

# Waskada Unit No. 10

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## Waterflood Progress Report

**January 1<sup>st</sup> – December 31<sup>st</sup>, 2013**

**PennWest**

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## **Introduction:**

The Waskada Unit No. 10 pressure maintenance project commenced water injection into the Mission Canyon designed and in accordance with Manitoba Energy and Mines Approval No. PM 46.

Please refer to Attachment 1 – Area Map.

PRESSURE MAINTENANCE: Governed by Board Order No. PM 46

## **Unit Information**

UNITIZED ZONE: Mission Canyon  
Original Unit, February 1, 1986 Board Order; Voluntary  
First Enlargement, September 1, 1986

POOL: Waskada Mission Canyon 3a C (03 43C)

This report documents the performance of the Waskada Unit No.10 pressure maintenance project for the period of January 1 to December 31, 2013. The Unit had production from 3 wells and no injection in 2013.

Unit 10 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 Mission Canyon in the Waskada area produces light density crude (approximately 36° API). Stratigraphically the Mission Canyon can be divided up into various members and marker beds (ie. MC3b, MC3a, MC2, MC1). It is overlain by the Charles Formation or the angular Paleozoic/Mississippian Unconformity, with beds dipping to the southwest. The lithology consists of complex interbedded grainstones, packstones, wackestones, and mudstones with some members consisting of predominantly primary anhydrite (ie. MC2). Porous members typically have porosity of 13-15% and permeabilities of 20-40 mD), although localized alteration due to the truncating Mississippian Unconformity can significantly reduce or eliminate those values in certain areas. Oil accumulation is generally found on isolated structural highs or areas with associated updip permeability degradation.

## **Discussion**

### **Production and Injection Performance**

Board Order No. PM 46 provided for pressure maintenance operations in Waskada Unit No.10. The Unit includes 2 abandoned injection wells and 6 producers. 3 wells produced for a short while in 2013. Pressure maintenance by water injection began in February 1986 and ceased in March 1987 and has remained shut in since this date. Water injection appears to have accelerated water production while

having little positive effect on oil production hence water injection has not been an effective enhanced recovery mechanism. The previous operator, Omega, therefore abandoned the injectors.

Please refer to Attachment 2 – A summary 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 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 0.16 and the Cumulative VRR from injection start is at 0.19. Both have declined gradually since ceasing injection in 1987. The Monthly VRR for the short period of injection in the late 1980s was well above 1.0 and could have easily contributed to high water production. Currently there is no active injector in this Unit and PennWest has no plans to reactivate injection.

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

Please refer to Attachment 7 – Individual Injection Well Performance Plots (2)

### **Pressure Surveys:**

No pressure surveys were conducted in 2013.

