

**WASKADA UNIT NO. 10  
WATERFLOOD EOR PROJECT**

**ANNUAL WATERFLOOD PROGRESS REPORT FOR 2015**

**June 30, 2016**

**Tundra Oil and Gas Partnership**

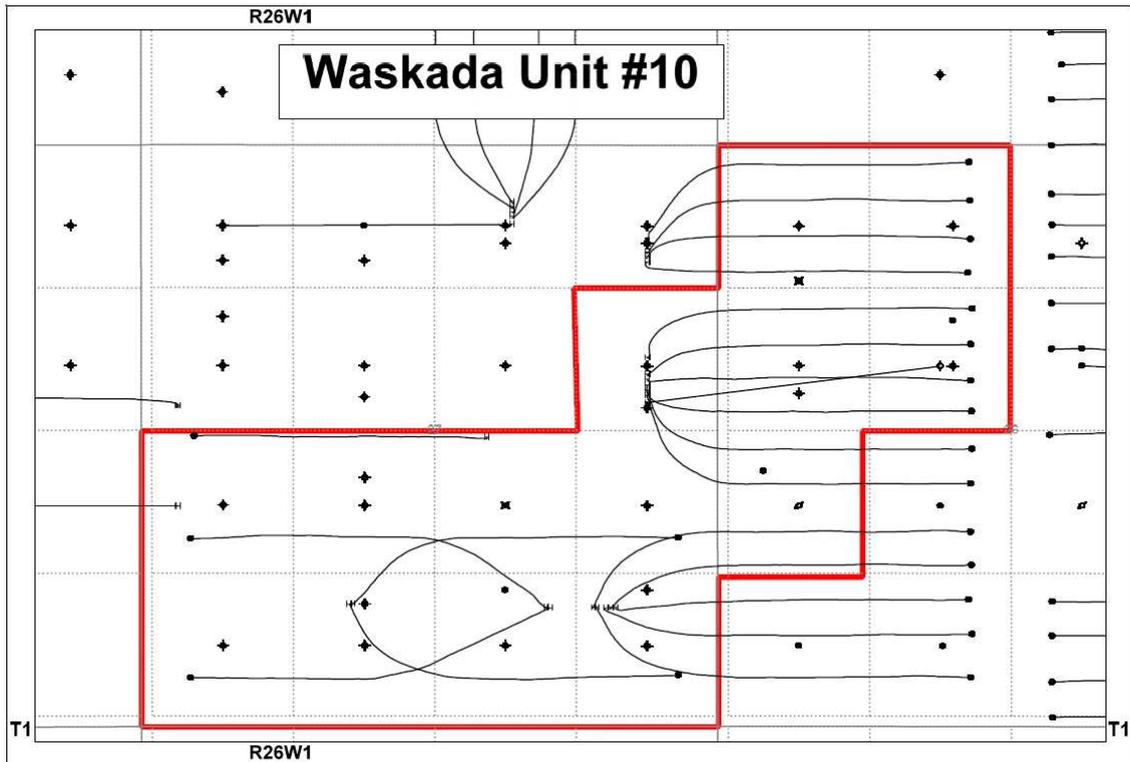
## Table of Contents

Introduction	3.
Discussion	4.
Production History	4.
Waterflood EOR Operating Strategy and Performance	5.
Water Source and Quality	5.
Injection Wellhead Pressures	5.
Reservoir Pressure	6.
Well Servicing	6.
Waterflood Performance Discussion	6.
List of Appendices	7.
Table 1: Waskada Unit No. 10 Well List and History	
Table 2: Waskada Unit No. 10 Voidage Replacement Ratio Calculation	
Table 3: Waskada Unit No. 10 Monthly Injection Table	
Table 4: Summary of Producing Wells	

## **INTRODUCTION**

Waskada Unit No. 10 Enhanced Oil Recovery (EOR) Waterflood Project was approved under Board Order No. PM 46 effective February 1986. The Unit area contains 5 abandoned wells, including 2 abandoned injectors, and 3 producing/inactive wells in 14 LSDs in Township 1, Range 26 W1 as shown in the figure below.

