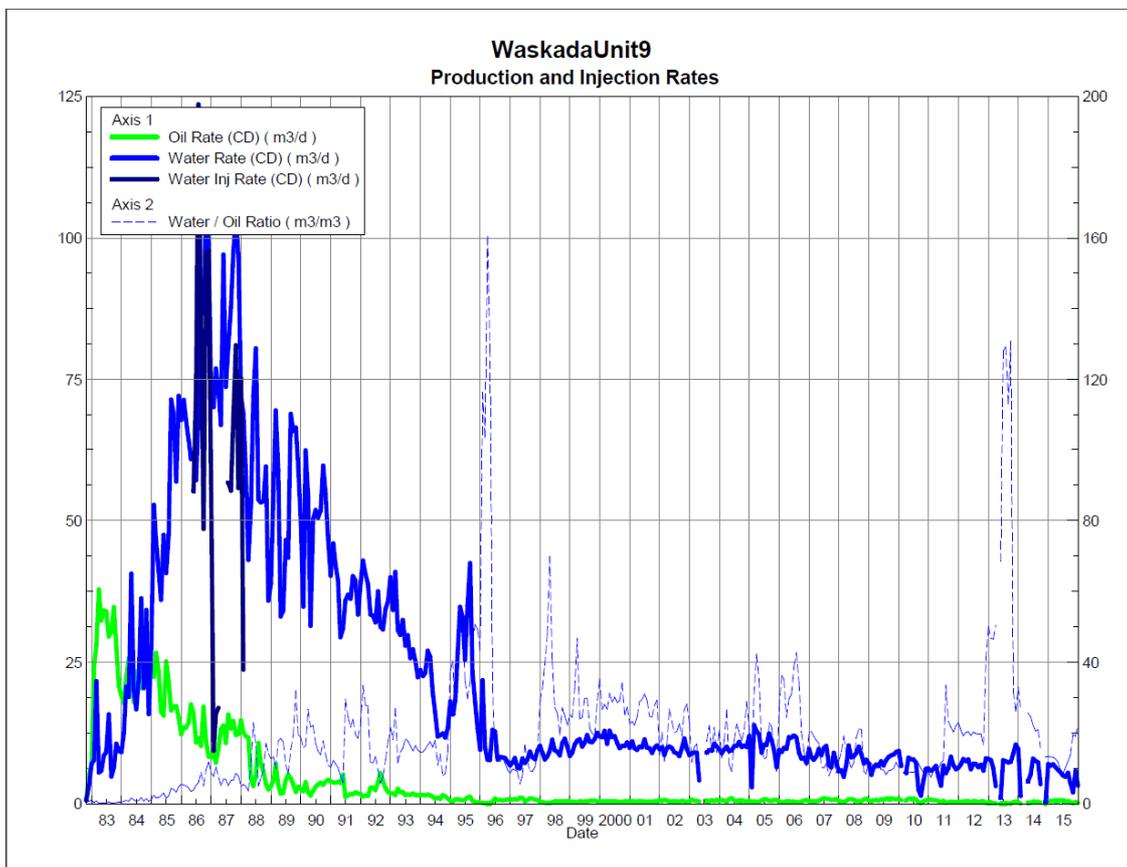
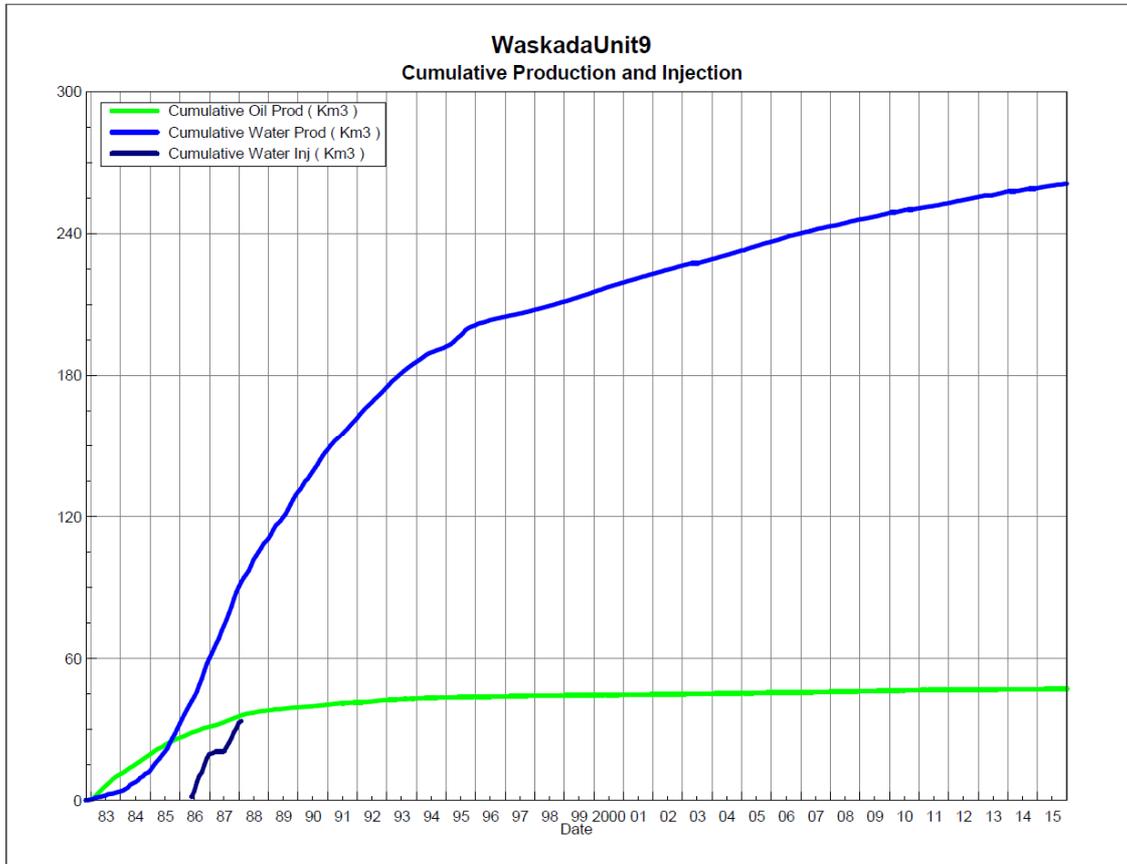


