

Waskada Unit No. 4

Waterflood Progress Report

January 1st – December 31st, 2013

PennWest

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Introduction:

The Waskada Unit No.4 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, January 1, 1984 Board Order – Voluntary

POOL: Waskada Lower Amaranth A (03 29A)

This report documents the performance of the Waskada Unit No. 4 pressure maintenance project for the period of January 1 to December 31, 2013. The Unit had 9 active producers and no active injectors at the end of 2013. There were 2 new drills in 2013.

Please refer to Attachment 1A – Area Map of New Drills

Unit No. 4 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, silstones, 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.4. From the startup of injection in June 1984, injection rates fluctuated to the same degree in each injector, making it difficult to link any production responses to any injector. The Unit includes 9 injection wells; at the end of 2013 none are currently active. Injection ceased essentially in 2011; there was 1 month's injection into 05-13 in June. There are currently 9 active producers; 2 horizontal wells were drilled in 2013 adding to Unit production.

Please refer to Attachment 2 – A Summary of the Unit Well List and History with New Drills

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

Please refer to Attachment 3A – A Production Plot of the New Drills

Please refer to Attachment 4 – A Summary 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 is at 1.3; the Cumulative VRR from injection start is at 1.7. Both have dropped slightly in the last year due to essentially no injection from 2011 onwards and the startup of new producers. 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 (9).

Pressure Surveys:

There were no pressure surveys conducted in 2013.

Corrosion and Scale Prevention Program:

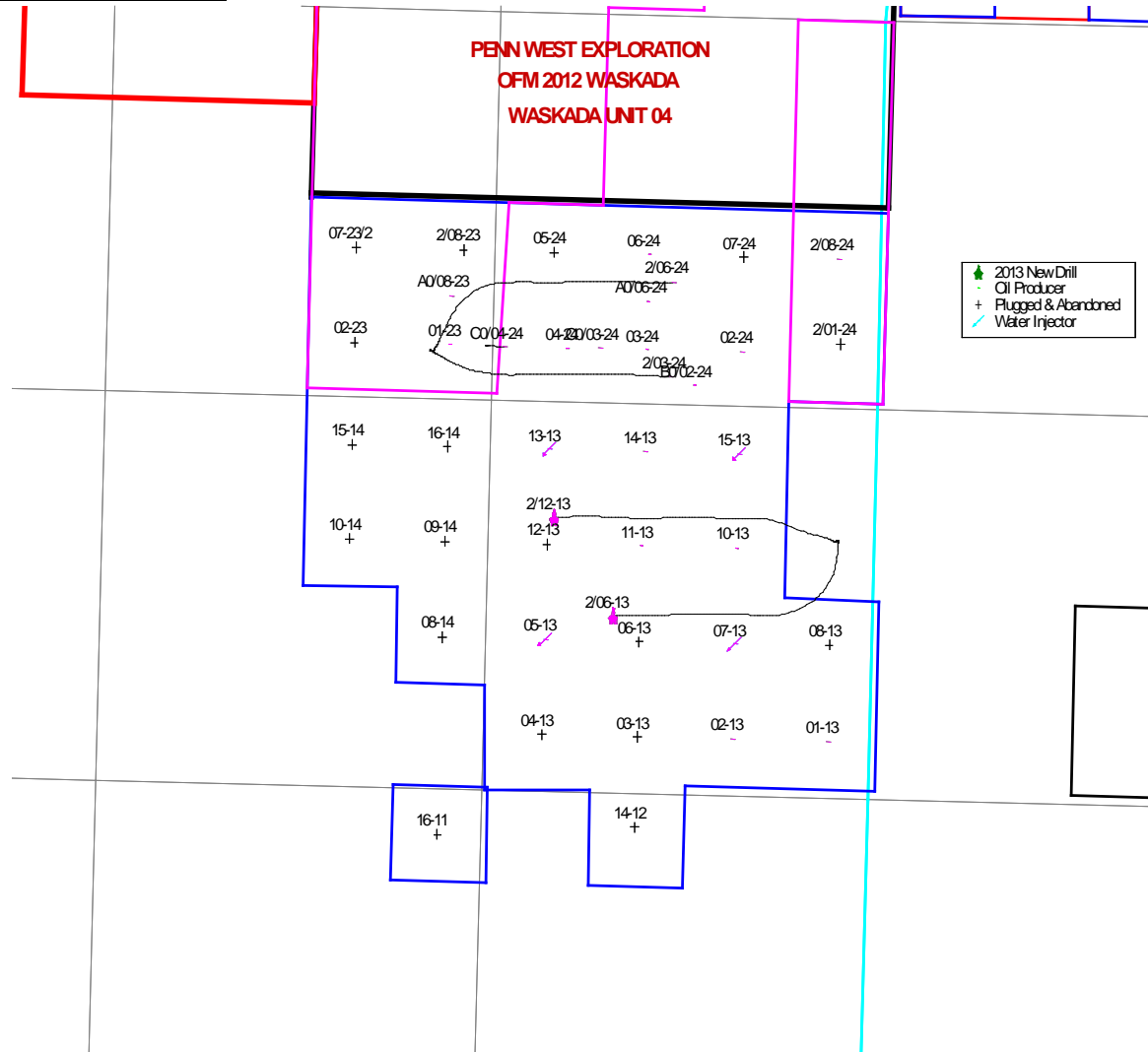
We currently inject ScalCor down all the new horizontal wells. PennWest will be installing cathodic protection on the wells. The new gathering system is Fibreglass and as such is not susceptible to corrosion.

Summary and Recommendations

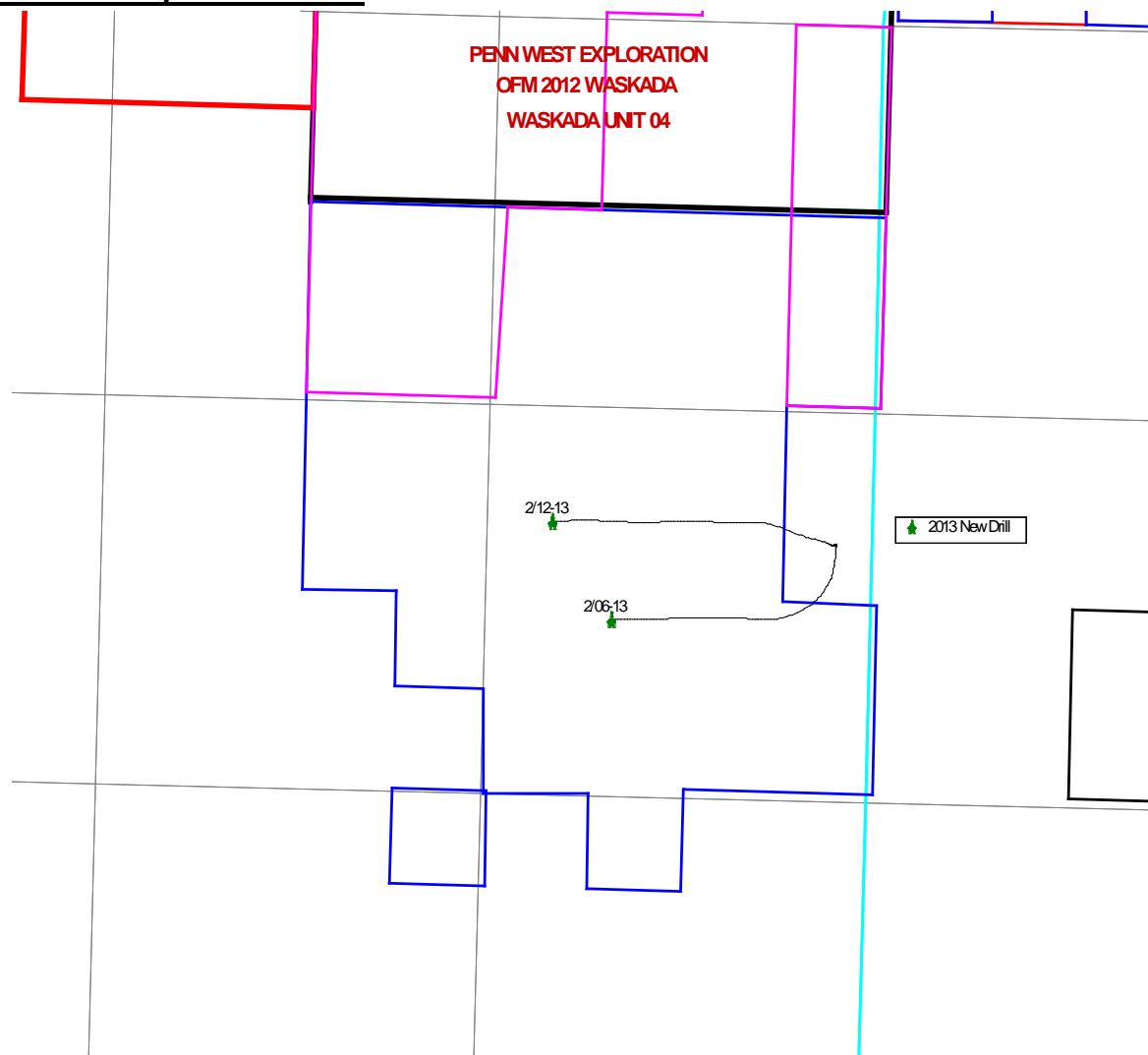
The behaviour of Waskada Unit 4 producers are indicated by good initial oil productivity, rapidly declining to low rates, with almost no discernible water flood response. It is also believed that fracture stimulation treatments, performed on these wells prior to initiation of water injection, “broke 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.

