

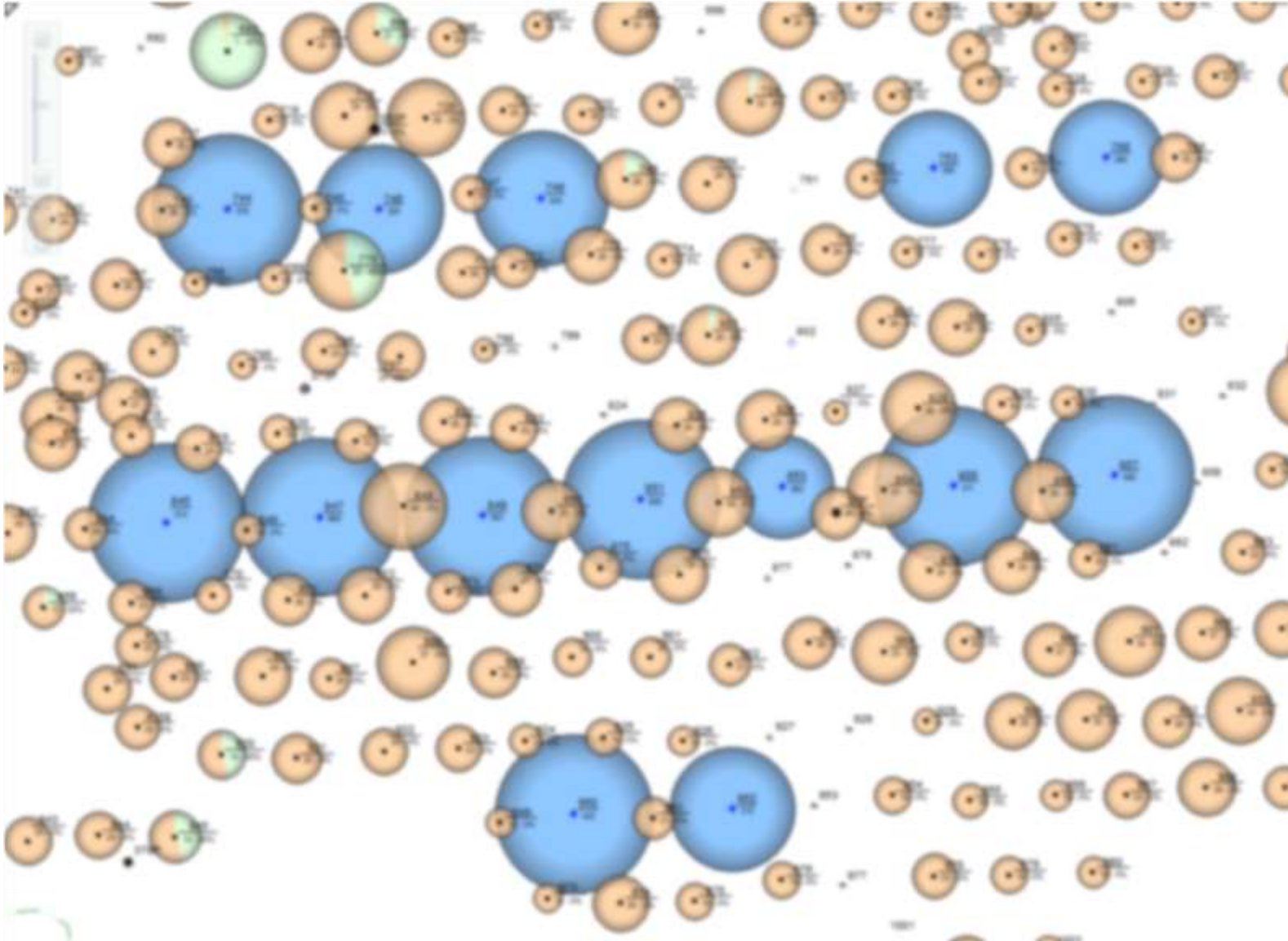


MULTIWELL RETROSPECTIVE TESTING