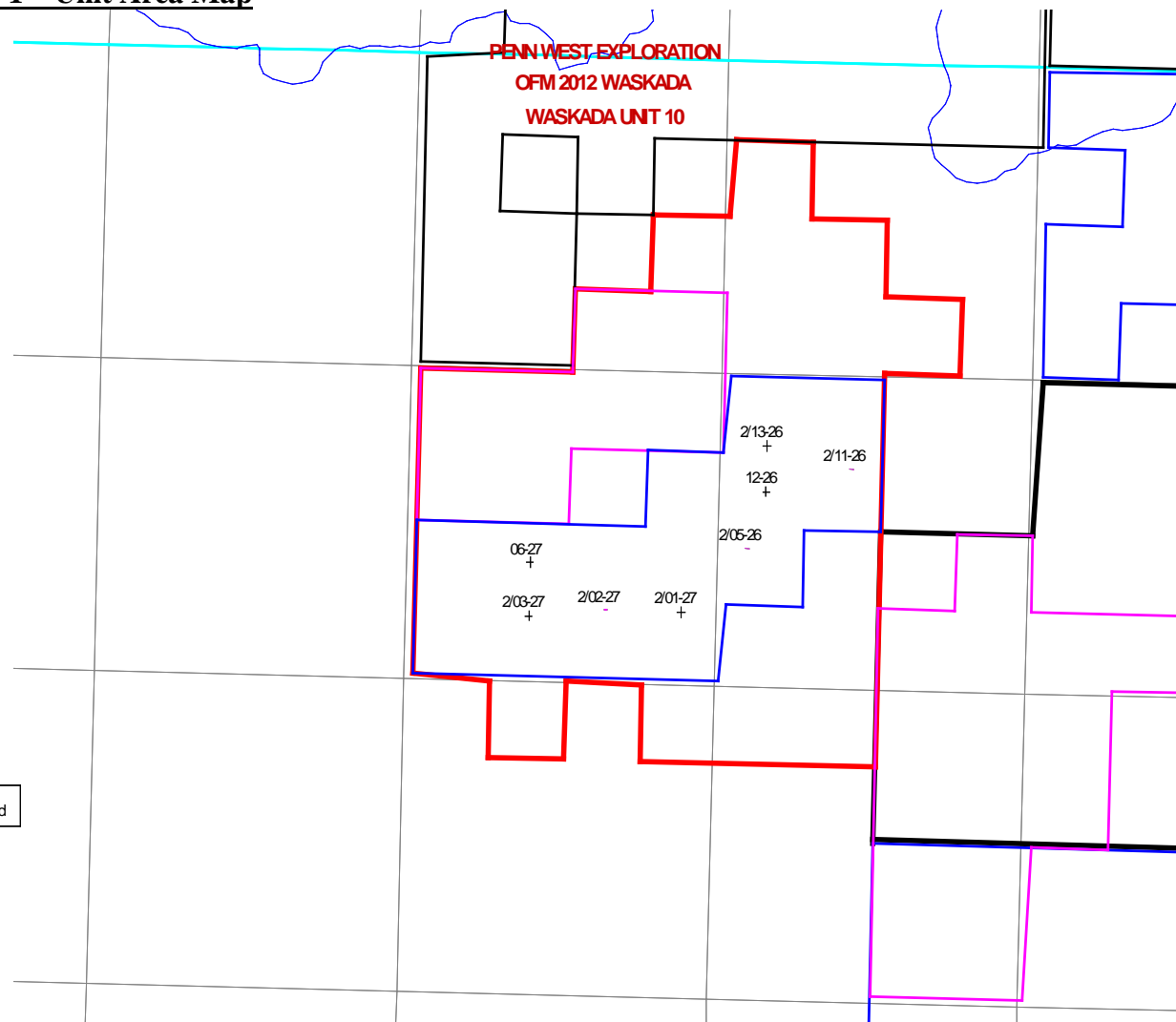
### **Corrosion and Scale Prevention Program:**