A horizontal producer and conversion of vertical producers to injector well pilot was contemplated for the Lower Amaranth targeting Unit 13 with results scalable to all Lower Amaranth Units. It is currently inactive pending evaluation of alternative schemes.

ATTACHMENT 1 – Unit Area Map



ATTACHMENT 1B – Area Map of New Drills



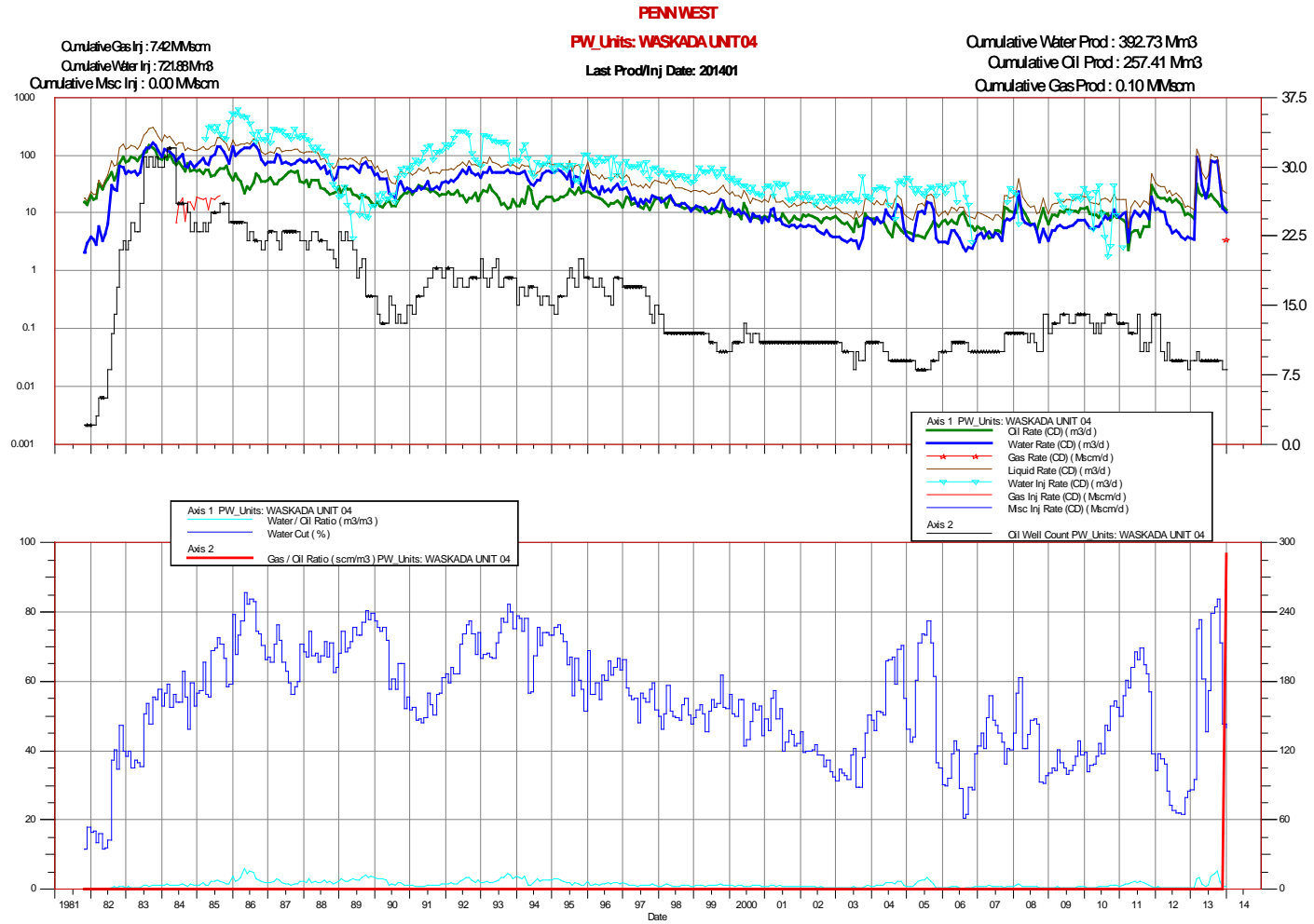
Attachment 2

Unit History: WASKADA UNIT 04

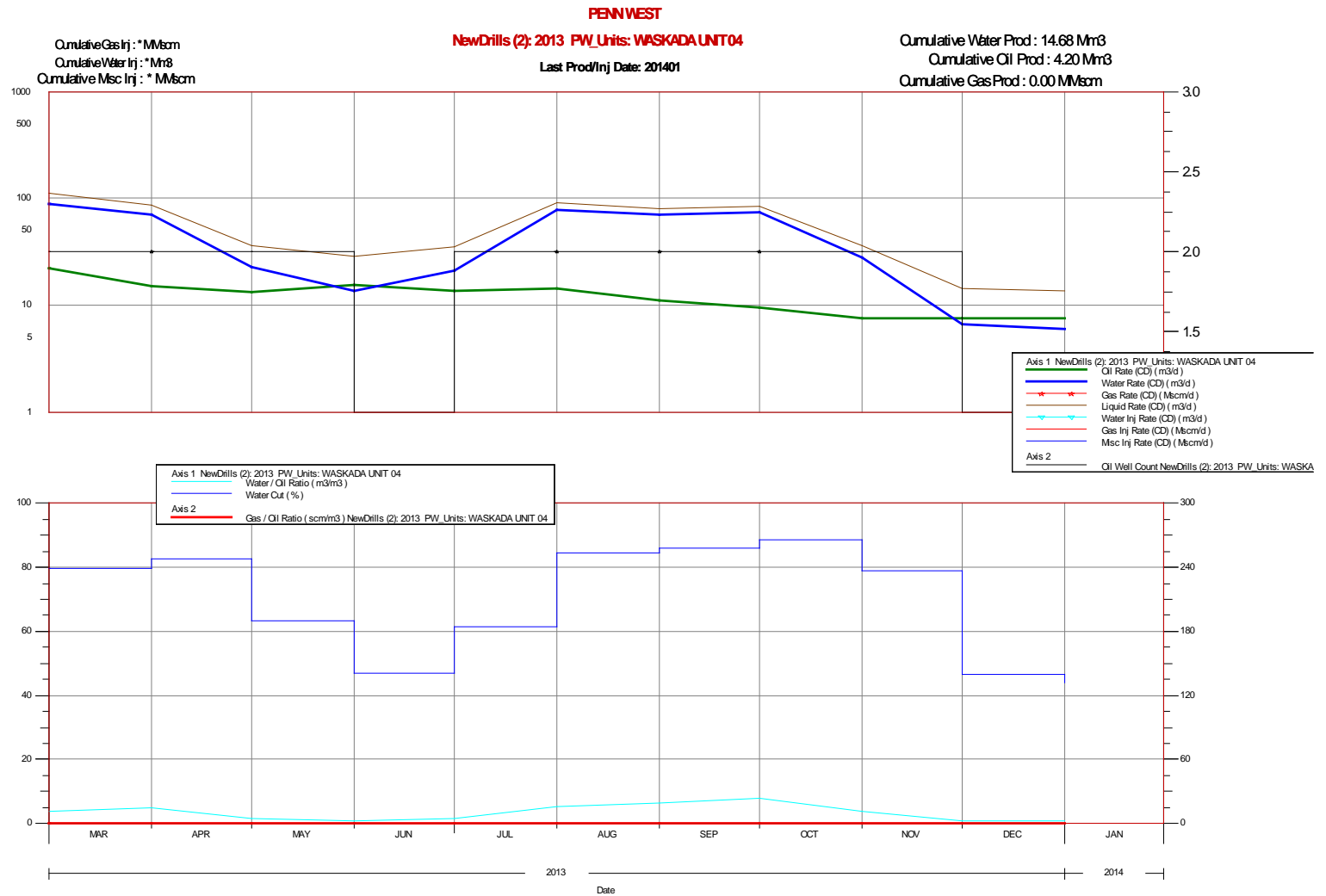
Well	Completion Date	OPERATOR	STATUS	New Drills	Kelly Bushing Elevation m	Total Depth m	First Production Date	Cum Oil Prod Mm3	Cum Water Prod Mm3	Last Production Date	First Injection Date	Cum Water Inj Mm3	Cum Gas Inj MMscm	Last Injection Date
02/06-13-001-26W1/0	1/19/2013	PENN_WEST	OIL	2013	470.3	1855	3/1/2013	0.3	10.81	11/1/2013		0	0	
02/12-13-001-26W1/0	1/25/2013	PENN_WEST	OIL	2013	470.4	1990	3/1/2013	3.89	3.87	1/1/2014		0	0	
00/16-11-001-26W1/0	7/15/1982	OMEGA_HYDR	ABD-OIL	<N/A>	466.5	946	8/1/1982	0.47	3.86	12/1/1985	12/1/1985	15.53	0	4/1/1989
00/14-12-001-26W1/0	3/10/1982	PENN_WEST	ABD-OIL	<N/A>	469.8	935	7/1/1982	1.01	0.91	7/1/1989		0	0	
00/01-13-001-26W1/0	12/15/1981	PENN_WEST	OIL	<N/A>	470.4	947	3/1/1982	13	11.79	5/1/2012		0	0	
00/02-13-001-26W1/0	9/12/1982	PENN_WEST	OIL	<N/A>	470.2	953	10/1/1982	11.94	1.61	1/1/2012		0	0	
00/03-13-001-26W1/0	8/16/1982	PENN_WEST	ABD-OIL	<N/A>	468.2	949	10/1/1982	2.98	1.14	1/1/1997		0	0	
00/04-13-001-26W1/0	7/27/1982	PENN_WEST	ABD-OIL	<N/A>	469.5	955	9/1/1982	1.84	1.02	3/1/1990		0	0	
00/05-13-001-26W1/0	7/23/1982	PENN_WEST	WTR-INJ	<N/A>	470	953.5	9/1/1982	0.79	0.41	5/1/1984	6/1/1984	46.87	0.83	6/1/2013
00/06-13-001-26W1/0	6/18/1982	PENN_WEST	ABD-OIL	<N/A>	470	953	7/1/1982	6.44	33.35	4/1/1990		0	0	
00/07-13-001-26W1/0	8/8/1982	PENN_WEST	WTR-INJ	<N/A>	470.7	946	9/1/1982	2.01	0.38	11/1/1985	12/1/1985	138.3	0	2/1/2011
00/08-13-001-26W1/0	8/3/1982	PENN_WEST	ABD-OIL	<N/A>	470.9	952	11/1/1982	2.46	0.46	9/1/1989		0	0	
00/10-13-001-26W1/0	6/26/1982	PENN_WEST	OIL	<N/A>	469.9	952	8/1/1982	11.5	1.74	1/1/2014		0	0	
00/11-13-001-26W1/0	6/22/1982	PENN_WEST	OIL	<N/A>	468.4	954	11/1/1982	5.21	3.57	7/1/2011		0	0	
00/12-13-001-26W1/0	7/31/1982	PENN_WEST	ABD-OIL	<N/A>	469.8	953	9/1/1982	4.22	2.1	9/1/1997		0	0	
00/13-13-001-26W1/0	6/29/1982	PENN_WEST	WTR-INJ	<N/A>	472	953	7/1/1982	2.75	1.91	5/1/1984	6/1/1984	78.38	2.6	10/1/2005
00/14-13-001-26W1/0	11/27/1981	PENN_WEST	OIL	<N/A>	468.7	952	4/1/1982	11.79	6.7	11/1/2012		0	0	
00/15-13-001-26W1/0	7/14/1981	PENN_WEST	WTR-INJ	<N/A>	470.2	954	11/1/1981	3.66	0.63	5/1/1984	6/1/1984	75.82	1.53	10/1/2006