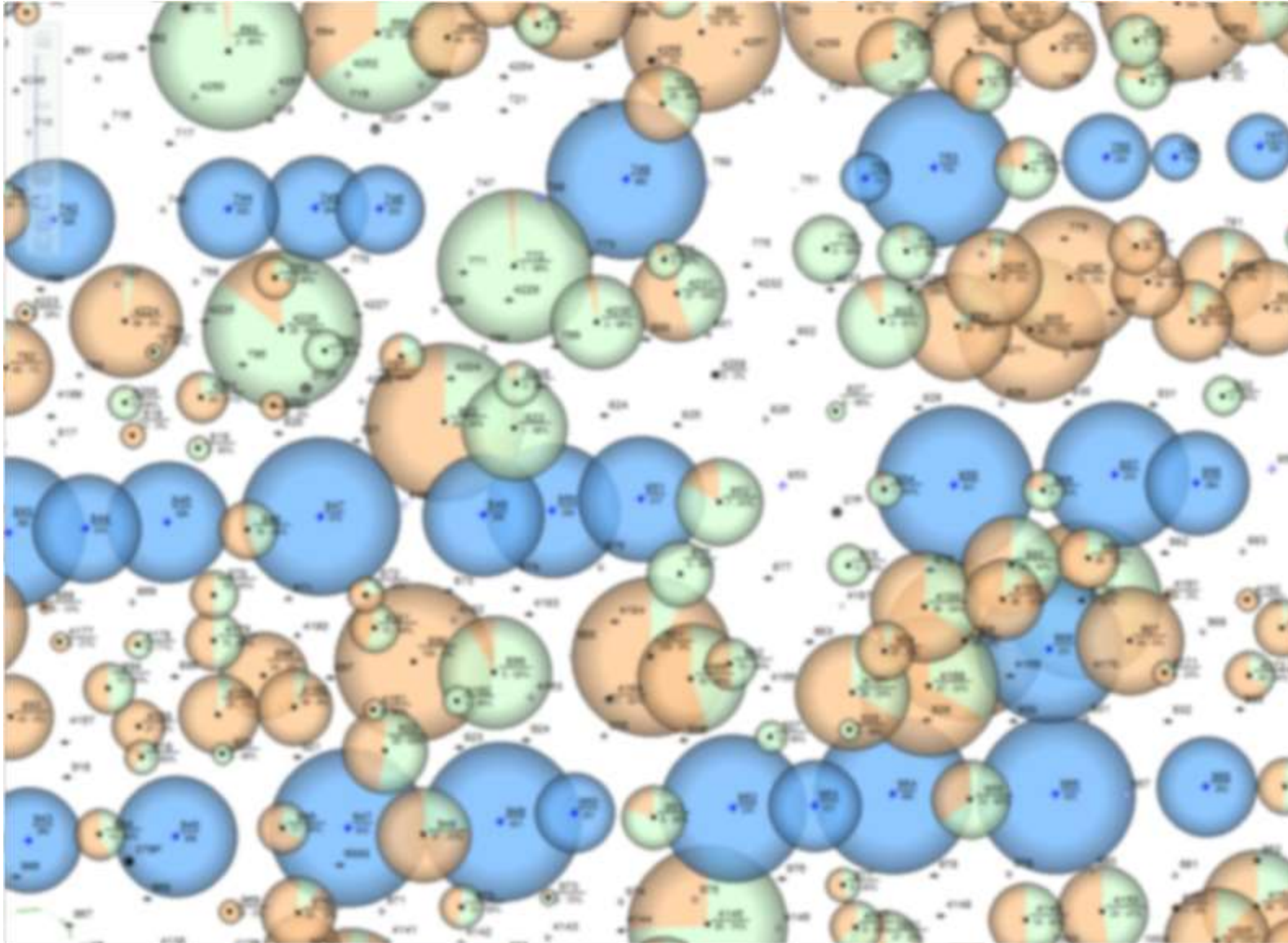
MRT

WATER FLOODING (WF)