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**

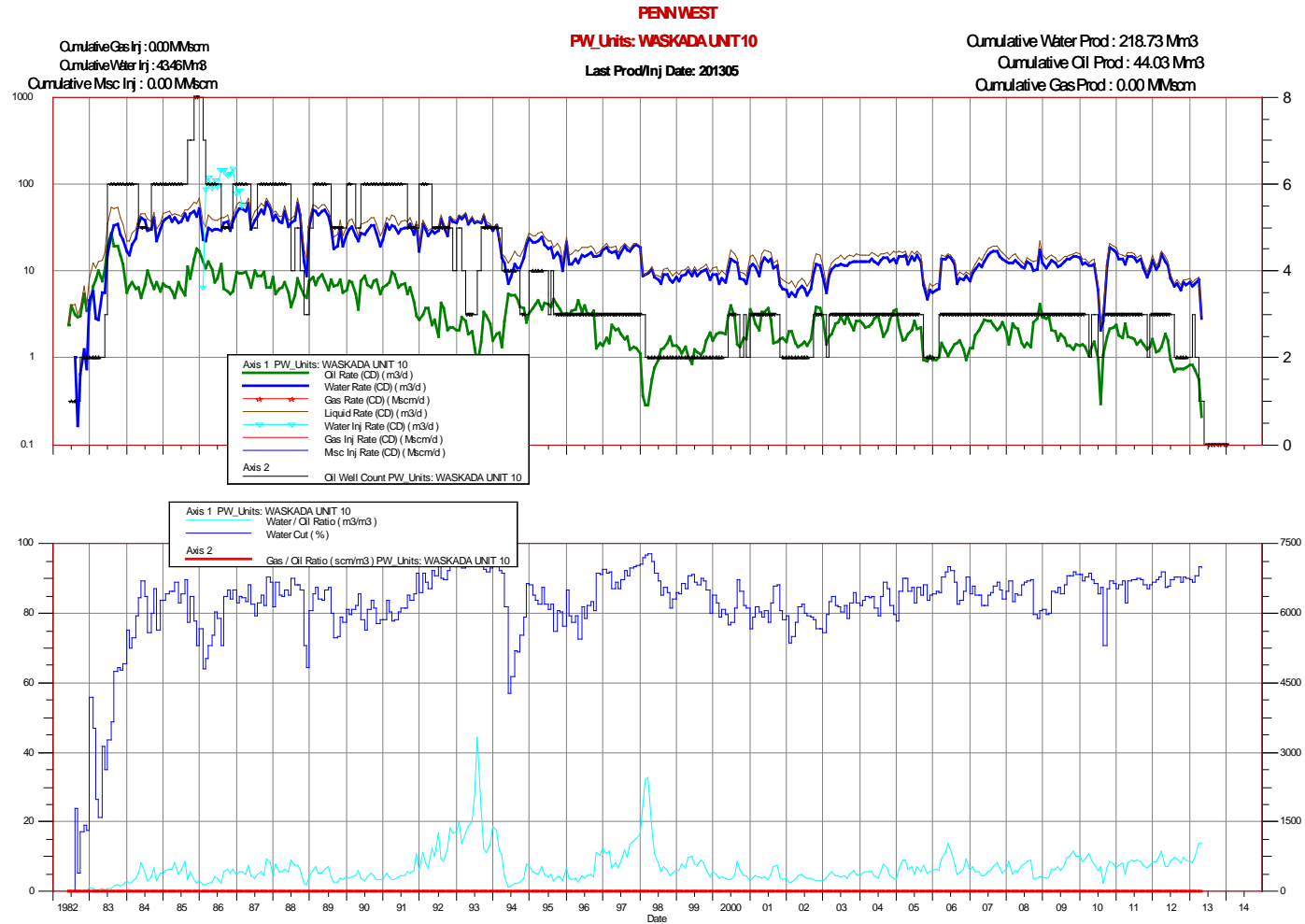
Since there is only one producer and no injection wells in this unit, we do not have any plans for this unit other than monitoring the 3 producers.