00/08-14-001-26W1/0	6/15/1982	PENN_WEST	ABD-OIL	<N/A>	470.2	944.6	8/1/1982	7.31	12.92	6/1/2000		0	0	
00/09-14-001-26W1/0	8/20/1982	PENN_WEST	ABD-OIL	<N/A>	468.7	948	11/1/1982	3.89	12.53	12/1/1989		0	0	
00/10-14-001-26W1/0	9/10/1982	OMEGA_HYDR	ABD-OIL	<N/A>	469.1	953.5	12/1/1982	0.64	10.53	6/1/1986		0	0	
00/15-14-001-26W1/0	8/24/1982	PENN_WEST	ABD-WINJ	<N/A>	469.4	950	11/1/1982	0.61	4.79	5/1/1984	6/1/1984	29.14	0.53	6/1/2000
00/16-14-001-26W1/0	2/22/1982	PENN_WEST	ABD-OIL	<N/A>	467	942	4/1/1982	5.25	1.74	1/1/1991		0	0	
00/01-23-001-26W1/0	7/2/1982	PENN_WEST	OIL	<N/A>	470.5	953	8/1/1982	15.45	11.9	9/1/2013		0	0	
00/02-23-001-26W1/0	10/26/1982	PENN_WEST	ABD-OIL	<N/A>	468.3	953	12/1/1982	2.26	34.84	3/1/1990		0	0	
00/07-23-001-26W1/2	9/20/1982	PENN_WEST	ABD-OIL	<N/A>	470.9	950		0	0		8/1/1984	85.4	0.37	9/1/2001
02/08-23-001-26W1/0	5/28/1983	PENN_WEST	ABD-OIL	<N/A>	470.4	950	6/1/1983	6.28	27.06	6/1/1996		0	0	
A0/08-23-001-26W1/0	2/28/1991	PENN_WEST	OIL	<N/A>	468	963	3/1/1991	5.28	1.63	1/1/2014		0	0	
02/01-24-001-26W1/0	6/2/1983	PENN_WEST	ABD-OIL	<N/A>	469.5	955.5	6/1/1983	5.26	3.37	5/1/1996		0	0	
00/02-24-001-26W1/0	7/3/1982	PENN_WEST	OIL	<N/A>	468.9	953	12/1/1982	15.97	14.77	5/1/2012		0	0	
B0/02-24-001-26W1/0	11/1/1997	PENN_WEST	OIL	<N/A>	469.4	960	12/1/1997	4.79	0.31	2/1/2012		0	0	
00/03-24-001-26W1/0	6/23/1983	PENN_WEST	OIL	<N/A>	471.3	952.1	7/1/1983	19.65	62.79	1/1/2014		0	0	
02/03-24-001-26W1/0	10/17/2011	PENN_WEST	OIL	<N/A>	470.4	1782	12/1/2011	3.1	0.7	1/1/2014		0	0	
C0/03-24-001-26W1/0	4/8/1991	PENN_WEST	OIL	<N/A>	472.1	965	4/1/1991	2.69	1.43	1/1/2014		0	0	
00/04-24-001-26W1/0	6/27/1983	PENN_WEST	OIL	<N/A>	473.2	950	7/1/1983	30.15	79.22	1/1/2014		0	0	
C0/04-24-001-26W1/0	3/6/1991	PENN_WEST	OIL	<N/A>	469.9	970	3/1/1991	3.59	5.26	2/1/2012		0	0	
00/05-24-001-26W1/0	6/19/1983	PENN_WEST	ABD-WINJ	<N/A>	469.3	957	7/1/1983	2.59	2.03	5/1/1984	6/1/1984	106.36	0.85	4/1/1993
00/06-24-001-26W1/0	7/2/1983	PENN_WEST	OIL	<N/A>	472	948	7/1/1983	12.55	2.6	3/1/2013		0	0	
02/06-24-001-26W1/0	10/24/2011	PENN_WEST	OIL	<N/A>	470.6	1890	12/1/2011	4.02	1.64	1/1/2014		0	0	
A0/06-24-001-26W1/0	4/4/1991	PENN_WEST	OIL	<N/A>	472.1	960	4/1/1991	2.66	3.28	3/1/2011		0	0	
00/07-24-001-26W1/0	9/28/1981	PENN_WEST	ABD-WINJ	<N/A>	470.3	961	11/1/1981	3.04	0.29	5/1/1984	6/1/1984	146.07	0.71	6/1/2009
02/08-24-001-26W1/0	8/3/1983	PENN_WEST	PMP-OIL	<N/A>	472.6	930	8/1/1983	14.1	10.83	2/1/2012		0	0	

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ATTACHMENT 3 – Unit Production and Injection Plot



