

PennWest

Waskada Unit No.13

Waterflood Progress Report

January 1st – December 31st, 2014

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INTRODUCTION

The Waskada Unit No.13 pressure maintenance project commenced water injection into the Lower Amaranth designed and in accordance with Manitoba Energy and Mines Approval No. PM 58.

Please refer to Attachment 1 – Area Map.

PRESSURE MAINTENANCE: Governed by Board Order No. PM 58

UNIT INFORMATION

UNITIZED ZONE: Lower Amaranth
Original Unit, November 1, 1985 Board Order - Voluntary

POOL: Waskada Lower Amaranth A (03 29A)

This report documents the performance of the Waskada Unit No.13 pressure maintenance project for the period of January 1 to December 31, 2014. The Unit had no injection in 2014.

Unit # 13 is part of the main Waskada field. The Waskada field is situated on the northeast rim of the Williston Basin in southern Manitoba. It comprises a large portion of Township 1 and 2, Ranges 25 and 26 W1.

GEOLOGY

The Waskada Fields produce light density crude (approximately 36° API), predominantly from the Lower Amaranth formation. This is an interlaminated, shallow marine to subtidal succession of sandstones, siltstones, and shale progressively onlaps the Mississippian unconformity surface from basin center, up dip to the north and eastern basin limits in Saskatchewan and Manitoba. The fine grained reservoir rock has a complex reservoir characterization with 13 to 16 % porosity and permeability on the order of 0.5 to 15 md. The Lower Amaranth, the oldest Mesozoic unit, is a clastic red bed sequence lying directly on the Paleozoic erosional surface. It consists of a series of dolomitic siltstones and sandstones interbedded with argillaceous siltstones and shales. The section is usually subdivided into a lower sandy unit and an overlying shale unit. The lower sequence is the oil production zone. The bulk of pay is found in the laminated sandstone/siltstone facies.

The Lower Amaranth has been classified into four general lithological types:

1. Interbedded shale/siltstone/sandstone by grain size, color and texture
2. Siltstone – This lithology occurs in distinct intervals up to two or three metres in thickness. It is generally light green in color and dolomitic.
3. Laminated sandstone – This occurs in distinct sandy intervals with a wide range of grain sizes and primary sedimentary structures.

4. Massive sandstone – This lithology occurs in thin intervals and usually associated with the laminated sandstones facies. Beds are usually light grey to reddish grey in color and coarse to medium – grained.

DISCUSSION

Production and Injection Performance

Board Order No. PM 58 provided for pressure maintenance operations in Waskada Unit No.13. From the startup of injection in late 1988, injection rates fluctuated to the same degree in each injector, making it difficult to link any production responses to any injector. The Unit includes 5 injection wells, none are currently active, and 5 active producers. Pressure maintenance by water injection ceased in September 2001.

Please refer to Attachment 2 – A spreadsheet of the Unit Well List and History.

Please refer to Attachment 3 – A Production and Injection plot of the Unit.

Please refer to Attachment 4 – A spreadsheet of Unit Annual Volumes and Rates.

Please refer to Attachment 5 – A Cumulative Production and Injection plot of the Unit.

Voidage Replacement Ratio Calculation:

The Cumulative VRR from production start reached a maximum of 1.26 in 1989 and has declined in the last 4 years to 0.4. The Cumulative VRR from injection start stabilized at 2.0 dropping slowly until the last 4 years where it has declined to 0.5. The decline in both Cumulative VRR's in the last 3 years is coincident with no injection from September 2001 and low production and the startup of horizontal producers in 2011. Currently there are no active injectors in this Unit and PennWest has no plans to reactivate at this time any of the old injectors.

Please refer to Attachment 6 – A Unit Voidage Replacement Ratio Plot.

Please refer to Attachment 7 – Individual Injection Well Performance Plots.

Pressure Surveys:

Pressure Surveys were conducted on 6 wells. Pressures were in the range of 1580 kPa to 2177 kPa with average being 1833 kPa.

Corrosion and Scale Prevention Program:

Scale corrosion programs are implemented throughout the field. Wells and pipelines have mitigation measures in place.