**Figure 1: Waskada Unit 10 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. 10.

## **DISCUSSION**

### **Production History**

For the wells included in Waskada Unit No. 10, production started in June 1982 with the 00/06-27-001-26W1/0 Vertical well. Average oil production peaked for the first time at 4.6 m<sup>3</sup>/d per well in August 1983. This production was coming from 6 wells and totaled 27.6 m<sup>3</sup>/d for the whole Unit. The Unit did not produce any fluid throughout 2015. Water injection commenced in Waskada Unit No. 10 in February 1986 until end of March 1987. 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 10 Production/Injection Rates and WOR vs Time**

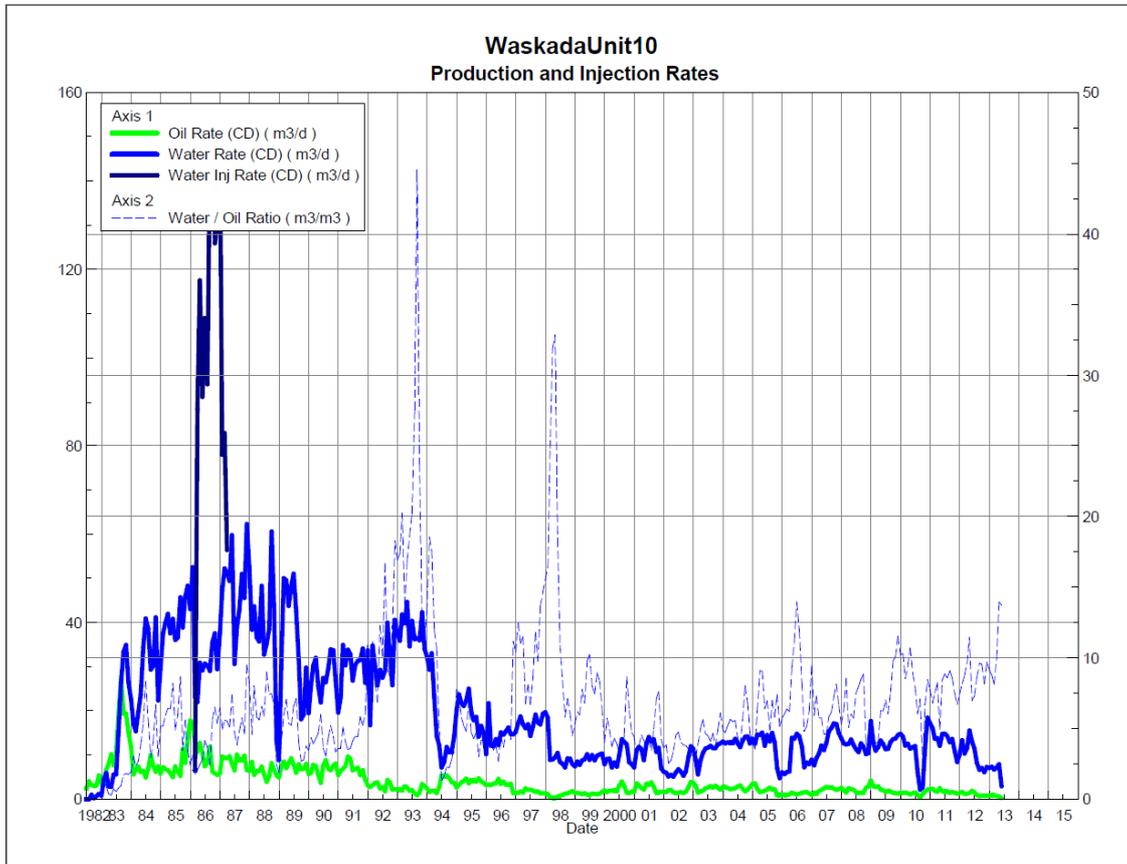
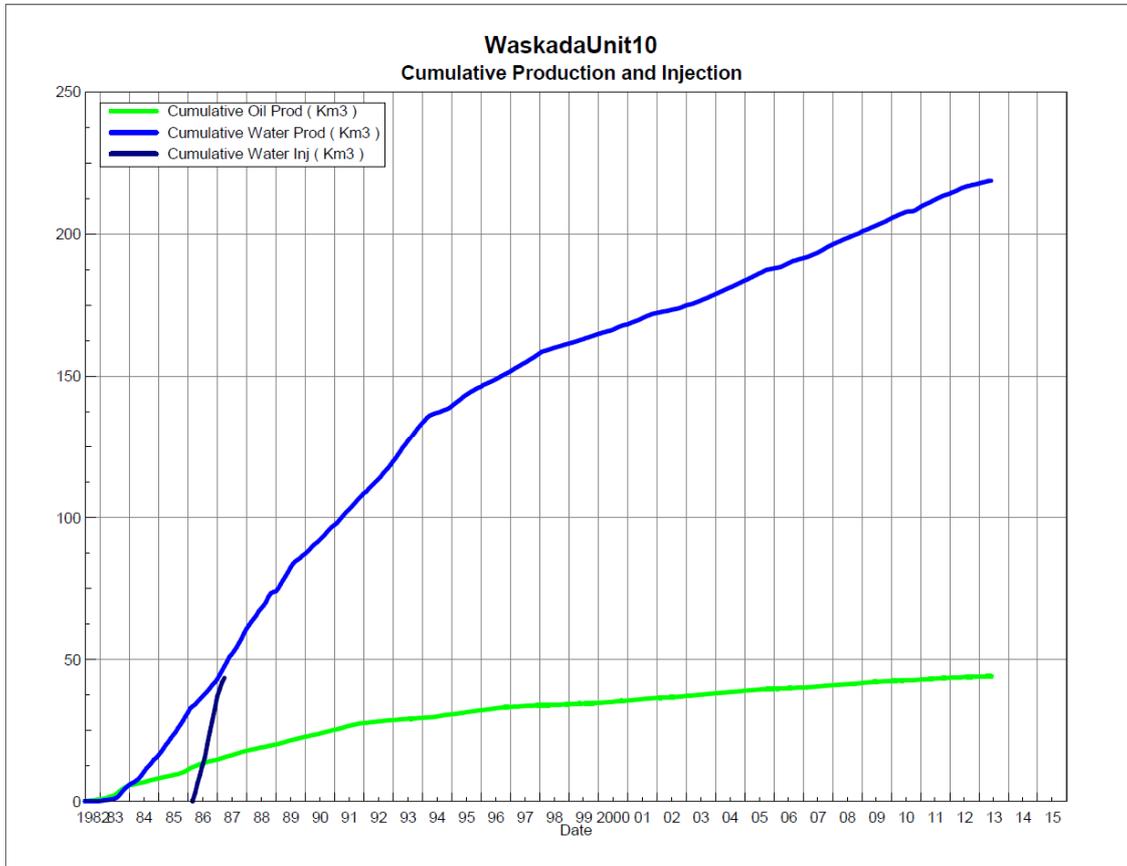