ATTACHMENT 3A – 2013 New Drills Production Plot



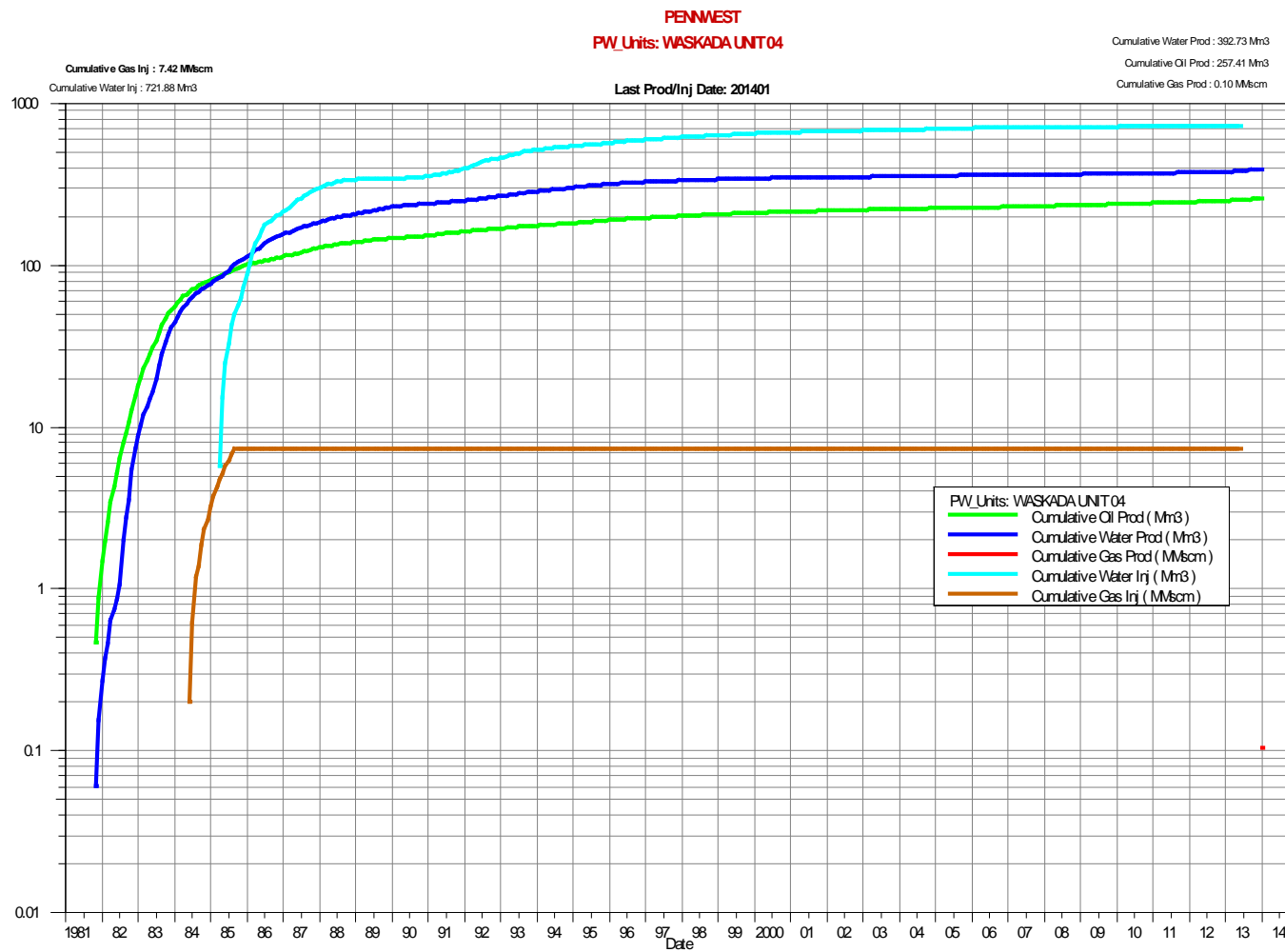
ATTACHMENT 4

PW_Units: WASKADA UNIT 04

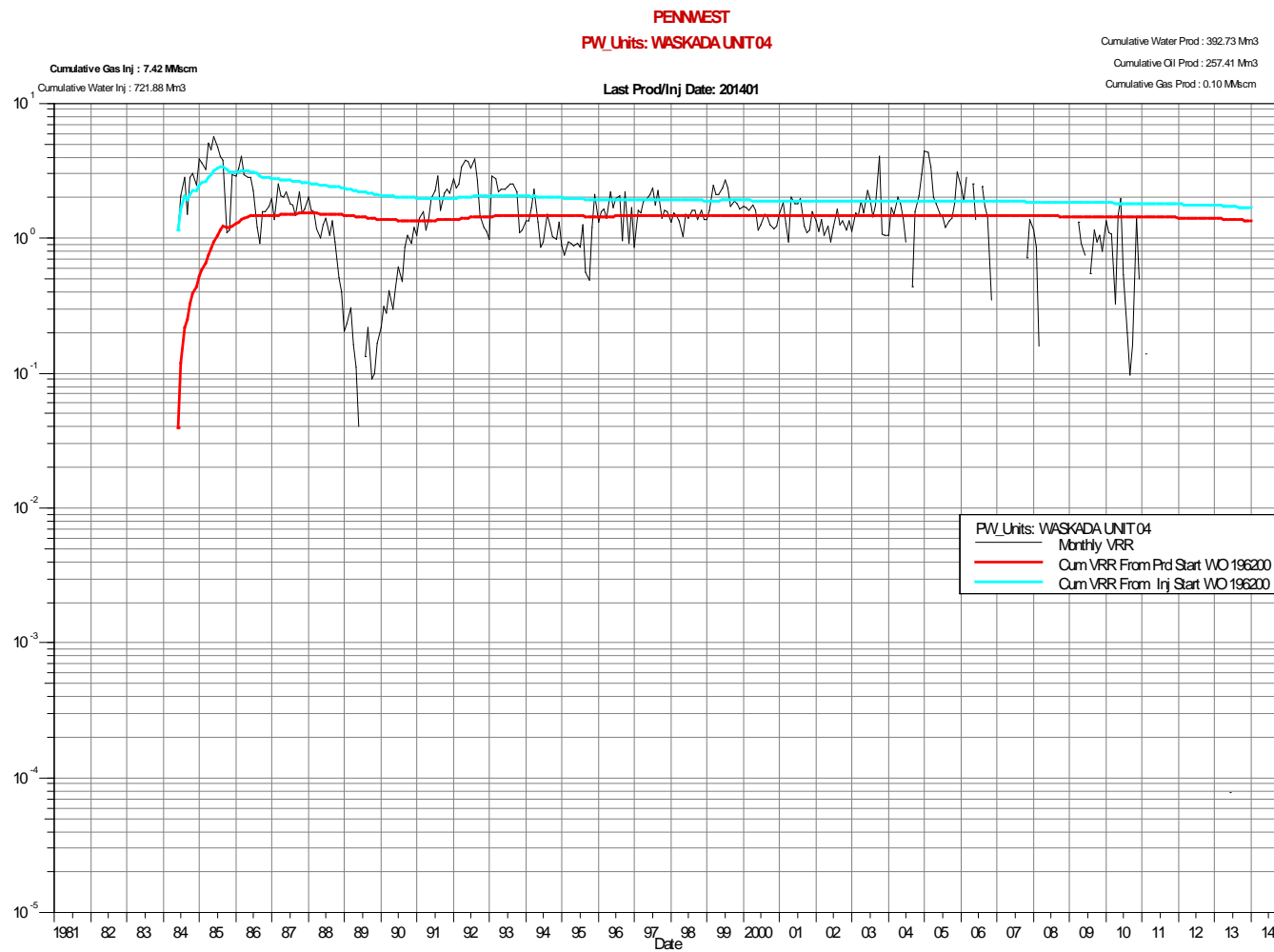
Rates and Volume History

Date	Annual Oil Prod m3	Annual Oil Rate m3/d	Annual Water Prod m3	Annual Water Rate m3/d	Annual Water Inj m3	Annual Water Inj Rate m3/d	Annual Gas Inj Mscm	Annual Gas Inj Rate Mscm/d
1/1/1981	891	2.44	153.6	0.42				
1/1/1982	14700.6	40.28	7215.4	19.77				
1/1/1983	37396.7	102.46	34057.1	93.31				
1/1/1984	26933.2	73.59	33399.9	91.26	0	0	2679.1	7.32
1/1/1985	19313.5	52.91	34523.4	94.58	73162	200.44	4738.5	12.98
1/1/1986	12944.7	35.46	43741.7	119.84	134971	369.78	0	0
1/1/1987	15258.2	41.8	28894.3	79.16	86108	235.91	0	0
1/1/1988	10750.9	29.37	23051.2	62.98	43873	119.87	0	0
1/1/1989	7953.8	21.79	22723.1	62.26	4701	12.88	0	0
1/1/1990	5811.5	15.92	11722.6	32.12	10613	29.08	0	0
1/1/1991	8955.7	24.54	10017.8	27.45	36491	99.97	0	0
1/1/1992	7311.2	19.98	16486.1	45.04	66196	180.86	0	0
1/1/1993	7059.5	19.34	18650.2	51.1	56746	155.47	0	0
1/1/1994	6296.3	17.25	15906.1	43.58	30651	83.98	0	0
1/1/1995	7690.5	21.07	15621.1	42.8	22900	62.74	0	0
1/1/1996	6364.2	17.39	10418.4	28.47	28328	77.4	0	0
1/1/1997	5288.3	14.49	6833.3	18.72	21899	60	0	0
1/1/1998	5366.2	14.7	5577.2	15.28	16369	44.85	0	0
1/1/1999	4174.4	11.44	4629.1	12.68	18559	50.85	0	0
1/1/2000	3483.7	9.52	3486.9	9.53	10759	29.4	0	0
1/1/2001	3015.6	8.26	2747	7.53	9240	25.32	0	0
1/1/2002	2980.7	8.17	1890.4	5.18	6490	17.78	0	0
1/1/2003	2536.4	6.95	1516.5	4.15	7229	19.81	0	0
1/1/2004	2268.9	6.2	3250.6	8.88	8263	22.58	0	0
1/1/2005	1788.6	4.9	2914.9	7.99	9895	27.11	0	0
1/1/2006	2587.9	7.09	1213.2	3.32	5897	16.16	0	0
1/1/2007	2394.6	6.56	1808.9	4.96	1296	3.55	0	0
1/1/2008	3356.6	9.17	2919.8	7.98	1513	4.13	0	0
1/1/2009	3675.6	10.07	2132.4	5.84	4100	11.23	0	0
1/1/2010	3504.6	9.6	2692.2	7.38	5562	15.24	0	0
1/1/2011	2765.2	7.58	3539.9	9.7	71	0.19	0	0
1/1/2012	5838.6	15.95	2473.8	6.76				
1/1/2013	6394.4	17.52	16212.9	44.42	0	0	0	0
	----- 257051.8		----- 392421		----- 721880			Sum