SUMMARY AND RECOMMENDATIONS

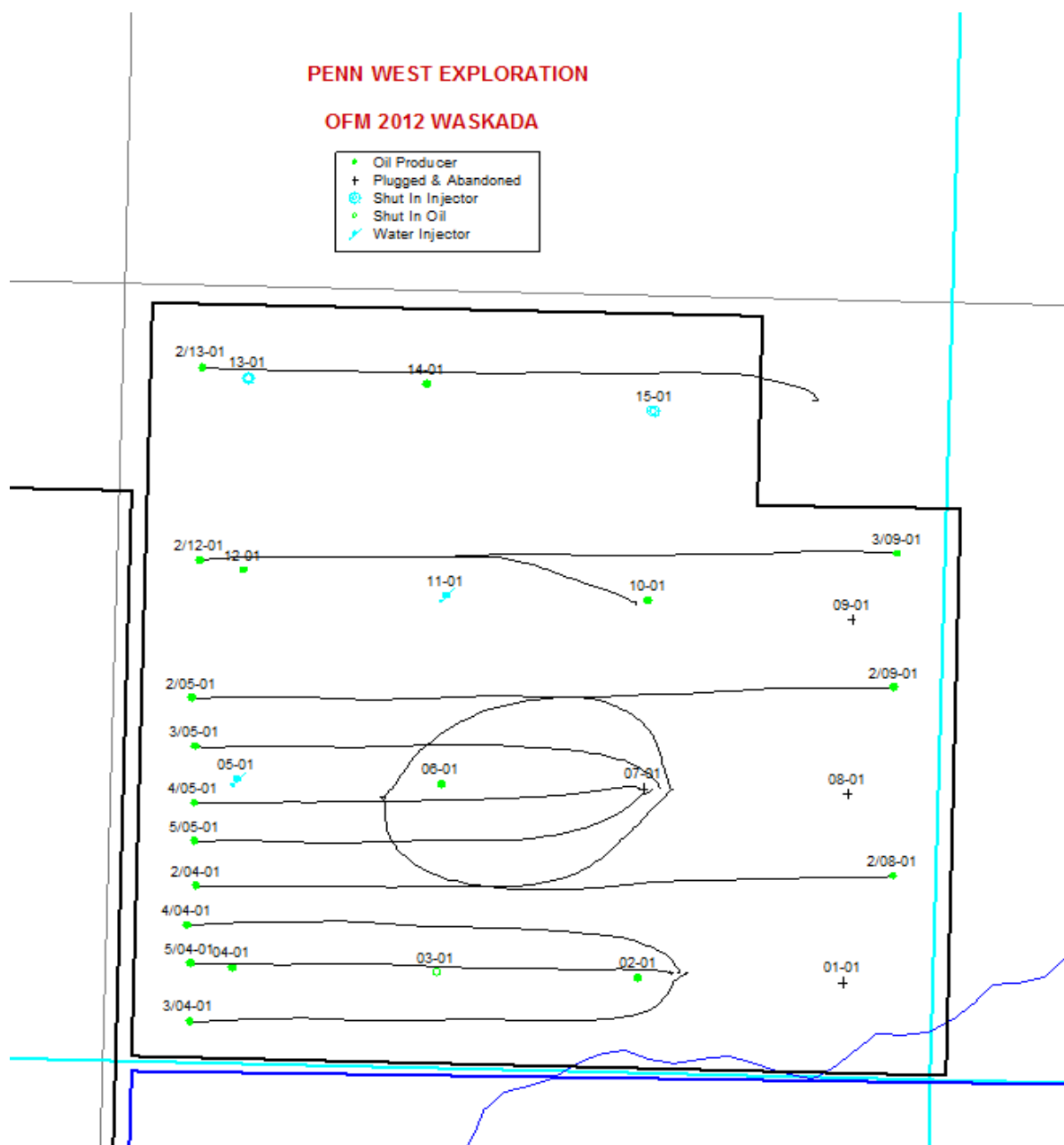
The behavior of Waskada Unit 13 producers are indicated by good initial oil productivity, rapidly declining to low decline rates, with almost no discernible water flood response. It is also believed that fracture stimulation treatments, performed on these wells prior to initiation of water injection, “broke through” into the higher productivity Mississippian and that the majority of injected water to date has entered this zone. This is one of the major explanations for lack of waterflood response to date and the continued decline in oil productivities.

ATTACHMENT 1A – UNIT AREA MAP

PENN WEST EXPLORATION

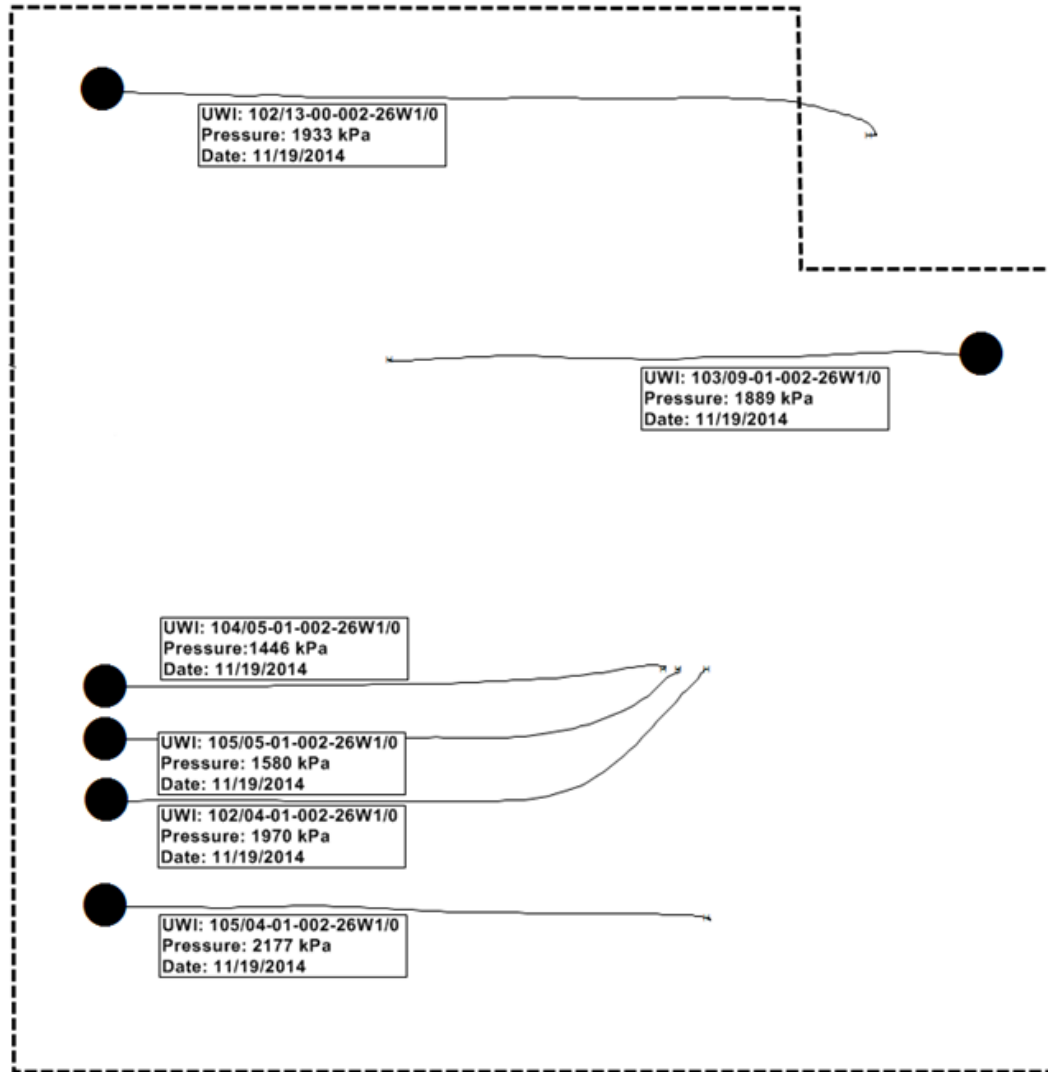
OFM 2012 WASKADA

- Oil Producer
- + Plugged & Abandoned
- ⊖ Shut In Injector
- Shut In Oil
- ↗ Water Injector