Figure 3 shows the cumulative production for Waskada Unit No. 5 to the end of December 2015 as 44.0 e<sup>3</sup>m<sup>3</sup> of oil, and 218.7 e<sup>3</sup>m<sup>3</sup> of water.

**Figure 3: Waskada Unit 10 Cumulative Oil, Water and Water Injected vs Time**



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

### **Corrosion and Scale Prevention**

The facilities in Unit 10 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

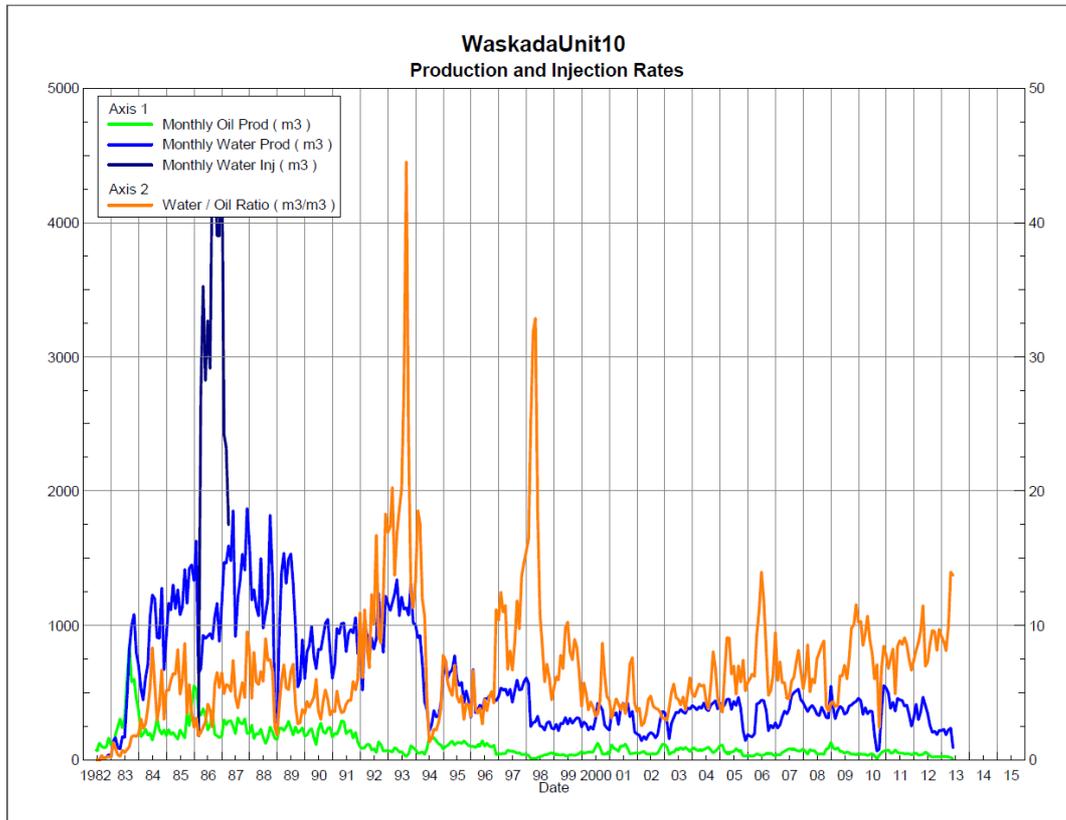
No well servicing was performed in 2015 for Waskada Unit No. 10.