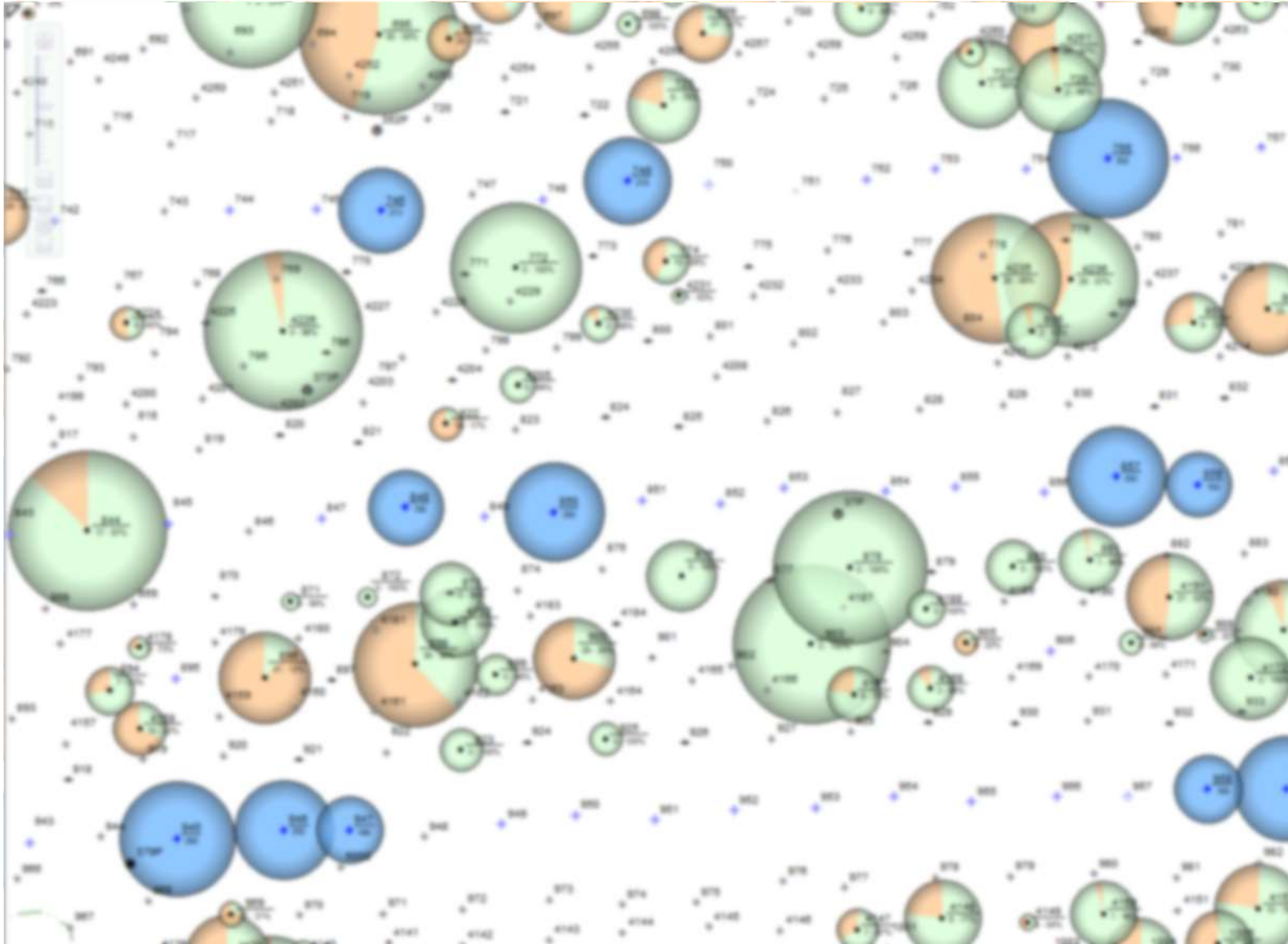
Waterflood at start



... 5 years later



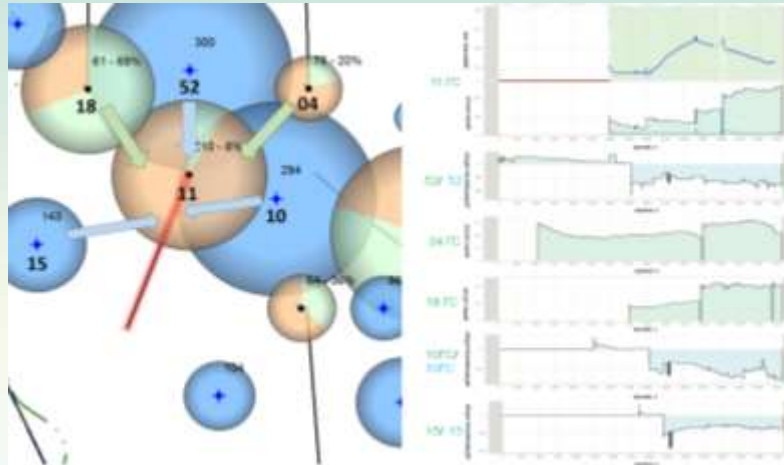