Figure 3 shows the cumulative production for Waskada Unit No. 9 to the end of December 2015 as 47.1 e<sup>3</sup>m<sup>3</sup> of oil, and 261.0 e<sup>3</sup>m<sup>3</sup> of water.

**Figure 3: Waskada Unit 9 Cumulative Oil, Water and Water Injected vs Time**



## **Waterflood EOR Operating Strategy and Performance**

### **Corrosion and Scale Prevention**

The facilities in Unit 9 are currently using cathodic and chemical protection against corrosion and scale in the new horizontal wells. All facilities are monitored every 3 months to assess the corrosion and ensure that proper electrical current is being supplied. There have been no issues with corrosion or scale to date.

### **Injection Wellhead Pressures**

No injection wellhead pressures were recorded in 2015.

## Reservoir Pressure

Where practical, Tundra is committed to collecting pressure data from newly drilled injection wells. Since no new wells were drilled in the Unit, therefore, no pressure surveys were conducted in 2015.

## Well Servicing

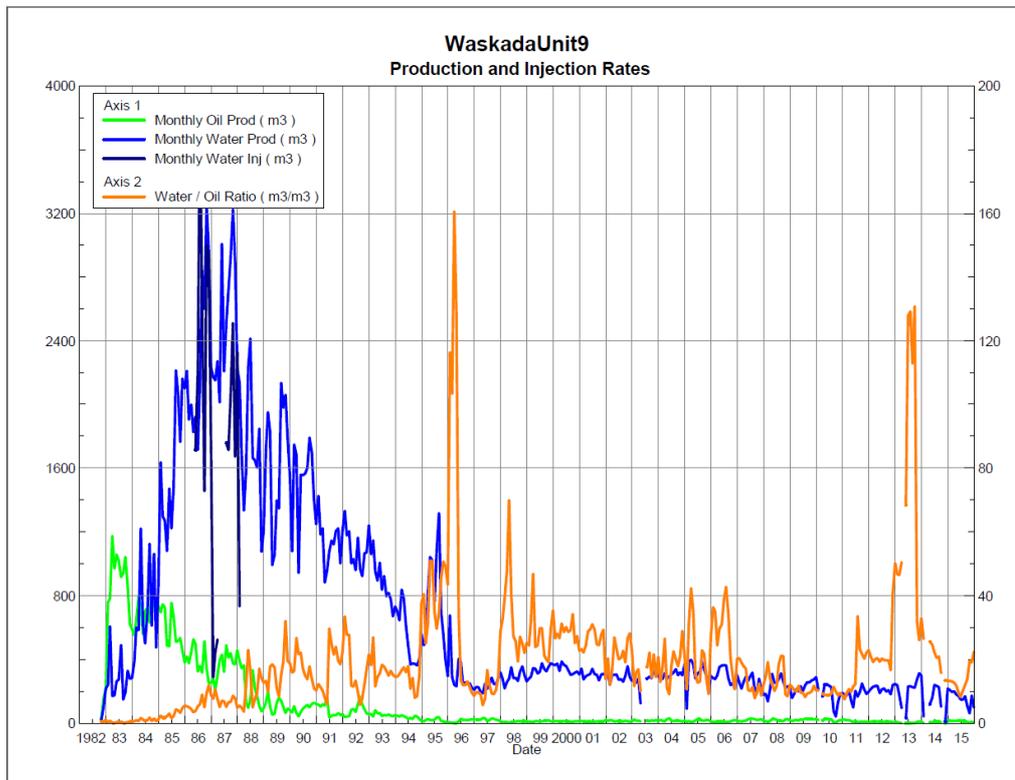
No well servicing was performed in 2015 for Waskada Unit No. 9.