## Waterflood Performance Discussion

From January 1 to December 31 in 2015, Waskada Unit No. 10 did not produce any fluid. There is no active injection in this Unit, and Tundra Oil and Gas has no plans to reactivate injection in the near future. Since there is no production nor injection in the Unit, the cumulative VRR stayed at 0.161.

Table 2 summarizes the yearly and cumulative VRR for Waskada Unit No. 10.

**Figure 4: Waskada Unit 10 Production and Injection Rate**



**TABLE NO. 1: WASKADA UNIT NO. 10 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>
102/05-26-001-26W1/0	Vertical	Pumping	7/1/1983	9962.8	42074.7	2/28/2013	0	
102/11-26-001-26W1/0	Vertical	Pumping	7/1/1983	11223.8	59764.1	5/31/2013	0	
100/12-26-001-26W1/0	Vertical	Abandoned	10/1/1982	2468.8	10515.6	9/30/1995	0	
102/13-26-001-26W1/0	Vertical	Abandoned	6/1/1983	606.6	5841.5	1/31/1986	20396.1	3/31/1987
102/01-27-001-26W1/0	Vertical	Abandoned	11/1/1985	2817.9	3839.8	4/30/1992	0	
102/02-27-001-26W1/0	Vertical	Producing	9/1/1985	6317.3	17903.5	4/30/2013	0	
102/03-27-001-26W1/0	Vertical	Abandoned	7/1/1983	1111.1	6683.3	2/28/1986	23063.4	3/31/1987
100/06-27-001-26W1/0	Vertical	Abandoned	6/1/1982	9516.3	72103.6	3/31/1994	0	
				44024.6	218726.1		43459.5	

**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	746	745.800	116	116.100	0.16		0.000	0.000	0.000
12/31/1983	4862	5608.000	5682	5797.600	1.17		0.000	0.000	0.000
12/31/1984	2459	8067.300	10451	16248.300	4.25		0.000	0.000	0.000
12/31/1985	3082	11149.200	14963	31211.200	4.86		0.000	0.000	0.000
12/31/1986	3480	14629.400	11801	43011.900	3.39	36972	36972.300	2.340	0.618
12/31/1987	3134	17763.500	17724	60736.000	5.66	6487	43459.500	0.304	0.535
12/31/1988	2244	20007.700	13246	73982.100	5.90		43459.500	0.000	0.448
12/31/1989	2712	22719.700	13189	87171.400	4.86		43459.500	0.000	0.384
12/31/1990	2461	25181.100	10116	97287.400	4.11		43459.500	0.000	0.344
12/31/1991	2410	27591.300	11202	108489.400	4.65		43459.500	0.000	0.310
12/31/1992	1059	28650.000	11251	119740.400	10.63		43459.500	0.000	0.285
12/31/1993	791	29440.500	13790	133530.700	17.45		43459.500	0.000	0.260
12/31/1994	1223	30663.600	5883	139413.900	4.81		43459.500	0.000	0.249
12/31/1995	1430	32093.200	6862	146275.700	4.80		43459.500	0.000	0.237
12/31/1996	1164	33257.600	5412	151687.800	4.65		43459.500	0.000	0.229
12/31/1997	617	33874.300	6348	158035.700	10.29		43459.500	0.000	0.221
12/31/1998	352	34225.800	3445	161481.100	9.80		43459.500	0.000	0.216
12/31/1999	466	34691.800	3342	164822.900	7.17		43459.500	0.000	0.212
12/31/2000	767	35459.100	3451	168273.500	4.50		43459.500	0.000	0.208
12/31/2001	941	36400.000	4000	172273.300	4.25		43459.500	0.000	0.203
12/31/2002	750	37149.600	2593	174866.000	3.46		43459.500	0.000	0.200
12/31/2003	882	38031.800	3962	178828.000	4.49		43459.500	0.000	0.195
12/31/2004	930	38962.200	4774	183602.400	5.13		43459.500	0.000	0.190
12/31/2005	701	39663.200	4307	187909.300	6.14		43459.500	0.000	0.186
12/31/2006	445	40108.200	3616	191525.400	8.13		43459.500	0.000	0.183
12/31/2007	798	40905.700	4784	196309.500	6.00		43459.500	0.000	0.179
12/31/2008	782	41687.300	4508	200817.900	5.77		43459.500	0.000	0.175
12/31/2009	708	42395.700	4655	205472.600	6.57		43459.500	0.000	0.171
12/31/2010	502	42898.100	4003	209475.200	7.97		43459.500	0.000	0.168
12/31/2011	622	43519.700	4714	214189.300	7.58		43459.500	0.000	0.164
12/31/2012	410	43930.000	3576	217765.600	8.72		43459.500	0.000	0.162
12/31/2013	95	44024.600	961	218726.100	10.15		43459.500	0.000	0.161
12/31/2014		44024.600		218726.100			43459.500		0.161
12/31/2015		44024.600		218726.100			43459.500		0.161