... another 5 years later



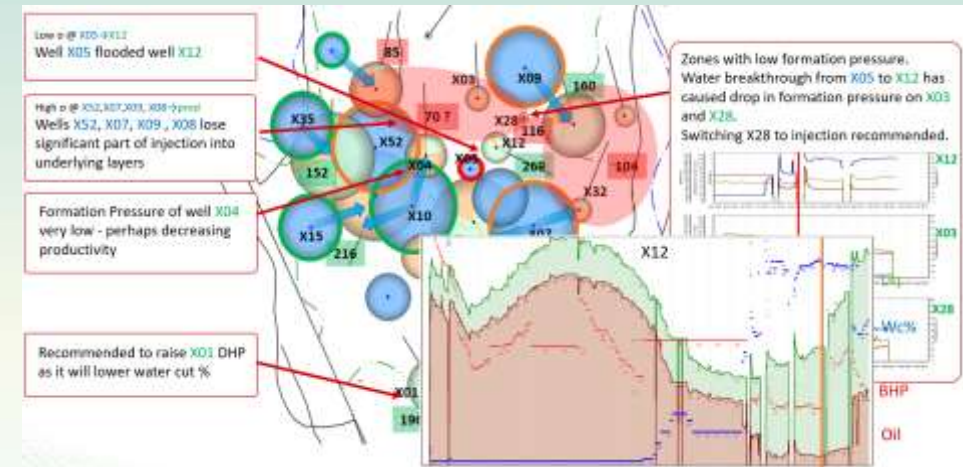
Multiwell Retrospective Testing (MRT)