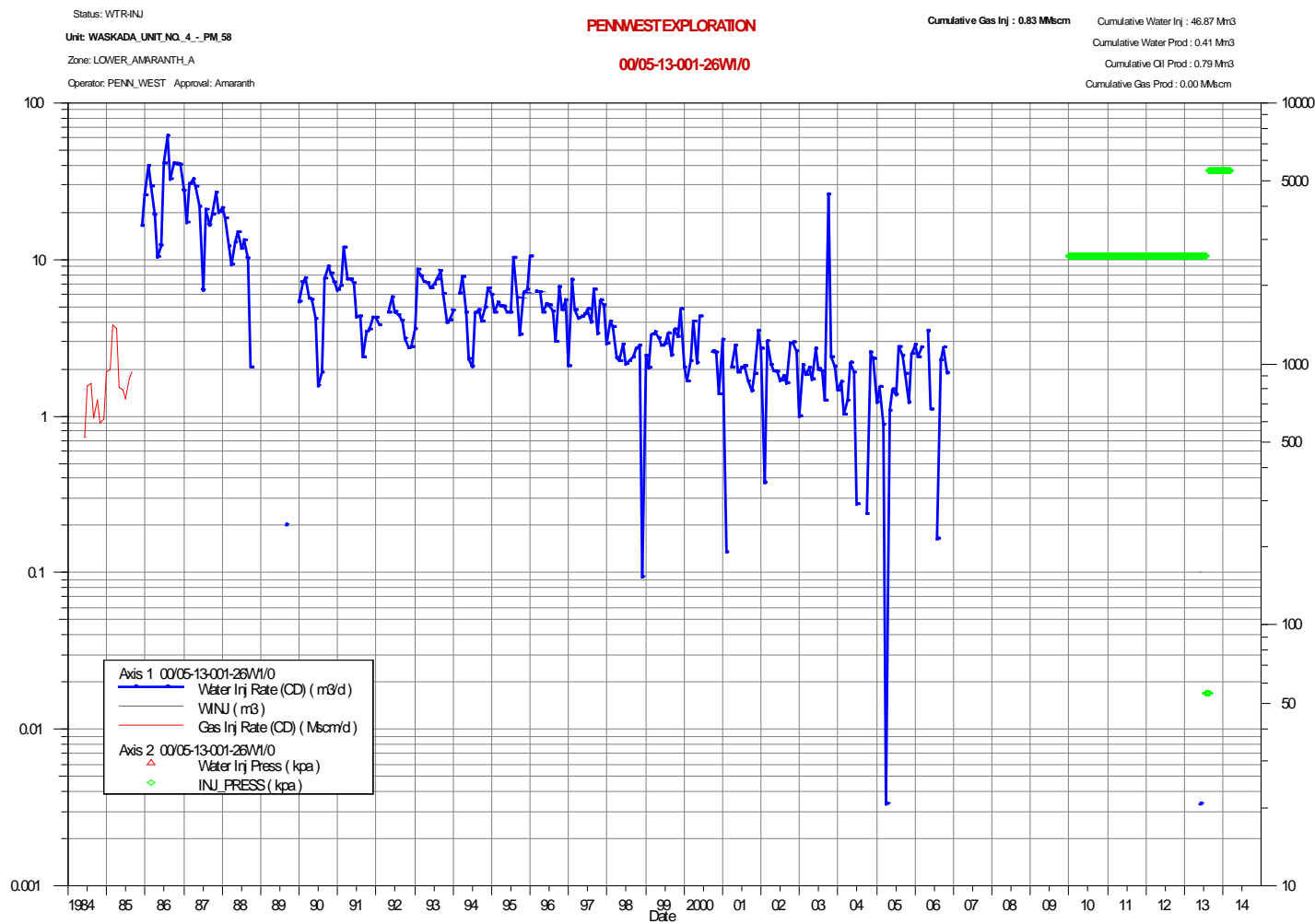
ATTACHMENT 5 – Unit Cumulative Production and Injection Plot



ATTACHMENT 6 – Unit Voidage Replacement Ratio Plot



ATTACHMENT 7 – Individual Injection Well Performance Plots (9 Wells)