ATTACHMENT 1B - 2014 PRESSURE SURVEYS

*PennWest Exploration
Accumap 2012
Waskada Unit # 13
2014 Pressure Surveys*

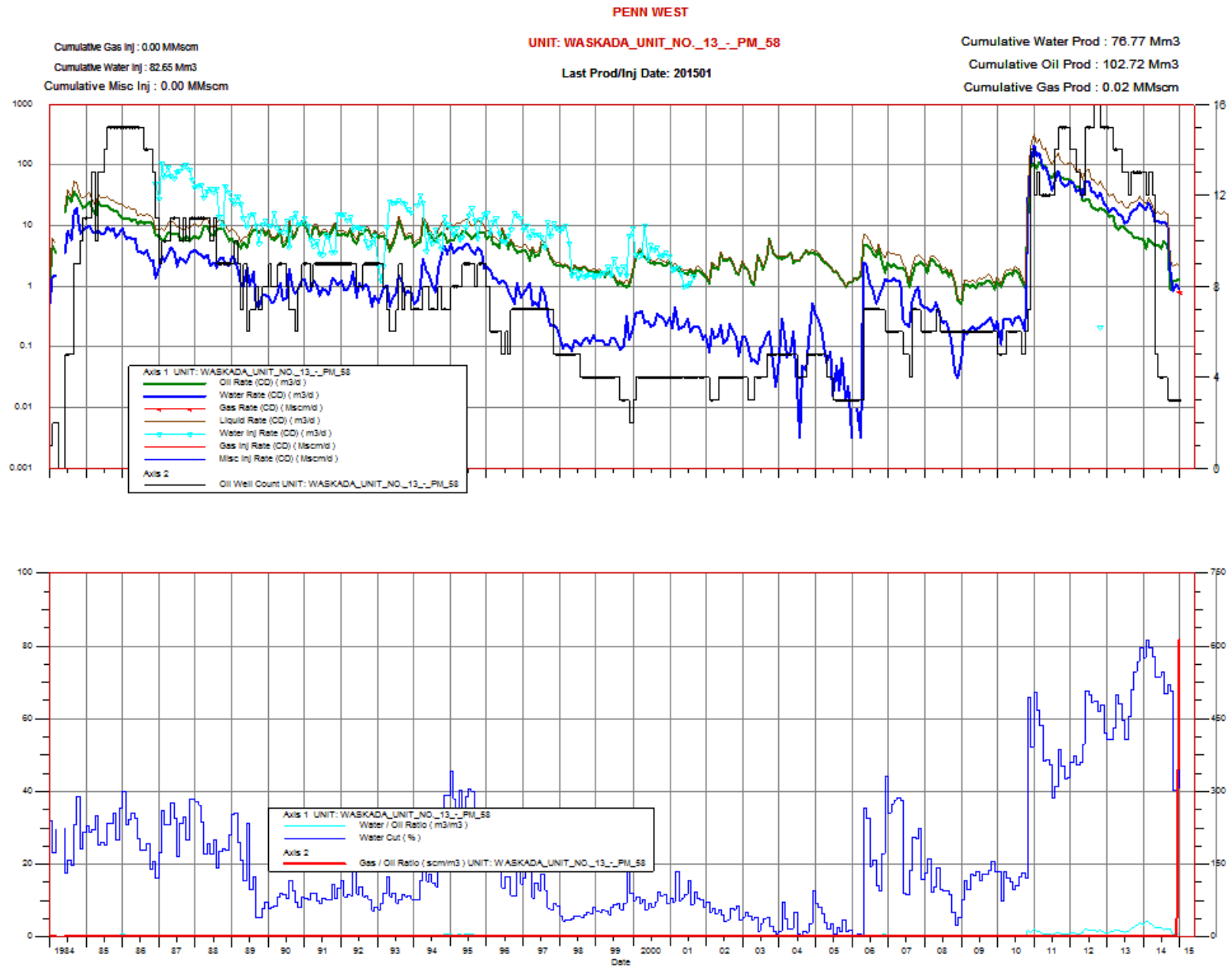


ATTACHMENT 2- UNIT HISTORY

Unit History : Waskada - Unit#13

<i>UWI</i>	<i>Completion Date</i>	<i>Operator</i>	<i>Status</i>	<i>New Drills</i>	<i>Kb Elevation</i>	<i>Total Depth</i>	<i>First prd Date</i>	<i>Cum Oil Prd</i>	<i>Cum Water Prd</i>	<i>Last Prd Date</i>	<i>First Inj Date</i>	<i>Cum Water Inj</i>	<i>Cum Gas Inj</i>	<i>Last Inj Date</i>
					<i>m</i>	<i>m</i>		<i>m3</i>	<i>m3</i>			<i>m3</i>	<i>scm</i>	
00/01-01-002-26W1/0	8/7/1984	OMEGA_HYDROC	ABD-OIL	<N/A>	471.40	953.00	9/1/1984	900.70	1029.20	2/1/1989		0.00	0.00	
00/02-01-002-26W1/0	8/12/1984	PENN_WEST	OIL	<N/A>	470.50	956.00	9/1/1984	6335.00	958.70	10/1/2012		0.00	0.00	
00/03-01-002-26W1/0	6/1/1984	PENN_WEST	SUS-OIL	<N/A>	468.70	950.00	7/1/1984	5992.60	2666.70	5/1/2008		0.00	0.00	
00/04-01-002-26W1/0	6/5/1984	PENN_WEST	OIL	<N/A>	469.60	950.00	6/1/1984	7802.80	1382.60	7/1/2011		0.00	0.00	
00/05-01-002-26W1/0	5/27/1984	PENN_WEST	WTR-INJ	<N/A>	470.20	949.00	6/1/1984	2256.00	515.90	12/1/1986	2/1/1987	22330.40	0.00	1/1/2000
00/06-01-002-26W1/0	5/25/1984	PENN_WEST	OIL	<N/A>	466.90	949.00	6/1/1984	7435.80	1130.50	2/1/2013		0.00	0.00	
00/07-01-002-26W1/0	8/16/1984	PENN_WEST	ABD-OIL	<N/A>	470.90	957.00	9/1/1984	1211.40	622.30	11/1/1986	2/1/1987	29150.10	0.00	9/1/2001
00/08-01-002-26W1/0	8/3/1984	PENN_WEST	ABD-OIL	<N/A>	471.90	950.00	9/1/1984	1942.60	1680.50	1/1/1996		0.00	0.00	
00/09-01-002-26W1/0	6/9/1985	OMEGA_HYDROC	ABD-OIL	<N/A>	471.80	946.00	7/1/1985	319.20	625.90	7/1/1988		0.00	0.00	
00/10-01-002-26W1/0	10/28/1984	PENN_WEST	OIL	<N/A>	471.40	955.00	11/1/1984	4851.30	2069.80	1/1/2015		0.00	0.00	
00/11-01-002-26W1/0	11/22/1984	PENN_WEST	WTR-INJ	<N/A>	469.00	949.00	12/1/1984	5677.30	1546.00	8/1/2011	11/1/2012	6.30	0.00	11/1/2012