## Waterflood Performance Discussion

From January 1 to December 31 in 2015, Waskada Unit No. 4 produced 2.0 e3m3 of fluid (0.1 e3m3 of Oil, 1.9 e3m3 of Water). There is no active injection in this Unit, and Tundra Oil and Gas has no plans to reactivate injection in the near future. Due to the vertical well being produced and no pressure support occurring in the Unit, the cumulative VRR has dropped in the last 17 years, down to 0.106.

Table 2 summarizes the yearly and cumulative VRR for Waskada Unit No. 9.

**Figure 4: Waskada Unit 9 Production and Injection Rate**



**TABLE NO. 1: WASKADA UNIT NO. 9 WELL SUMMARY**

<i>UWI</i>	<i>Type</i>	<i>Status</i>	<i>On Prod Date</i>	<i>Cum Prd Oil (m3)</i>	<i>Cum Prd Water (m3)</i>	<i>Last Prod Date</i>	<i>Cum Inj Water (m3)</i>	<i>Last Inj Date</i>
100/11-27-001-26W1/0	Vertical	Abandoned	10/1/1982	2584.7	6471.5	10/31/1989	19497.4	12/31/1986
102/12-27-001-26W1/2	Vertical	Abandoned	2/1/1986	2850.7	20555.8	2/28/1993	0	
100/13-27-001-26W1/0	Vertical	Abandoned	12/1/1982	11442.7	63342.1	2/29/1996	0	
102/13-27-001-26W1/2	Vertical	Abandoned	3/1/1989	65.5	2845.9	4/30/1991	0	
100/14-27-001-26W1/0	Vertical	Producing	12/1/1982	13314.4	75030	12/31/2015	0	
100/15-27-001-26W1/0	Vertical	Abandoned	2/1/1983	5156.1	20053.4	10/31/1989	0	
102/15-27-001-26W1/2	Vertical	Abandoned	3/1/1989	50.3	9217	2/28/1991	0	
100/16-27-001-26W1/0	Vertical	Abandoned	12/1/1982	10801.5	43800.9	4/30/1991	0	
102/16-27-001-26W1/2	Vertical	Abandoned	6/1/1990	576.9	15167.3	6/30/1996	0	
100/01-34-001-26W1/0	Vertical	Abandoned	12/1/1984	281.2	4176.3	2/28/1986	14027.8	1/31/1988
100/02-34-001-26W1/0	Vertical	Abandoned	6/1/1983	20.7	369.5	8/31/1983	0	
				47144.7	261029.7		33525.2	