TABLE NO. 3

**Tundra Oil and Gas  
Waskada Unit No. 10  
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>				<b>0.00</b>
<b>Unit No. 10 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	109.96	3,361.12
	1987	0	72.4	2,162.40
	1988	0	0.0	0.00
	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>				<b>5,523.52</b>

**TABLE NO. 4**

**Tundra Oil and Gas  
Waskada Unit No. 10  
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	0	0	0	0	0	0	0
Feb-15	0	0	0	0	0	0	0
Mar-15	0	0	0	0	0	0	0
Apr-15	0	0	0	0	0	0	0
May-15	0	0	0	0	0	0	0
Jun-15	0	0	0	0	0	0	0
Jul-15	0	0	0	0	0	0	0
Aug-15	0	0	0	0	0	0	0
Sep-15	0	0	0	0	0	0	0
Oct-15	0	0	0	0	0	0	0
Nov-15	0	0	0	0	0	0	0
Dec-15	0	0	0	0	0	0	0
	0		0		0		

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	5304	3.48	107	0.54	17	0.15	1
31/12/1983	32736	13.27	405	15.50	473	1.08	4
31/12/1984	48744	6.72	205	28.49	871	4.42	6
31/12/1985	49992	8.44	257	40.98	1247	5.54	6
31/12/1986	45672	9.55	290	32.25	983	3.86	5
31/12/1987	48768	8.59	261	48.59	1477	5.84	6
31/12/1988	41160	6.13	187	36.22	1104	5.92	5
31/12/1989	45216	7.44	226	36.24	1099	4.84	5
31/12/1990	44712	6.75	205	27.74	843	4.23	5
31/12/1991	47400	6.60	201	30.71	934	5.07	6
31/12/1992	43080	2.90	88	30.77	938	11.39	5
31/12/1993	42336	2.17	66	37.82	1149	19.99	5
31/12/1994	33288	3.35	102	16.21	490	7.08	4
31/12/1995	29472	3.92	119	18.81	572	4.86	3
31/12/1996	25824	3.18	97	14.77	451	5.34	3
31/12/1997	26232	1.69	51	17.39	529	10.86	3
31/12/1998	18288	0.96	29	9.43	287	14.37	2
31/12/1999	17256	1.28	39	9.15	278	7.50	2
31/12/2000	19104	2.09	64	9.43	288	4.82	2
31/12/2001	23424	2.58	78	10.96	333	4.53	3
31/12/2002	19200	2.05	62	7.09	216	3.59	2
31/12/2003	24720	2.41	74	10.82	330	4.58	3
31/12/2004	26232	2.54	78	13.04	398	5.32	3
31/12/2005	23952	1.92	58	11.82	359	6.43	3
31/12/2006	23501	1.22	37	9.89	301	8.24	3
31/12/2007	26,088	2.18	66	13.09	399	6.09	3
31/12/2008	26,062	2.13	65	12.31	376	6.35	3
31/12/2009	26,196	1.94	59	12.74	388	7.25	3
31/12/2010	20,462	1.38	42	10.98	334	7.84	2
31/12/2011	24,499	1.70	52	12.92	393	7.71	3
31/12/2012	21,373	1.12	34	9.78	298	8.91	2
31/12/2013	5,270	0.63	19	6.37	192	10.90	1
31/12/2014							
31/12/2015							
	955,563		3,724		18,346		