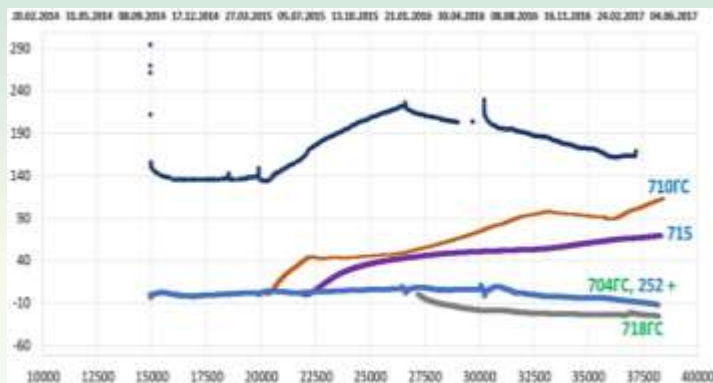
MRT Cell



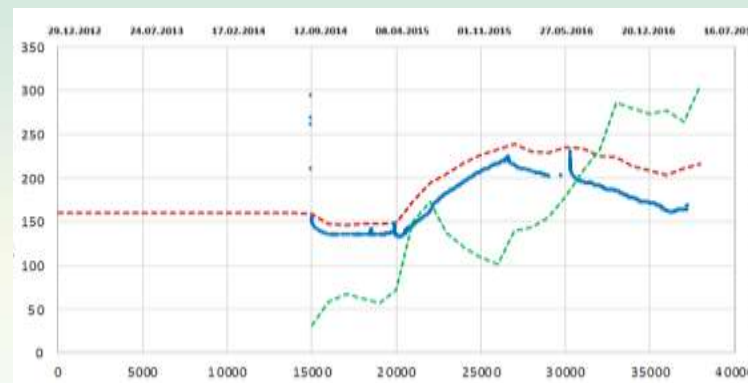
Field-wide MRT Analysis



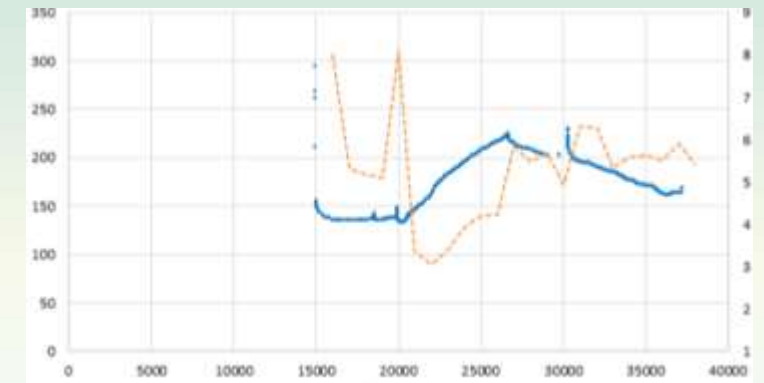
Pressure impact decomposition



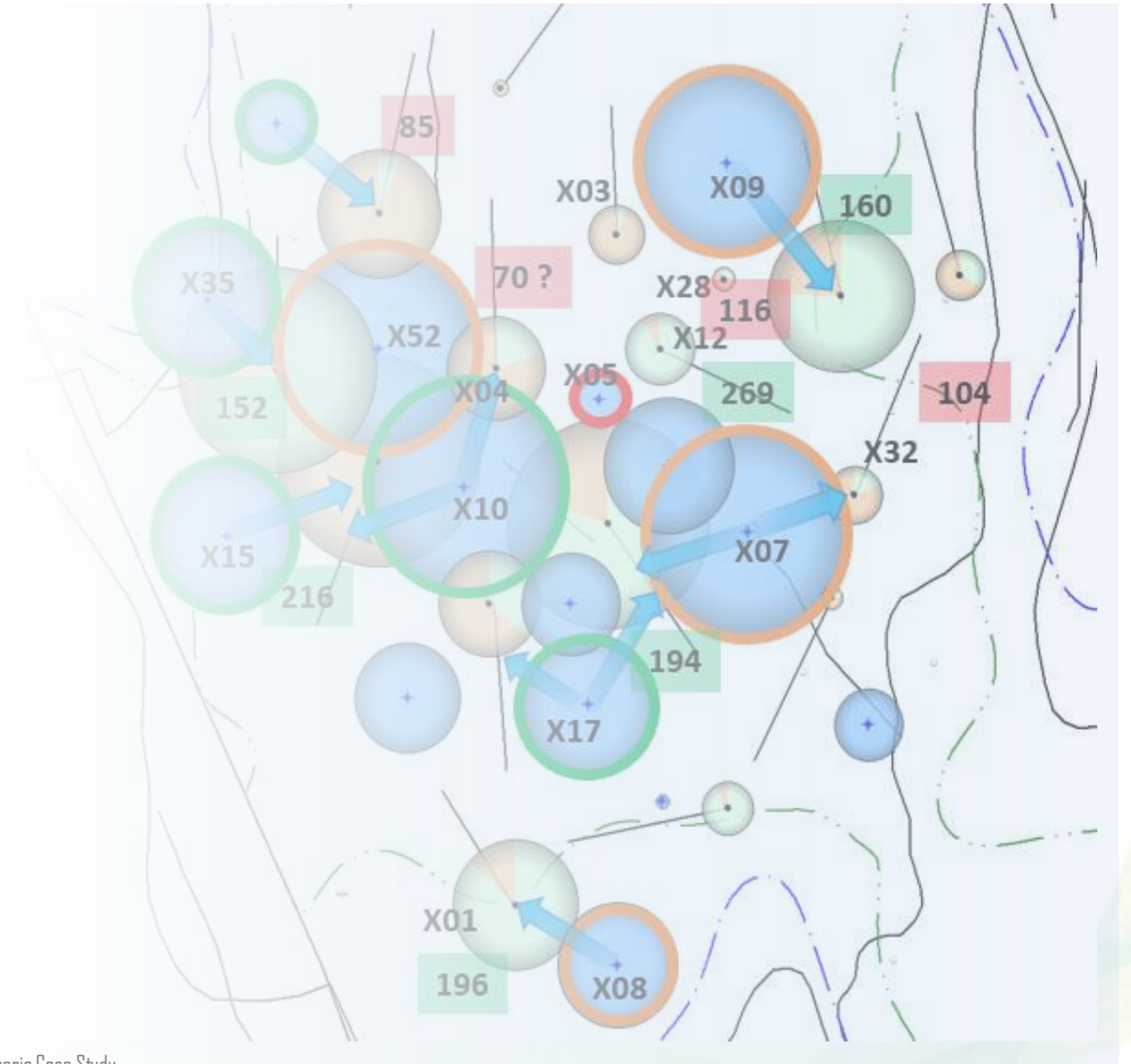