00/12-01-002-26W1/0	12/17/1984	PENN_WEST	OIL	<N/A>	470.60	960.00	1/1/1985	5432.00	1018.90	12/1/2010		0.00	0.00	
00/13-01-002-26W1/0	12/13/1983	PENN_WEST	SUS-WTR-INJ	<N/A>	469.60	965.00	1/1/1984	936.30	314.80	10/1/1986	12/1/1986	17994.60	0.00	4/1/1998
00/14-01-002-26W1/0	1/15/1984	PENN_WEST	OIL	<N/A>	473.00	975.00	2/1/1984	3023.60	498.20	11/1/1999		0.00	0.00	
00/15-01-002-26W1/0	7/12/1985	PENN_WEST	SUS-WTR-INJ	<N/A>	474.10	946.00	8/1/1985	485.90	364.40	12/1/1986	1/1/1987	13172.40	0.00	4/1/1998
02/04-01-002-26W1/0	10/13/2010	PENN_WEST	OIL	<N/A>	471.40	1793.00	12/1/2010	4994.70	6987.10	4/1/2014		0.00	0.00	
02/05-01-002-26W1/0	9/29/2010	PENN_WEST	OIL	<N/A>	471.50	1767.00	12/1/2010	5072.40	7708.10	1/1/2015		0.00	0.00	
02/08-01-002-26W1/0	8/27/2010	PENN_WEST	OIL	<N/A>	470.60	1796.00	11/1/2010	3695.10	6932.30	4/1/2014		0.00	0.00	
02/09-01-002-26W1/0	8/23/2010	PENN_WEST	OIL	<N/A>	470.60	1802.00	11/1/2010	3854.20	5430.40	5/1/2013		0.00	0.00	
02/12-01-002-26W1/0	10/23/2010	PENN_WEST	OIL	<N/A>	471.90	1663.00	12/1/2010	4887.10	2414.50	3/1/2014		0.00	0.00	
02/13-01-002-26W1/0	11/10/2010	PENN_WEST	OIL	<N/A>	475.10	2008.00	12/1/2010	5038.20	3788.30	4/1/2014		0.00	0.00	
03/04-01-002-26W1/0	2/5/2011	PENN_WEST	OIL	<N/A>	471.10	1749.00	8/1/2011	2423.60	2561.70	4/1/2014		0.00	0.00	
03/05-01-002-26W1/0	9/24/2010	PENN_WEST	OIL	<N/A>	471.40	1707.00	12/1/2010	4049.10	7155.90	4/1/2014		0.00	0.00	
03/09-01-002-26W1/0	10/18/2010	PENN_WEST	OIL	<N/A>	470.30	1689.00	12/1/2010	1897.60	3625.80	4/1/2014		0.00	0.00	
04/04-01-002-26W1/0	2/11/2011	PENN_WEST	OIL	<N/A>	471.10	1763.00	9/1/2011	3072.00	2176.80	1/1/2015		0.00	0.00	
04/05-01-002-26W1/0	9/15/2010	PENN_WEST	OIL	<N/A>	471.50	1681.00	12/1/2010	3450.70	4777.20	8/1/2014		0.00	0.00	
05/04-01-002-26W1/0	2/17/2011	PENN_WEST	OIL	<N/A>	471.10	1722.00	8/1/2011	2149.50	2390.70	5/1/2014		0.00	0.00	
05/05-01-002-26W1/0	9/19/2010	PENN_WEST	OIL	<N/A>	471.50	1701.00	12/1/2010	3537.70	4399.00	4/1/2014		0.00	0.00	