**TABLE NO. 2 - VRR Calculations**

Date	Mth Oil Prod m3	Cum Oil Prod Km3	Mth Water Prod m3	Cum Water Prod Km3	Water Oil Ratio m3/m3	Mth Water Inj m3	Cum Water Inj Km3	VRR	Cum VRR
12/31/1982	401	401.100	340	339.800	0.85		0.000	0.000	0.000
12/31/1983	10722	11123.400	3451	3790.300	0.32		0.000	0.000	0.000
12/31/1984	8359	19482.800	8731	12521.000	1.04		0.000	0.000	0.000
12/31/1985	6954	26436.500	19766	32287.000	2.84		0.000	0.000	0.000
12/31/1986	4623	31059.500	27611	59897.700	5.97	19497	19497.400	0.592	0.204
12/31/1987	4475	35534.300	30348	90245.500	6.78	13295	32792.600	0.375	0.250
12/31/1988	2481	38015.400	20434	110679.000	8.24	733	33525.200	0.031	0.217
12/31/1989	1310	39325.300	19773	130451.700	15.09		33525.200	0.000	0.191
12/31/1990	1135	40459.900	17857	148308.400	15.74		33525.200	0.000	0.172
12/31/1991	967	41427.000	13640	161948.800	14.10		33525.200	0.000	0.160
12/31/1992	983	42410.400	13127	175076.000	13.35		33525.200	0.000	0.150
12/31/1993	651	43061.800	10603	185678.900	16.28		33525.200	0.000	0.143
12/31/1994	442	43503.700	6492	192171.100	14.69		33525.200	0.000	0.138
12/31/1995	237	43740.800	8991	201161.800	37.92		33525.200	0.000	0.133
12/31/1996	183	43923.700	3652	204813.500	19.97		33525.200	0.000	0.131
12/31/1997	278	44201.600	2918	207731.900	10.50		33525.200	0.000	0.130
12/31/1998	118	44319.300	3460	211191.500	29.39		33525.200	0.000	0.128
12/31/1999	152	44471.700	4031	215222.400	26.45		33525.200	0.000	0.126
12/31/2000	145	44617.100	4067	219289.100	27.97		33525.200	0.000	0.124
12/31/2001	148	44765.200	3657	222945.600	24.69		33525.200	0.000	0.122
12/31/2002	167	44932.300	3483	226428.100	20.84		33525.200	0.000	0.121
12/31/2003	167	45099.700	2716	229143.700	16.22		33525.200	0.000	0.119
12/31/2004	214	45313.800	3690	232833.500	17.23		33525.200	0.000	0.118
12/31/2005	194	45507.800	3663	236496.000	18.88		33525.200	0.000	0.116
12/31/2006	142	45649.300	3588	240083.600	25.35		33525.200	0.000	0.115
12/31/2007	248	45896.800	2979	243062.100	12.03		33525.200	0.000	0.113
12/31/2008	219	46115.500	2871	245933.300	13.13		33525.200	0.000	0.112
12/31/2009	277	46392.600	2773	248706.700	10.01		33525.200	0.000	0.111
12/31/2010	211	46603.800	1946	250653.100	9.22		33525.200	0.000	0.110
12/31/2011	154	46757.300	2208	252860.800	14.38		33525.200	0.000	0.109
12/31/2012	119	46876.300	2606	255466.400	21.90		33525.200	0.000	0.108
12/31/2013	48	46924.600	2343	257809.300	48.51		33525.200	0.000	0.108
12/31/2014	69	46994.000	1354	259163.500	19.51		33525.200	0.000	0.107
12/31/2015	151	47144.700	1866	261029.700	12.38		33525.200	0.000	0.106

TABLE NO. 3

**Tundra Oil and Gas  
Waskada Unit No. 9  
2015 Injection Volumes**

Well Location	Date	Hours On	H <sub>2</sub> O Inj Cal-d avg (m <sup>3</sup> /d)	Monthly Injected H <sub>2</sub> O (m <sup>3</sup> )
<b>Unit No. 9 Total:</b>				
	Jan-15	0	0.0	0.00
	Feb-15	0	0.0	0.00
	Mar-15	0	0.0	0.00
	Apr-15	0	0.0	0.00
	May-15	0	0.0	0.00
	Jun-15	0	0.0	0.00
	Jul-15	0	0.0	0.00
	Aug-15	0	0.0	0.00
	Sep-15	0	0.0	0.00
	Oct-15	0	0.0	0.00
	Nov-15	0	0.0	0.00
	Dec-15	0	0.0	0.00
<b>2015 Group Totals:</b>				0.00
<b>Unit No. 9 Total:</b>				
	1981	0	0	0.00
	1982	0	0	0.00
	1983	0	0	0.00
	1984	0	0	0.00
	1985	0	0	0.00
	1986	0	79.5	2,437.18
	1987	0	48.3	1,477.24
	1988	0	23.6	732.60
	1989	0	0.0	0.00
	1990	0	0.0	0.00
	1991	0	0.0	0.00
	1992	0	0.0	0.00
	1993	0	0.0	0.00
	1994	0	0.0	0.00
	1995	0	0.0	0.00
	1996	0	0.0	0.00
	1997	0	0.0	0.00
	1998	0	0.0	0.00
	1999	0	0.0	0.00
	2000	0	0.0	0.00
	2001	0	0.0	0.00
	2002	0	0.0	0.00
	2003	0	0.0	0.00
	2004	0	0.0	0.00
	2005	0	0.0	0.00
	2006	0	0.0	0.00
	2007	0	0.0	0.00
	2008	0	0.0	0.00
	2009	0	0.0	0.00
	2010	0	0.0	0.00
	2011	0	0.0	0.00
	2012	0	0.0	0.00
	2013	0	0.0	0.00
	2014	0	0.0	0.00
	2015	0	0.0	0.00
<b>Group Totals:</b>				4,647.02