Frm. pressure history reconstruction



PI history reconstruction



Waterflood fine tuning with MRT



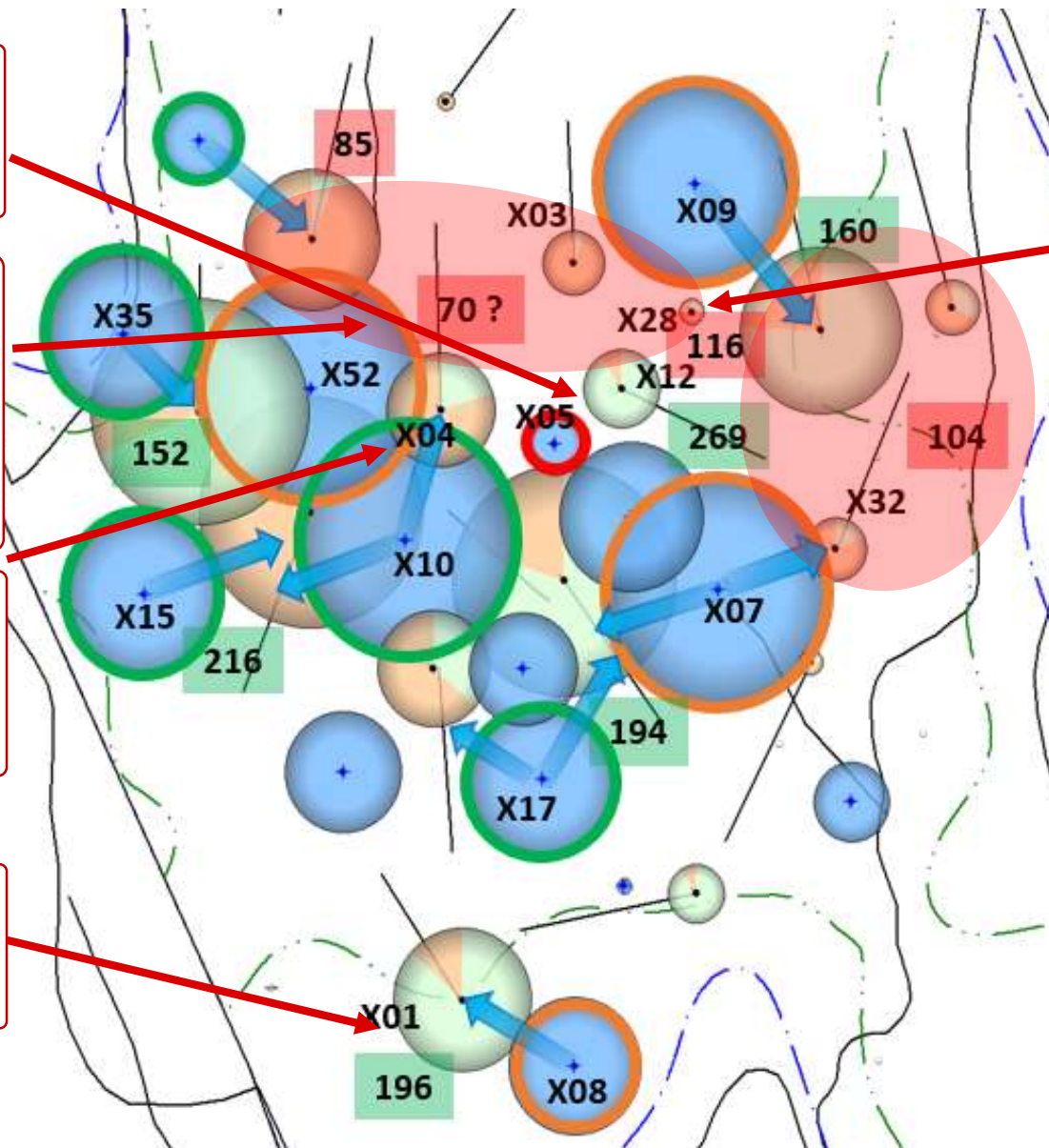
Waterflood fine tuning with MRT

Low σ @ **X05** → **X12**
X05 breakthrough to **X12**