ATTACHMENT 3 – UNIT PRODUCTION AND INJECTION PLOT

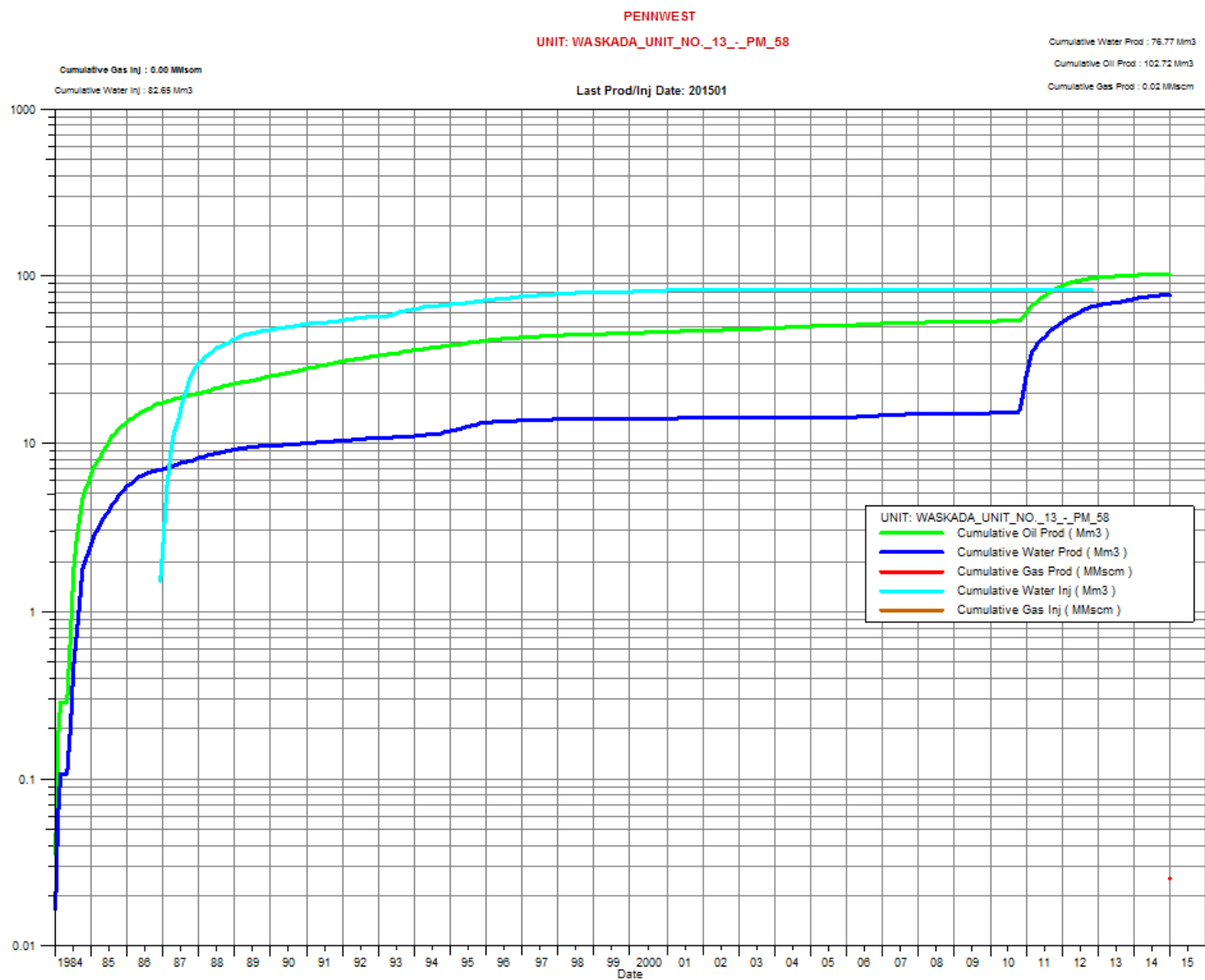


ATTACHMENT 4 –UNIT ANNUAL VOLUMES AND RATES

Unit: Waskada --Unit# 13--P58								
Rates and Volume History								
Date	Annual Oil Prd	Annual Oil Rate	Annual Water Prod	Annual Water Prod Rate	Annual Water Inj	Annual Water Inj Rate	Annual Gas Inj	Annual Gas Inj rate
	m3	m3/d	m3	m3/d	m3	m3/d	Mscm	Mscm/d
1/1/1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/1/1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/1/1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/1/1984	5912.30	16.15	2243.70	6.13	0.00	0.00	0.00	0.00
1/1/1985	7233.50	19.82	3042.70	8.34	0.00	0.00	0.00	0.00
1/1/1986	4258.90	11.67	1699.20	4.66	1530	4.19	0.00	0.00
1/1/1987	2417.20	6.62	1118.30	3.06	27340	74.90	0.00	0.00
1/1/1988	2887.20	7.89	1045.20	2.86	12821	35.03	0.00	0.00
1/1/1989	2393.10	6.56	516.20	1.41	5873	16.09	0.00	0.00
1/1/1990	2733.10	7.49	329.80	0.90	3919	10.74	0.00	0.00
1/1/1991	2965.50	8.12	372.80	1.02	2521	6.91	0.00	0.00
1/1/1992	2637.90	7.21	364.50	1.00	3493	9.54	0.00	0.00
1/1/1993	2518.10	6.90	306.00	0.84	6013	16.47	0.00	0.00
1/1/1994	2516.20	6.89	724.20	1.98	4084	11.19	0.00	0.00
1/1/1995	2612.90	7.16	1488.20	4.08	3903	10.69	0.00	0.00
1/1/1996	1903.30	5.20	430.30	1.18	3873	10.58	0.00	0.00
1/1/1997	1282.10	3.51	214.40	0.59	2950	8.08	0.00	0.00
1/1/1998	729.00	2.00	43.80	0.12	1354	3.71	0.00	0.00
1/1/1999	508.50	1.39	50.70	0.14	816	2.24	0.00	0.00
1/1/2000	981.80	2.68	107.30	0.29	1696	4.63	0.00	0.00
1/1/2001	679.60	1.86	87.20	0.24	463	1.27	0.00	0.00
1/1/2002	804.70	2.20	57.00	0.16	0	0	0	0
1/1/2003	993.60	2.72	36.70	0.10	0	0	0	0
1/1/2004	1160.40	3.17	49.00	0.13	0	0	0	0
1/1/2005	772.80	2.12	39.00	0.11	0	0	0	0
1/1/2006	1066.80	2.92	312.10	0.86	0	0	0	0
1/1/2007	746.00	2.04	303.20	0.83	0	0	0	0
1/1/2008	677.20	1.85	106.50	0.29	0	0	0	0

1/1/2009	378.60	1.04	76.50	0.21	0	0	0	0
1/1/2010	3703.60	10.15	3989.00	10.93	0	0	0	0
1/1/2011	28900.10	79.18	32442.30	88.88	0	0	0	0
1/1/2012	11244.60	30.72	14622.90	39.95	6	0.02	0.00	0.00
1/1/2013	3576.90	9.80	6289.80	17.23	0	0	0	0
1/1/2014	1488.10	4.08	4235.90	11.61	0	0	0	0
Sum	102683.60		76744.40		82654			