Status: ABD-WINJ

Unit: WASKADA_UNIT_NO_4_-_PMI_58

Zone: LOWER_AMARANTH_A

Operator: PENN_WEST Approval: Amaranth

PENNVEST EXPLORATION

00/05-24-001-26W1/O

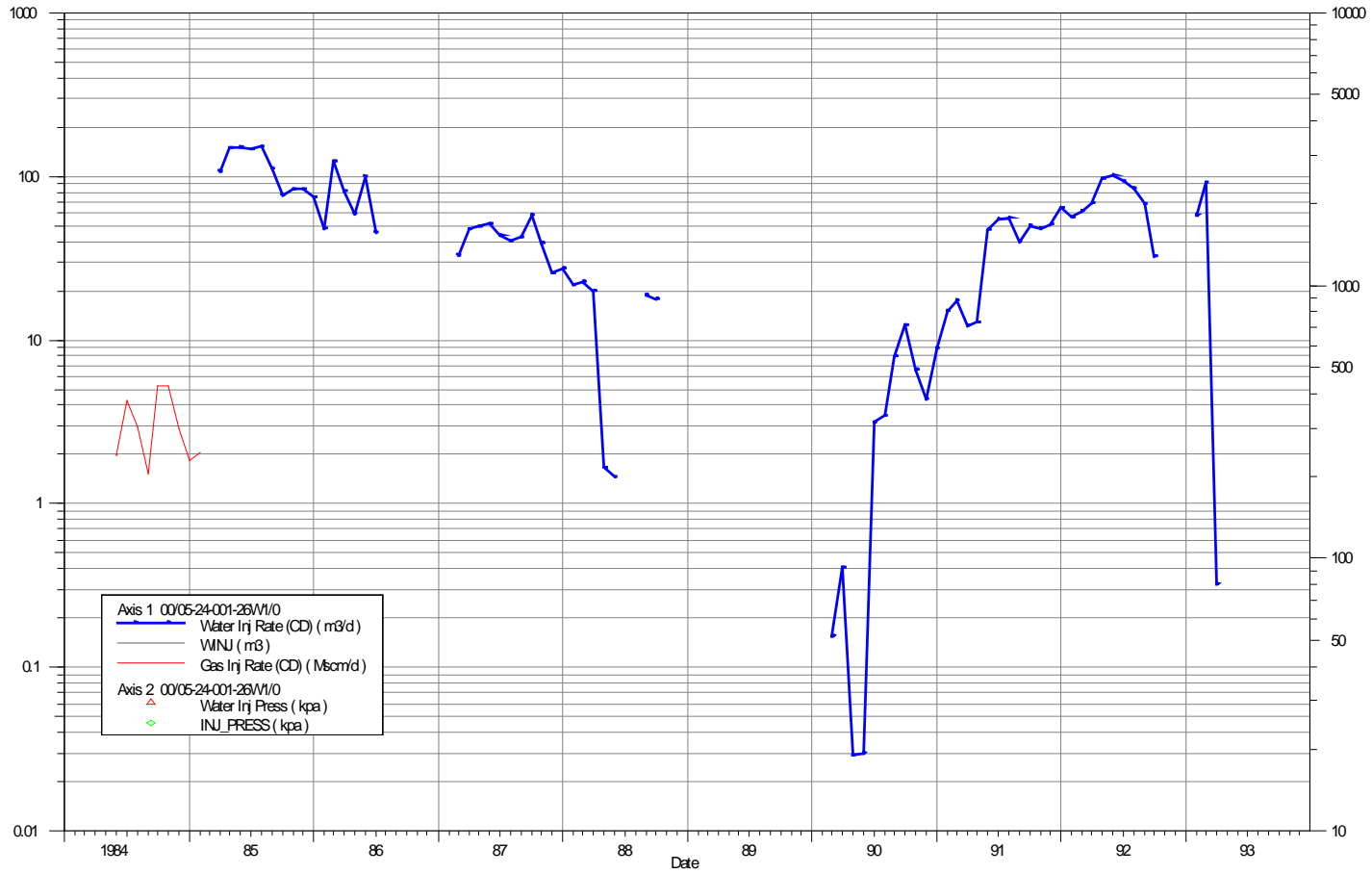
Cumulative Gas Inj : 0.85 MMscm

Cumulative Water Inj : 106.36 Mn3

Cumulative Water Prod : 2.03 Mn3

Cumulative Oil Prod : 2.59 Mn3

Cumulative Gas Prod : 0.00 MMscm



Status: WTR:INJ

Unit: WASKADA_UNIT_NO_4_-_PM_58

Zone: LOWER_AMARANTH_A

Operator: PENN_WEST Approval: Amaranth

PENNAESTEXPLORATION

00/07-13-001-26W/I/O

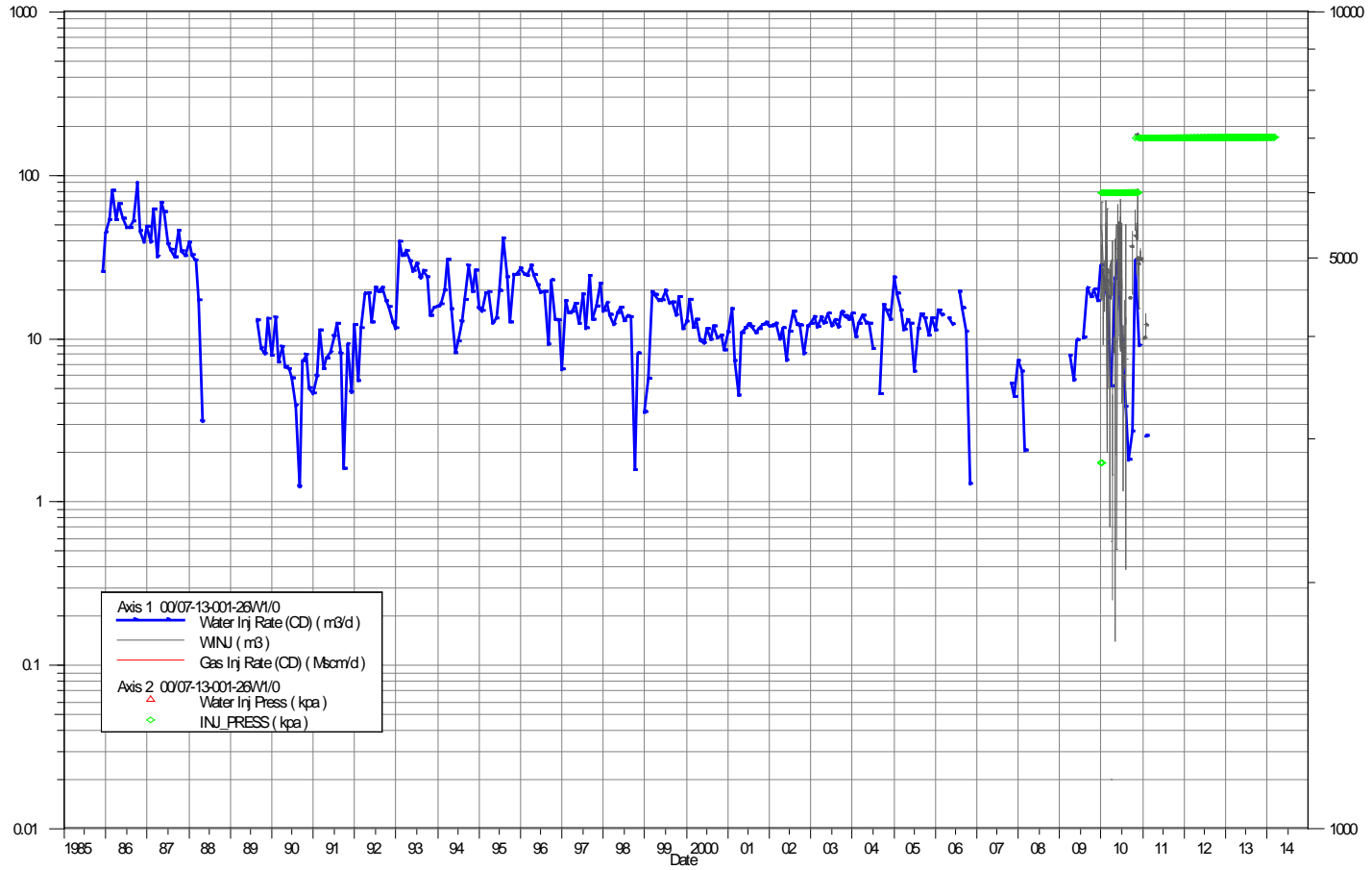
Cumulative Gas Inj : 0.00 MMscm

Cumulative Water Inj : 136.30 Mm3

Cumulative Water Prod : 0.38 Mm3

Cumulative Oil Prod : 2.01 Mm3

Cumulative Gas Prod : 0.00 MMscm



Status: ABD-OIL

Unit: WASKADA_UNIT_NO_4_-_PM_58

Zone: LOWER_AMARANTH_A

Operator: PENN_WEST Approval: Amaranth

PENNMVEST EXPLORATION

00/07-23-001-26W1/2

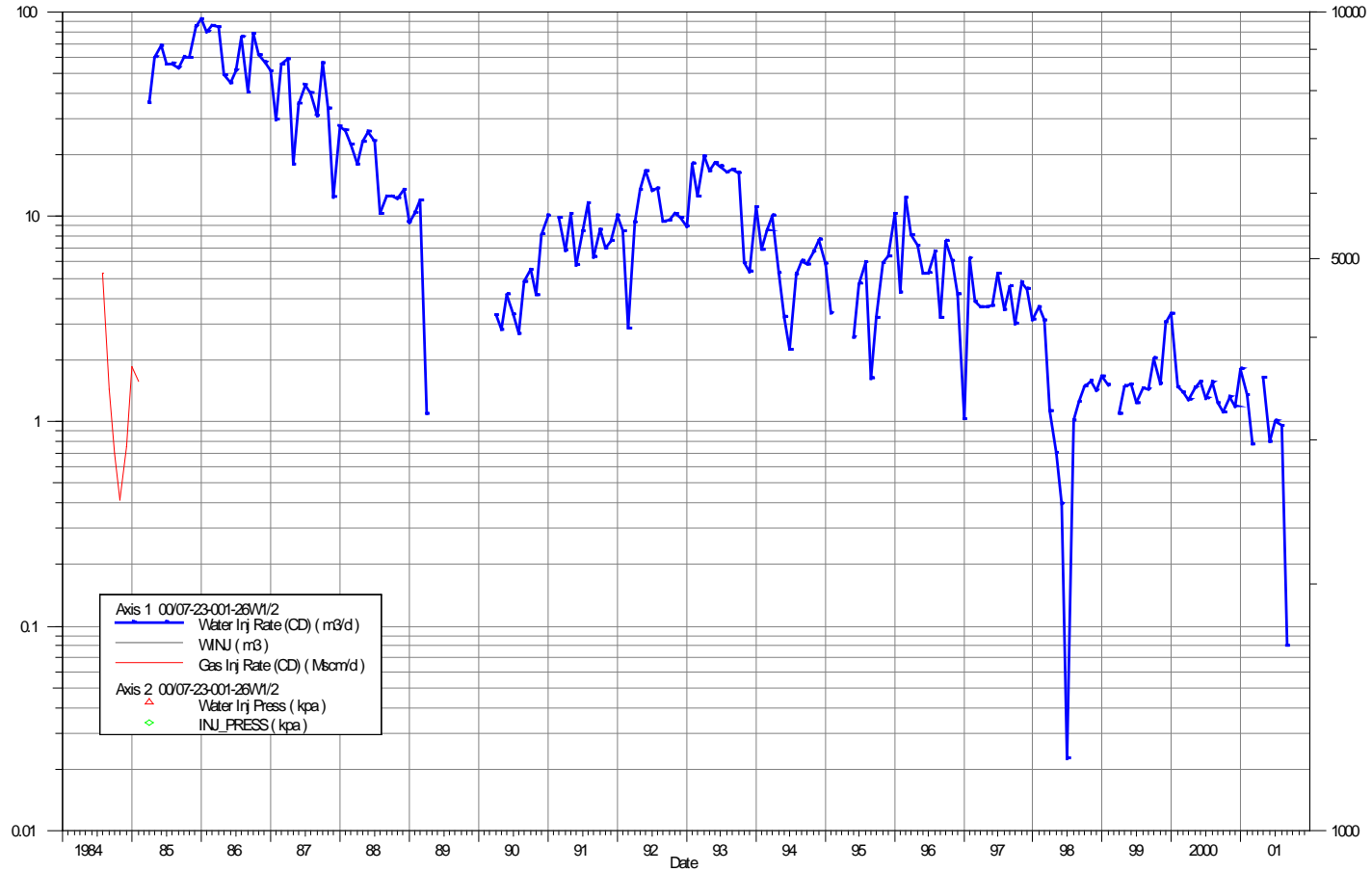
Cumulative Gas Inj : 0.37 MMscm