TABLE NO. 4

**Tundra Oil and Gas  
Waskada Unit No. 9  
2015 Production Volumes**

Date	Hours On	Oil Rate (CD) m3/d	Monthly Oil Prod m3	Water Rate (CD) m3/d	Monthly Water Prod m3	Water Oil Ratio m3/m3	Well Count
Jan-15	715	0.51	16	6.73	209	13	1
Feb-15	672	0.53	15	7.00	196	13	1
Mar-15	744	0.51	16	6.46	200	13	1
Apr-15	706	0.51	15	5.98	179	12	1
May-15	739	0.58	18	5.55	172	10	1
Jun-15	715	0.60	18	4.98	150	8	1
Jul-15	744	0.46	14	4.77	148	10	1
Aug-15	744	0.45	14	5.45	169	12	1
Sep-15	720	0.26	8	3.63	109	14	1
Oct-15	744	0.10	3	2.02	63	20	1
Nov-15	720	0.30	9	5.78	173	19	1
Dec-15	384	0.14	4	3.18	99	22	1
	8,347		151		1,866		

Date	Hours On	Oil Rate (CD) m3/d	Monthly Oil Prod m3	Water Rate (CD) m3/d	Monthly Water Prod m3	Water Oil Ratio m3/m3	Well Count
31/12/1982	2136	4.37	134	3.69	113	0.78	1
31/12/1983	41568	29.38	894	9.53	288	0.35	5
31/12/1984	39120	22.86	697	23.83	728	1.05	5
31/12/1985	49152	19.11	579	54.09	1647	3.07	6
31/12/1986	41136	12.68	385	75.59	2301	6.47	5
31/12/1987	38112	12.22	373	83.10	2529	7.04	4
31/12/1988	34728	6.78	207	55.84	1703	10.91	4
31/12/1989	45672	3.61	109	54.26	1648	16.75	5
31/12/1990	50232	3.11	95	49.01	1488	16.79	6
31/12/1991	39960	2.65	81	37.38	1137	17.32	5
31/12/1992	32304	2.68	82	35.86	1094	16.67	4
31/12/1993	27384	1.78	54	29.12	884	16.69	3
31/12/1994	26232	1.21	37	17.82	541	15.97	3
31/12/1995	25848	0.65	20	24.57	749	40.50	3
31/12/1996	13488	0.50	15	9.97	304	51.88	2
31/12/1997	8760	0.76	23	7.99	243	11.89	1
31/12/1998	8760	0.32	10	9.47	288	33.42	1
31/12/1999	8760	0.42	13	11.04	336	28.03	1
31/12/2000	8520	0.40	12	11.12	339	28.19	1
31/12/2001	8688	0.41	12	10.02	305	25.69	1
31/12/2002	8760	0.46	14	9.54	290	21.61	1
31/12/2003	6864	0.55	17	8.92	272	16.56	1
31/12/2004	8760	0.59	18	10.08	307	18.88	1
31/12/2005	8184	0.53	16	10.07	305	21.23	1
31/12/2006	8450	0.39	12	9.83	299	28.15	1
31/12/2007	8,623	0.68	21	8.16	248	13.06	1
31/12/2008	8,707	0.60	18	7.84	239	14.36	1
31/12/2009	8,580	0.76	23	7.59	231	10.15	1
31/12/2010	6,367	0.63	19	5.78	177	9.43	1
31/12/2011	7,807	0.42	13	6.05	184	17.07	1
31/12/2012	8,580	0.33	10	7.13	217	23.90	1
31/12/2013	6,608	0.14	4	7.00	213	73.09	1
31/12/2014	4,543	0.25	8	4.91	150	20.31	1
31/12/2015	8,347	0.41	13	5.13	156	13.81	1
	659,740		4,036		21,953		