ATTACHMENT 5 – UNIT CUMULATIVE PRODUCTION AND INJECTION PLOT



ATTACHMENT 6 – UNIT VOIDAGE REPLACEMENT RATIO PLOT

PENNWEST

UNIT: WASKADA_UNIT_NO_13_-_PM_58

Cumulative Water Prod : 76.77 Mm3

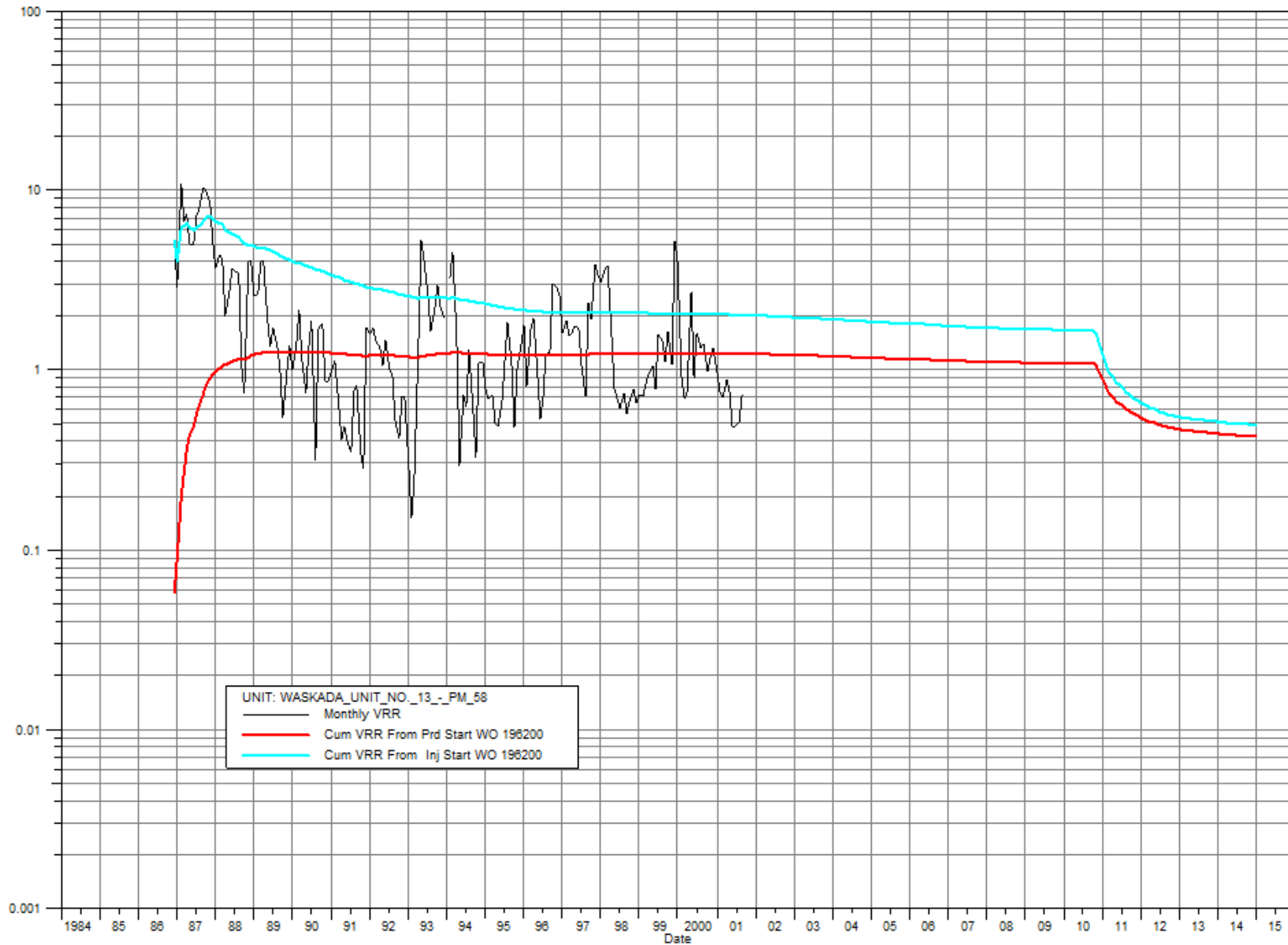
Cumulative Oil Prod : 102.72 Mm3

Cumulative Gas Prod : 0.02 Mm3cm

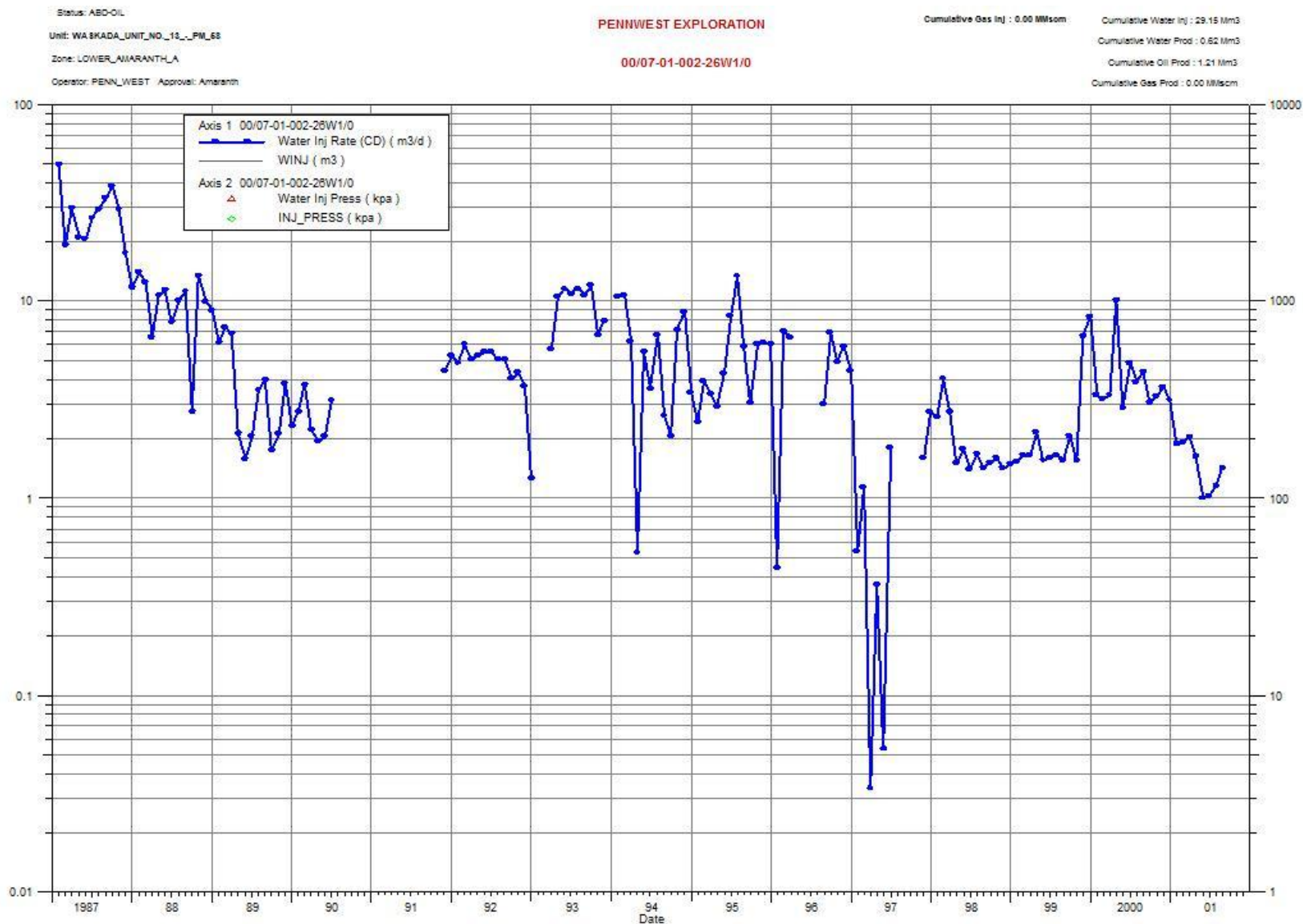
Cumulative Gas Inj : 0.00 Mm3cm

Cumulative Water Inj : 82.65 Mm3

Last Prod/Inj Date: 201501



ATTACHMENT 7 – INDIVIDUAL INJECTION WELL PERFORMANCE PLOTS (4 WELL)