Cumulative Water Inj : 85.40 Mm3

Cumulative Water Prod : * Mm3

Cumulative Oil Prod : * Mm3

Cumulative Gas Prod : * MMscm



Status: ABD-WINJ

Unit: WASKADA_UNIT_NO_4_-_PM_58

Zone: LOWER_AMARANTH_A

Operator: PENN_WEST Approval: Amaranth

PENNVEST EXPLORATION

00/07-24-001-26W1/O

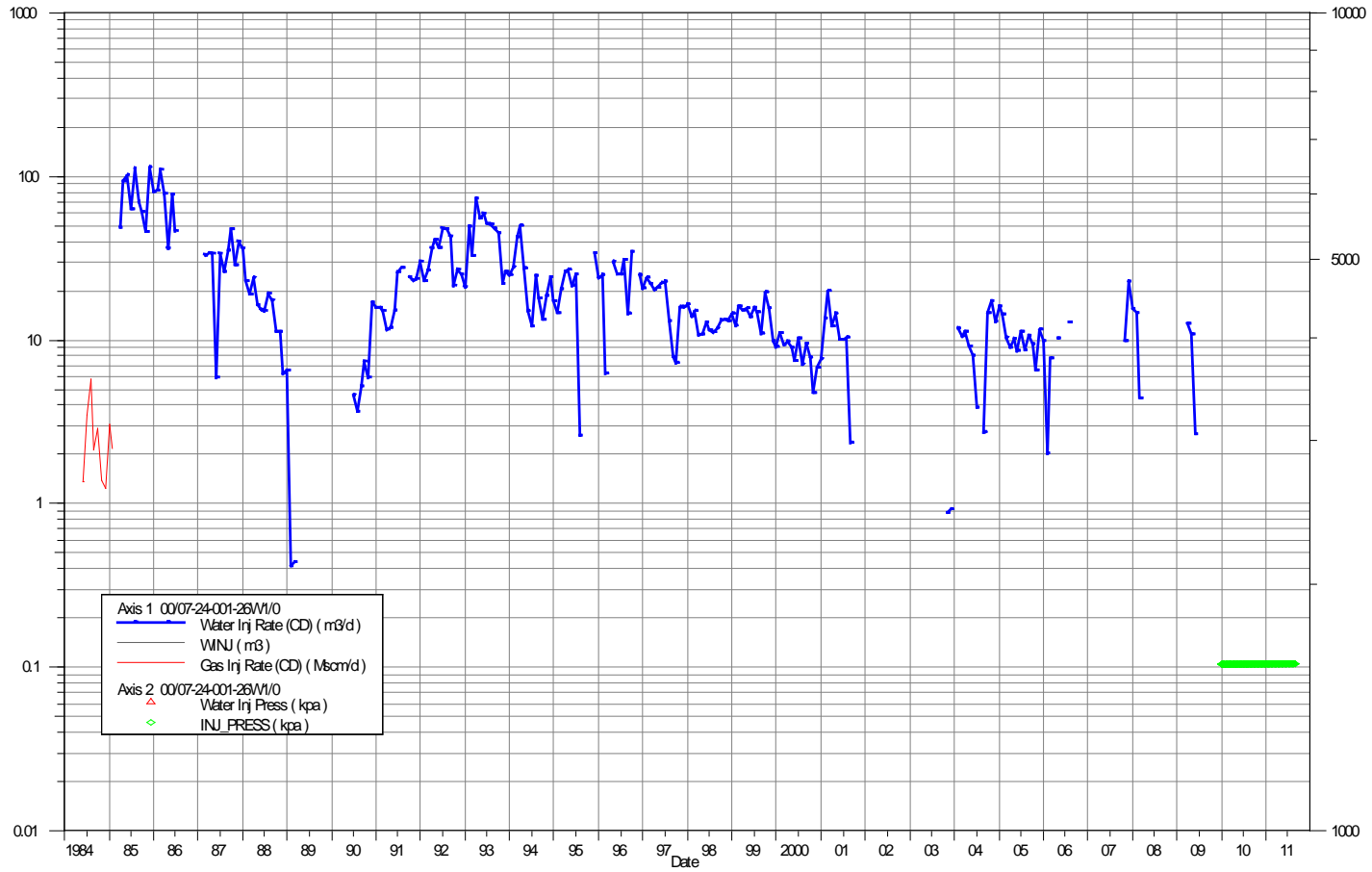
Cumulative Gas Inj : 0.71 MMscm

Cumulative Water Inj : 146.07 Mn3

Cumulative Water Prod : 0.29 Mn3

Cumulative Oil Prod : 3.04 Mn3

Cumulative Gas Prod : 0.00 MMscm



Status: WTR-INJ

Unit: WASKADA_UNIT_NO_4_-_PM_58

Zone: LOWER_AMARANTH_A

Operator: PENN_WEST Approval: Aamaranth

PENNVEST EXPLORATION

00/13-13-001-26W1/O

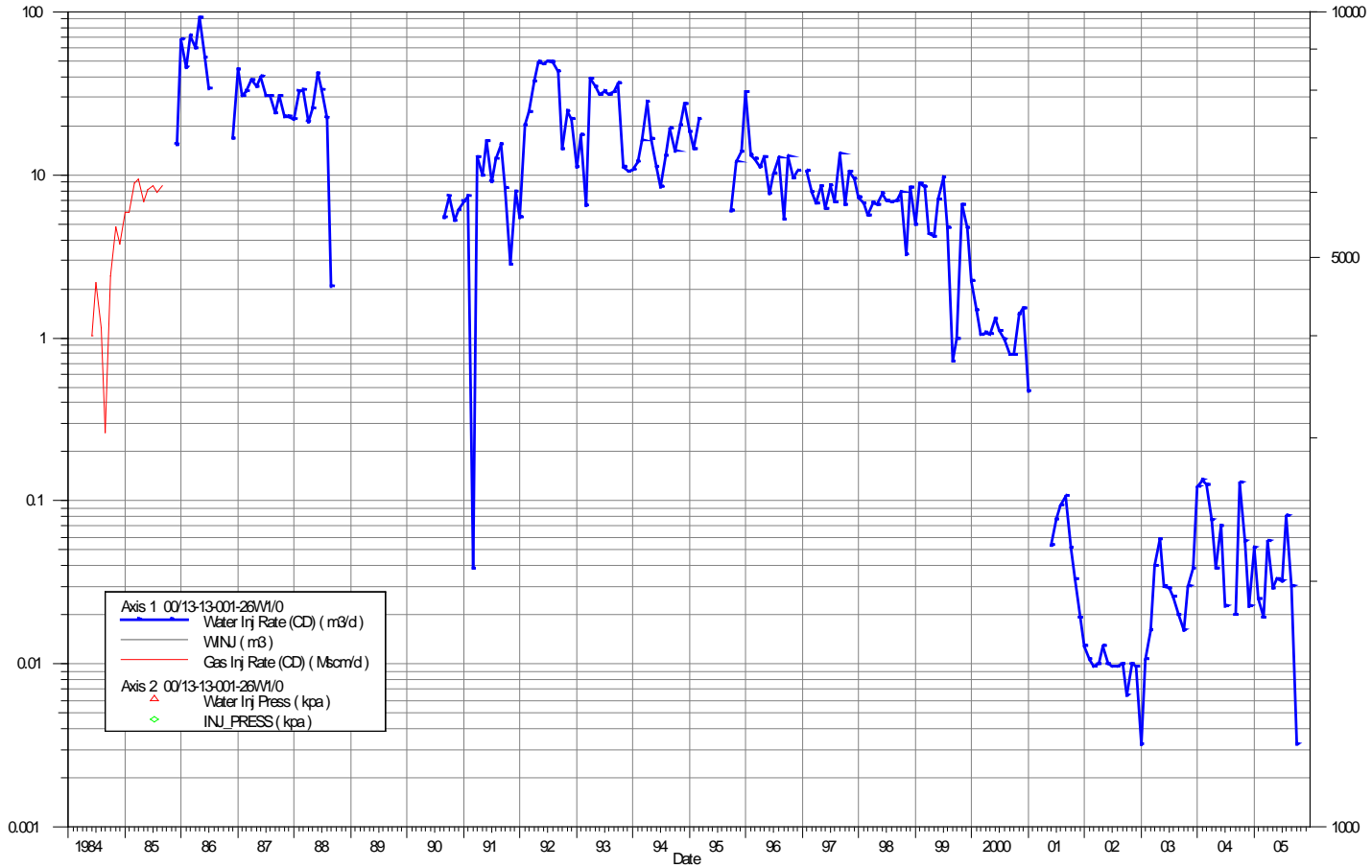
Cumulative Gas Inj : 2.60 MMscm

Cumulative Water Inj : 78.38 Mn3

Cumulative Water Prod : 1.91 Mn3

Cumulative Oil Prod : 2.75 Mn3

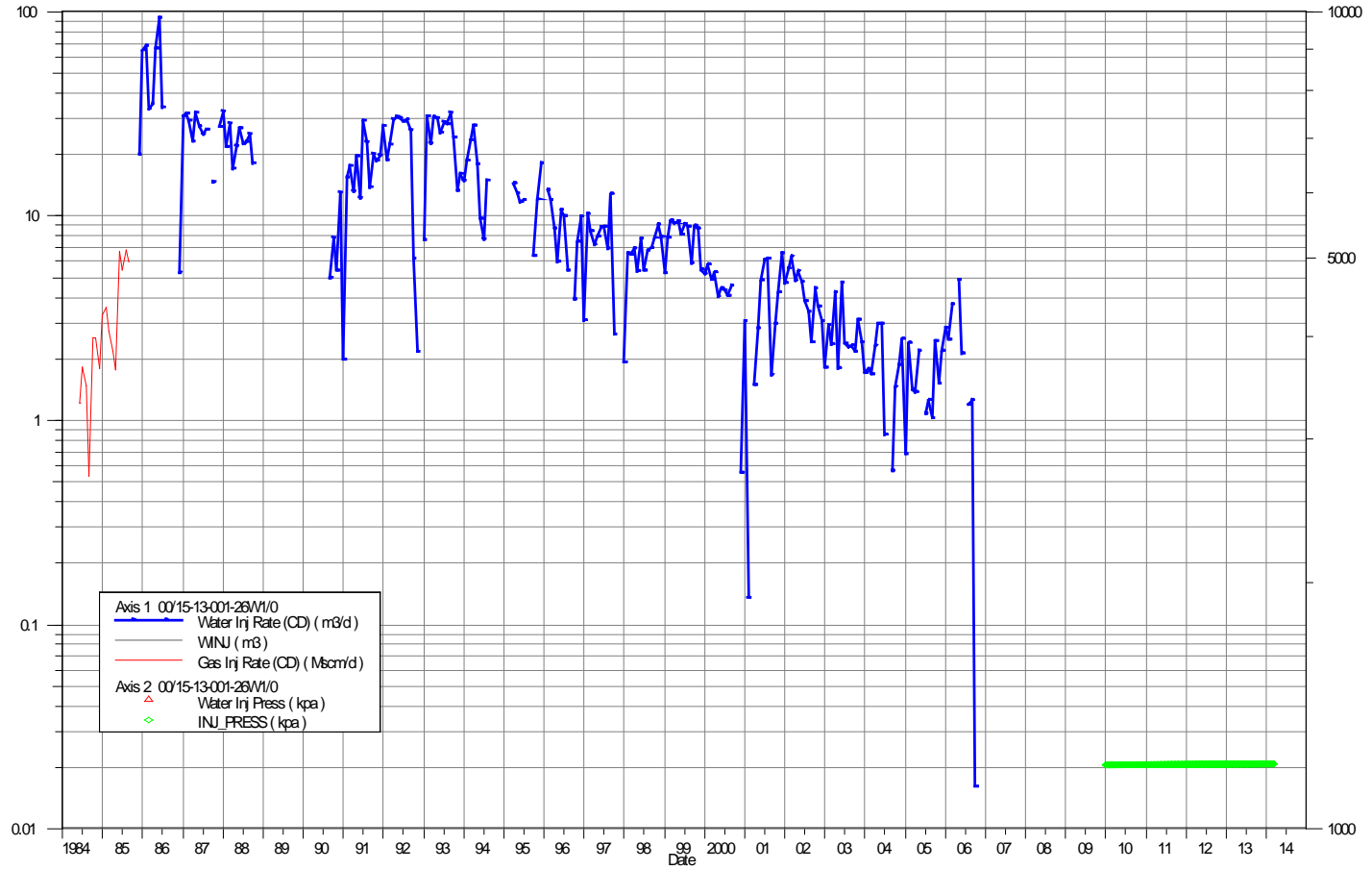
Cumulative Gas Prod : 0.00 MMscm



Status: WTR:INJ
Unit: WASKADA_UNIT_NO_4_-_PM_58