## ATTACHMENT 1 – Unit Area Map





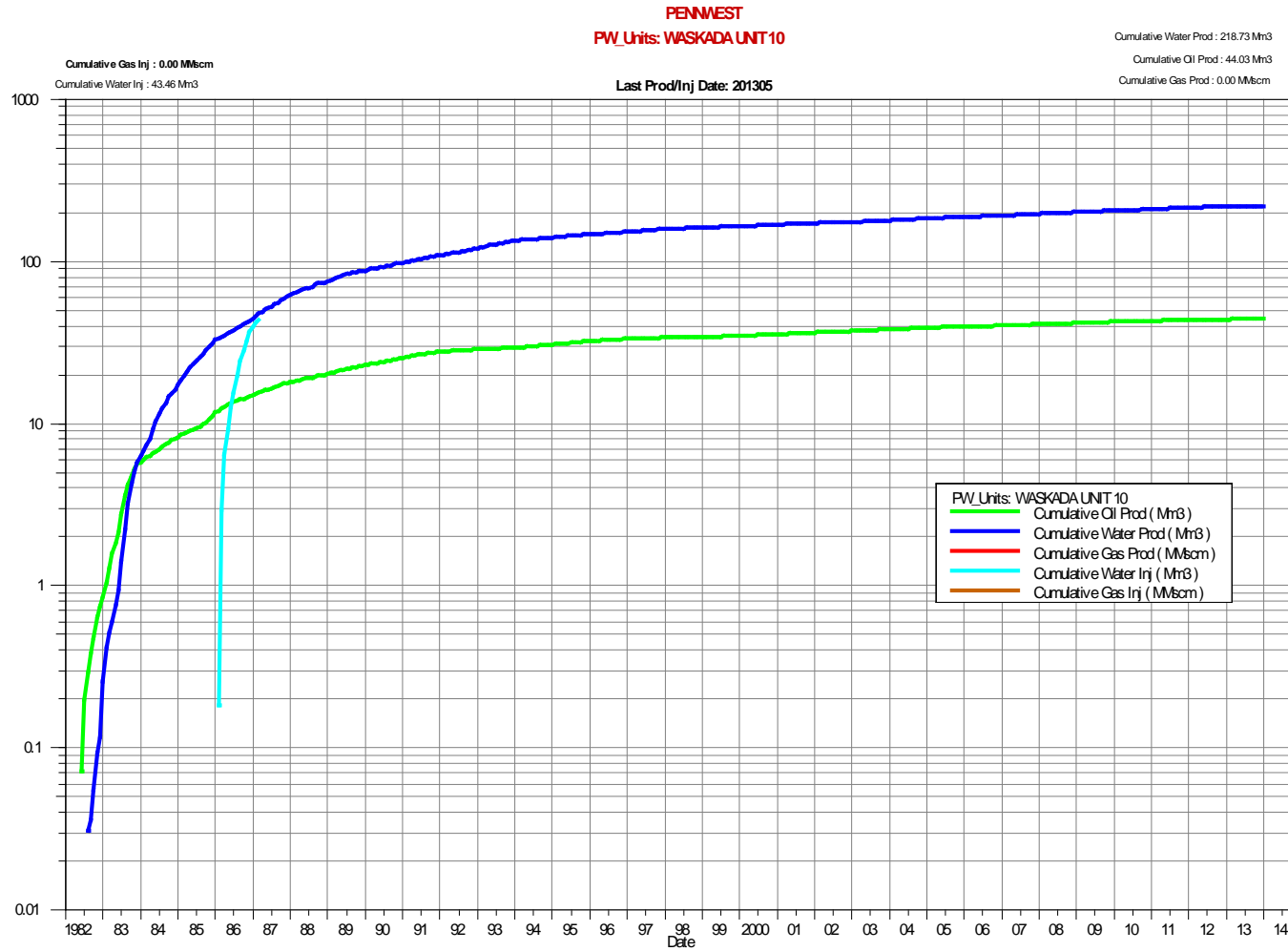
## ATTACHMENT 3 – Unit Production and Injection Plot