Status: OIL

Unit: WASKADA_UNIT_NO_15_-_PM_68

Zone: LOWER_AMARANTH_A

Operator: PENN_WEST / Approval: Amaranth

PENNWEST EXPLORATION

Cumulative Gas Inj : 0.00 MMscm

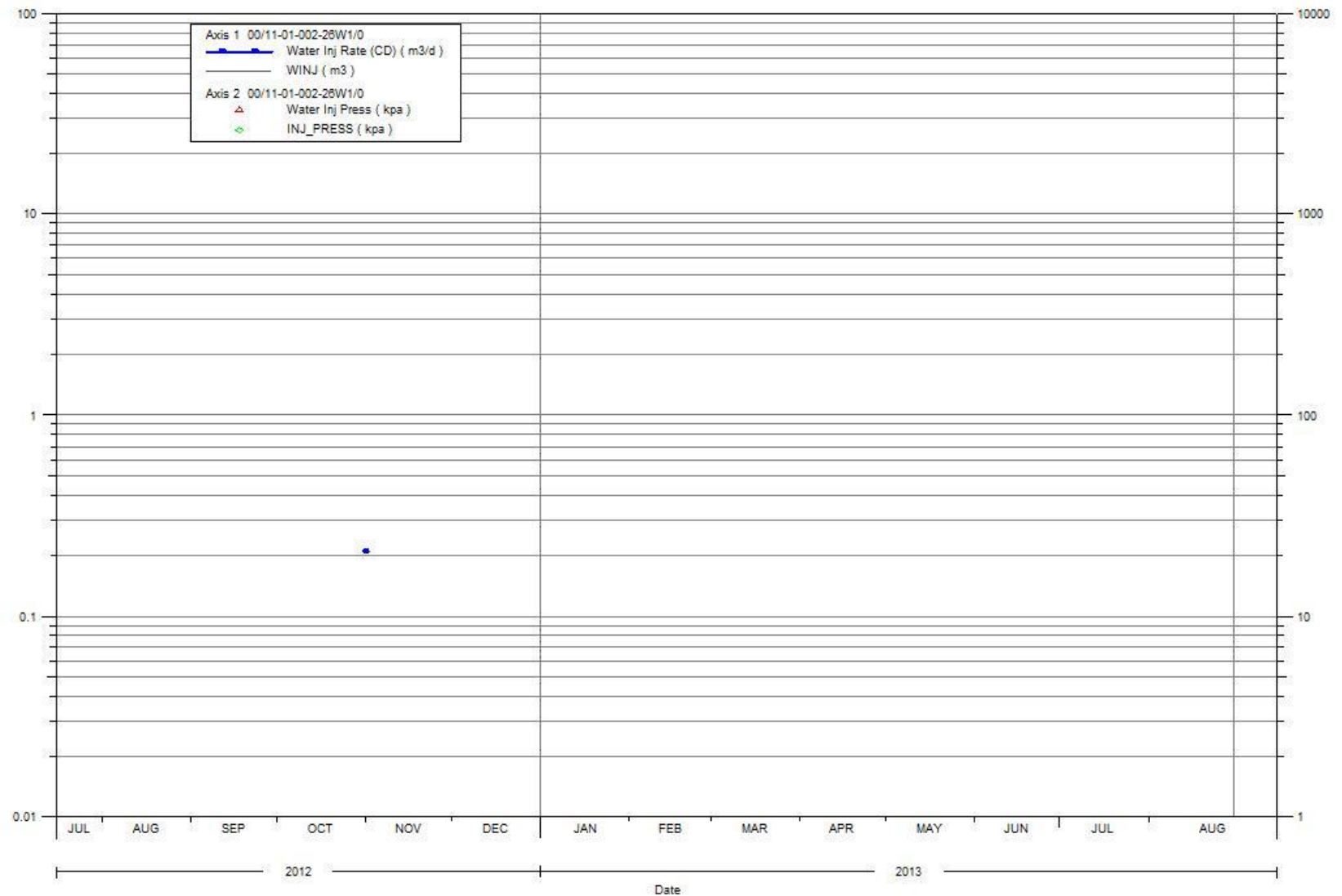
Cumulative Water Inj : 0.01 Mm3

Cumulative Water Prod : 1.55 Mm3

Cumulative Oil Prod : 5.58 Mm3

00/11-01-002-26W1/0

Cumulative Gas Prod : 0.00 MMscm



Status: SUS-WTR-INJ

Unit: WA BKADA_UNIT_NO_14_PWL68

Zone: LOWER_AMARANTH_A

Operator: PENN_WEST Approval: Amaranth

PENNWEST EXPLORATION

00/13-01-002-26W1/0