Zone: LOWER_AMARANTH_A
Operator: PENN_WEST Approval: Amaranth

PENNAESTEXPLORATION
00/15-13-001-26W/I/O

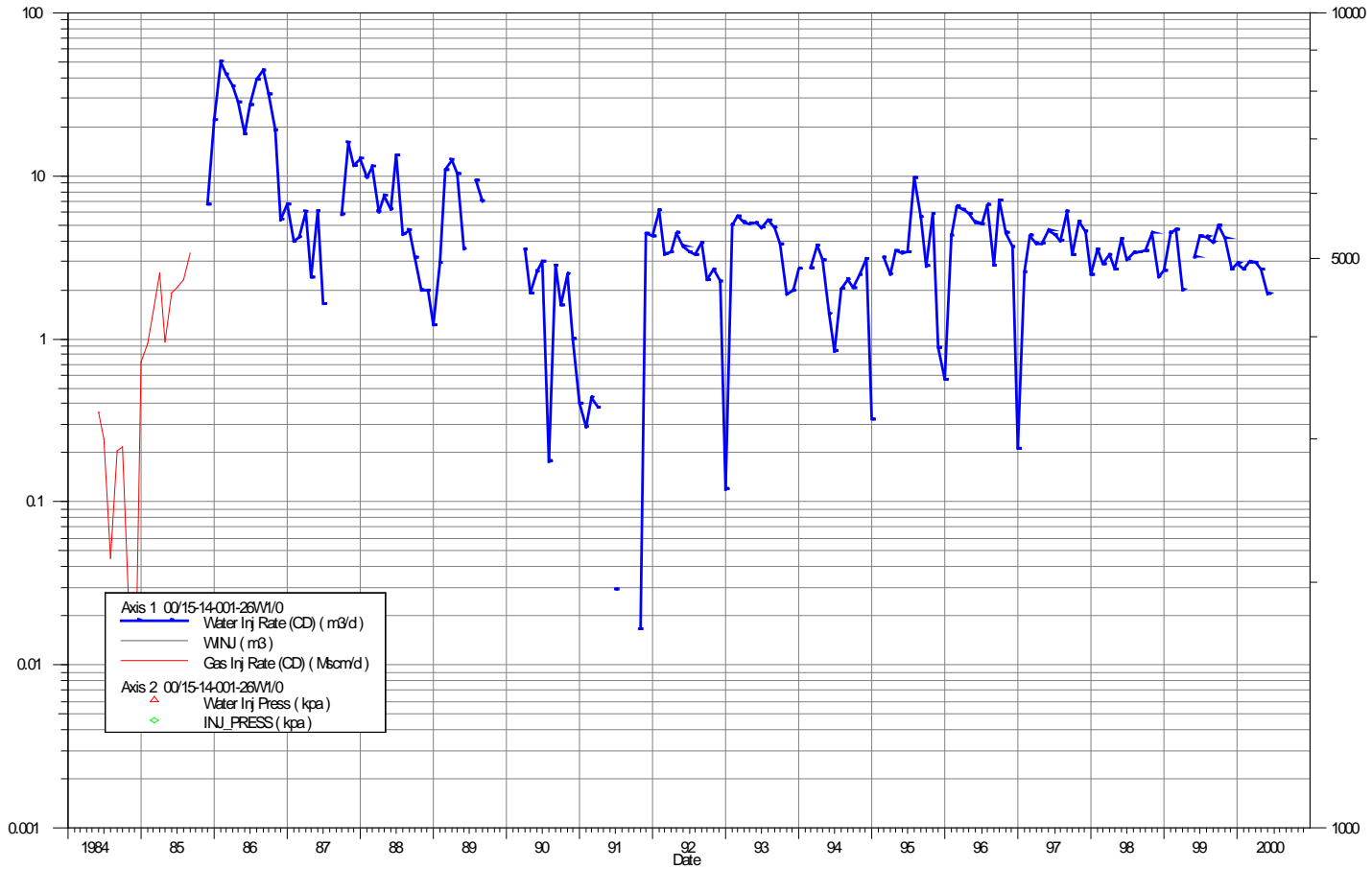
Cumulative Gas Inj : 1.53 MMscm Cumulative Water Inj : 75.82 Mm3
Cumulative Water Prod : 0.63 Mm3
Cumulative Oil Prod : 3.66 Mm3
Cumulative Gas Prod : 0.00 MMscm



Status: ABD-WINJ
Unit: WASKADA_UNIT_NO_4_-_PM_58
Zone: LOWER_AMARANTH_A
Operator: PENN_WEST Approval: Amaranth

PENNVEST EXPLORATION
00/15-14-001-26W/I/O

Cumulative Gas Inj : 0.53 MMscm Cumulative Water Inj : 29.14 Mn3
Cumulative Water Prod : 4.79 Mn3 Cumulative Oil Prod : 0.61 Mn3
Cumulative Gas Prod : 0.00 MMscm



Status: ABD-OIL

Unit: WASKADA_UNIT_NO_4_-_PMI_58

Zone: LOWER_AMARANTH_A

Operator: OMEGA_HYDROC Approval: Amaranth

PENNAVEST EXPLORATION

00/16-11-001-26W1/O

Cumulative Gas Inj : 0.00 MMscm

Cumulative Water Inj : 15.53 Mm3

Cumulative Water Prod : 3.86 Mm3

Cumulative Oil Prod : 0.47 Mm3

Cumulative Gas Prod : 0.00 MMscm