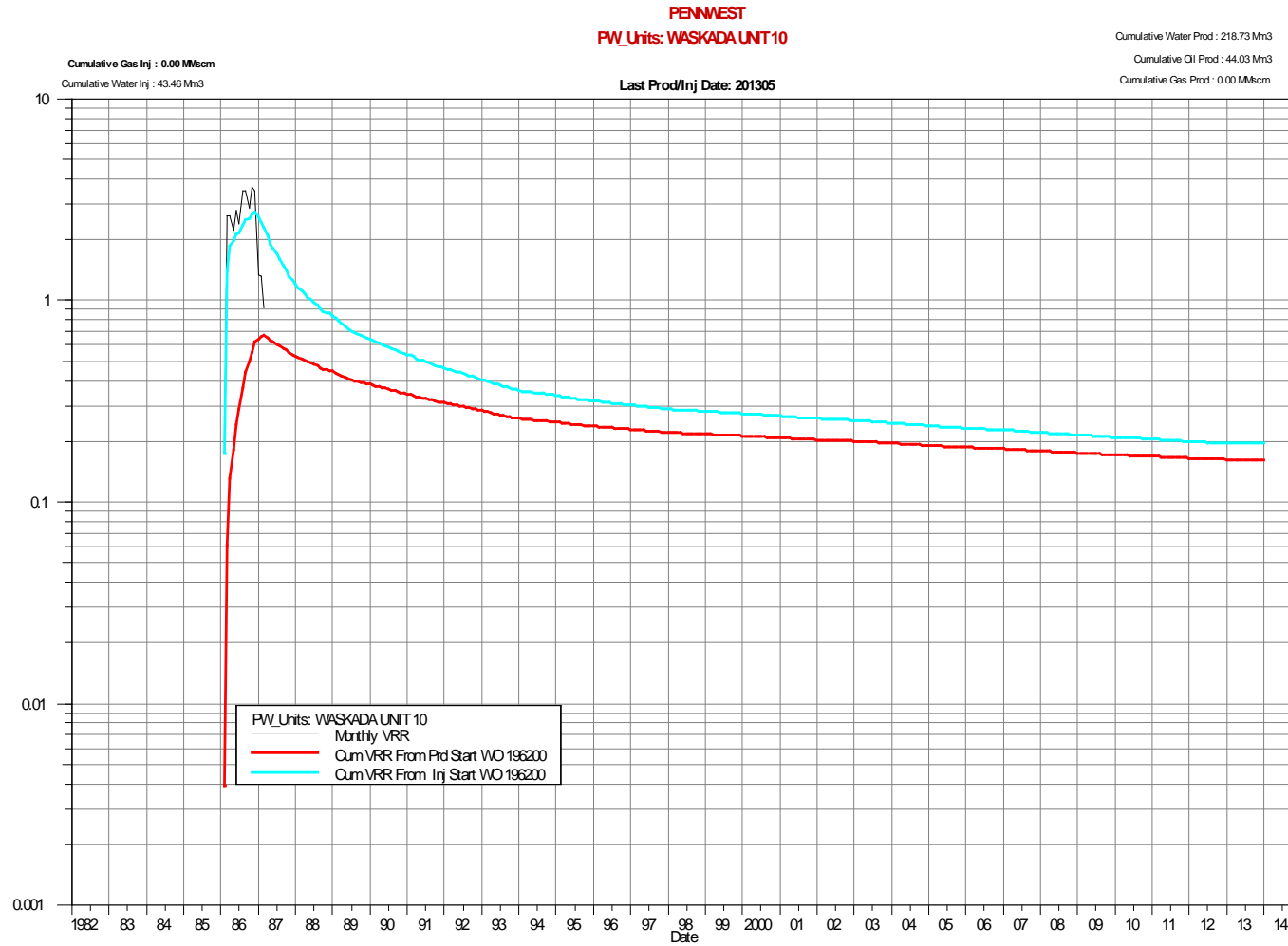




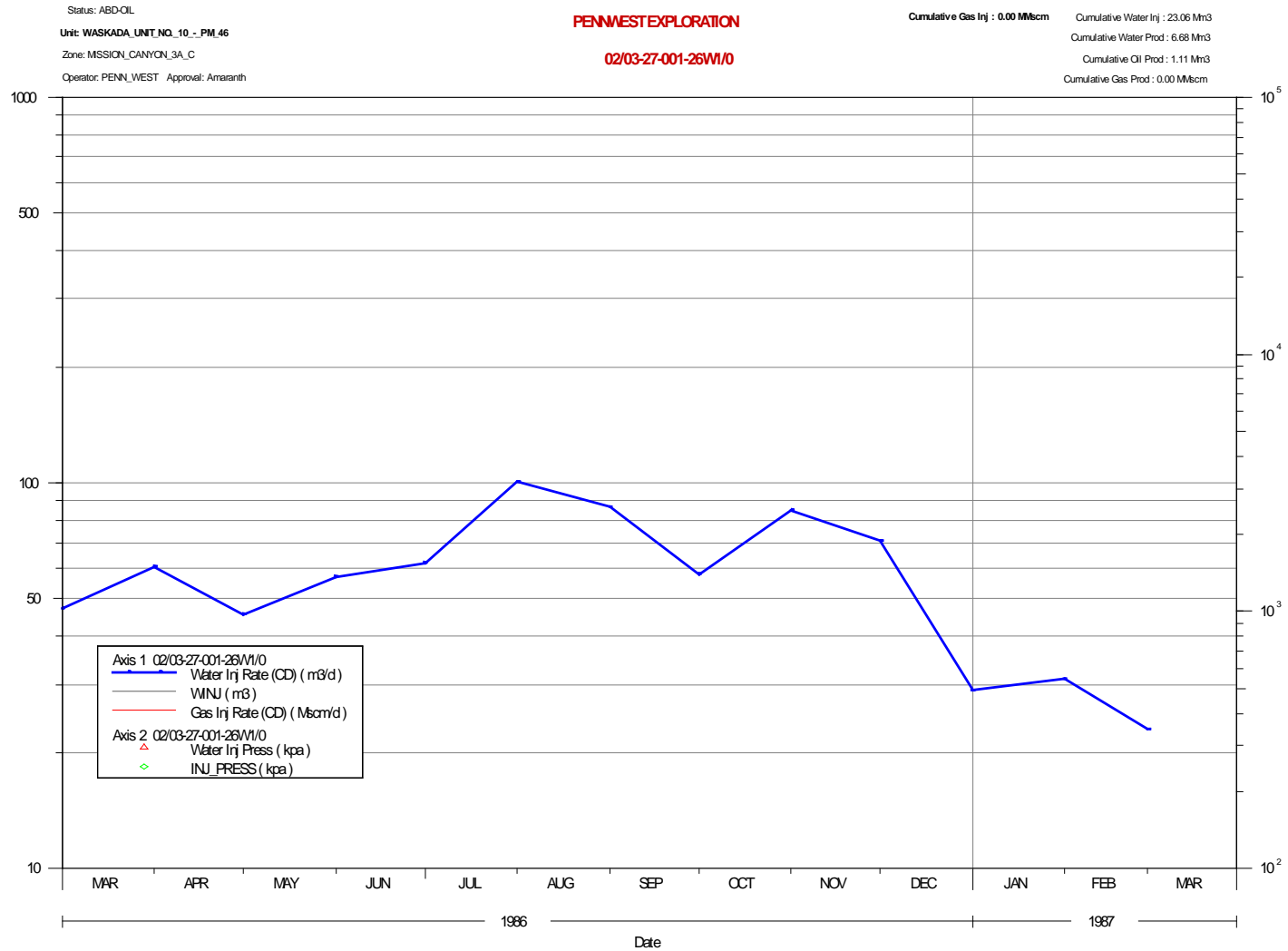
## ATTACHMENT 5 – Unit Cumulative Production and Injection Plot



## ATTACHMENT 6 – Unit Voidage Replacement Ratio Plot



## ATTACHMENT 7 – Individual Injection Well performance Plots (2 Wells)



Status: ABD-WINJ  
Unit: WASKADA\_UNIT\_NO\_10\_-\_PM\_46  
Zone: MISSION\_CANYON\_3A\_C  
Operator: PENN\_WEST Approval: Amaranth

**PENNVEST EXPLORATION**  
**02/13-26-001-26WI/O**

Cumulative Gas Inj : 0.00 MMscm  
Cumulative Water Inj : 20.40 Mn3  
Cumulative Water Prod : 5.84 Mn3  
Cumulative Oil Prod : 0.61 Mn3  
Cumulative Gas Prod : 0.00 MMscm