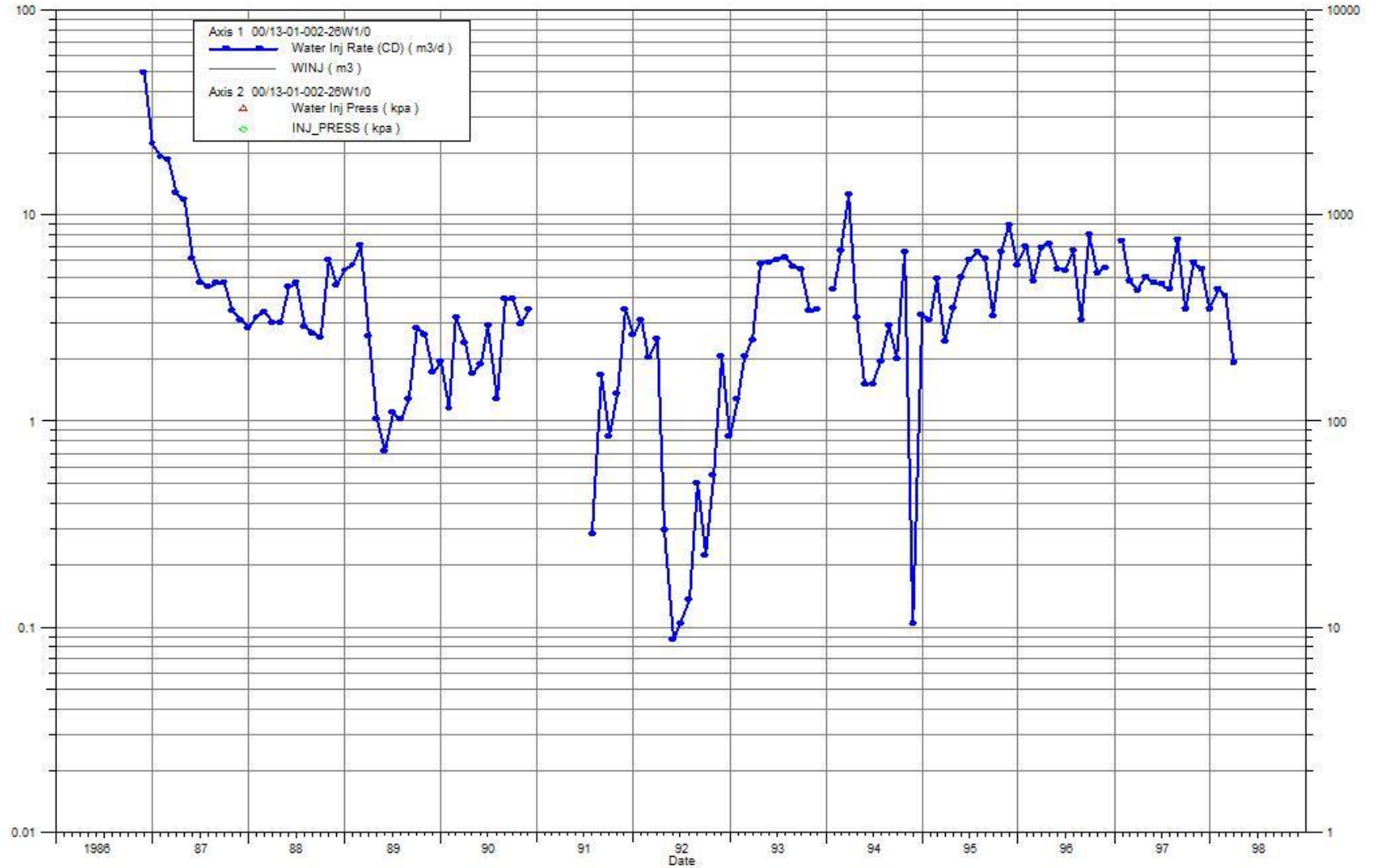
Cumulative Gas Inj : 0.00 Mm3cm

Cumulative Water Inj : 17.99 Mm3

Cumulative Water Prod : 0.31 Mm3

Cumulative Oil Prod : 0.94 Mm3

Cumulative Gas Prod : 0.00 Mm3cm



Status: SUS-WTR-INJ

Unit: WA SKADA_UNIT_NO_13_PW_68

Zone: LOWER_AMARANTH_A

Operator: PENN_WEST Approval: Amaranth

PENNWEST EXPLORATION

00/15-01-002-26W1/0

Cumulative Gas Inj : 0.00 MMscm

Cumulative Water Inj : 13.17 Mm3

Cumulative Water Prod : 0.36 Mm3

Cumulative Oil Prod : 0.49 Mm3

Cumulative Gas Prod : 0.00 MMscm