High σ @ **X52, X07, X09, X08** → **prod**
X52, X07, X09, X08 are losing most water into underlying pay

Low P_{frm} **X04**, low PI

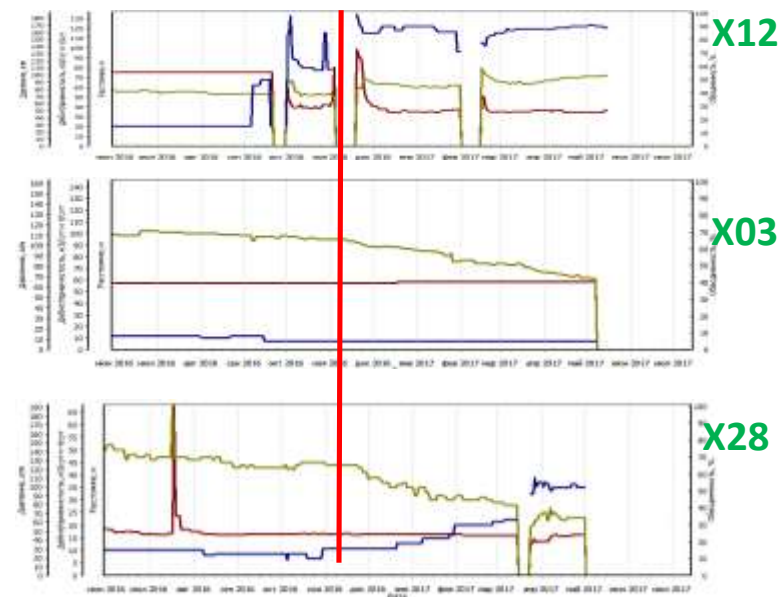
Recommendation: reduce **X01** drawdown to decrease watercut %



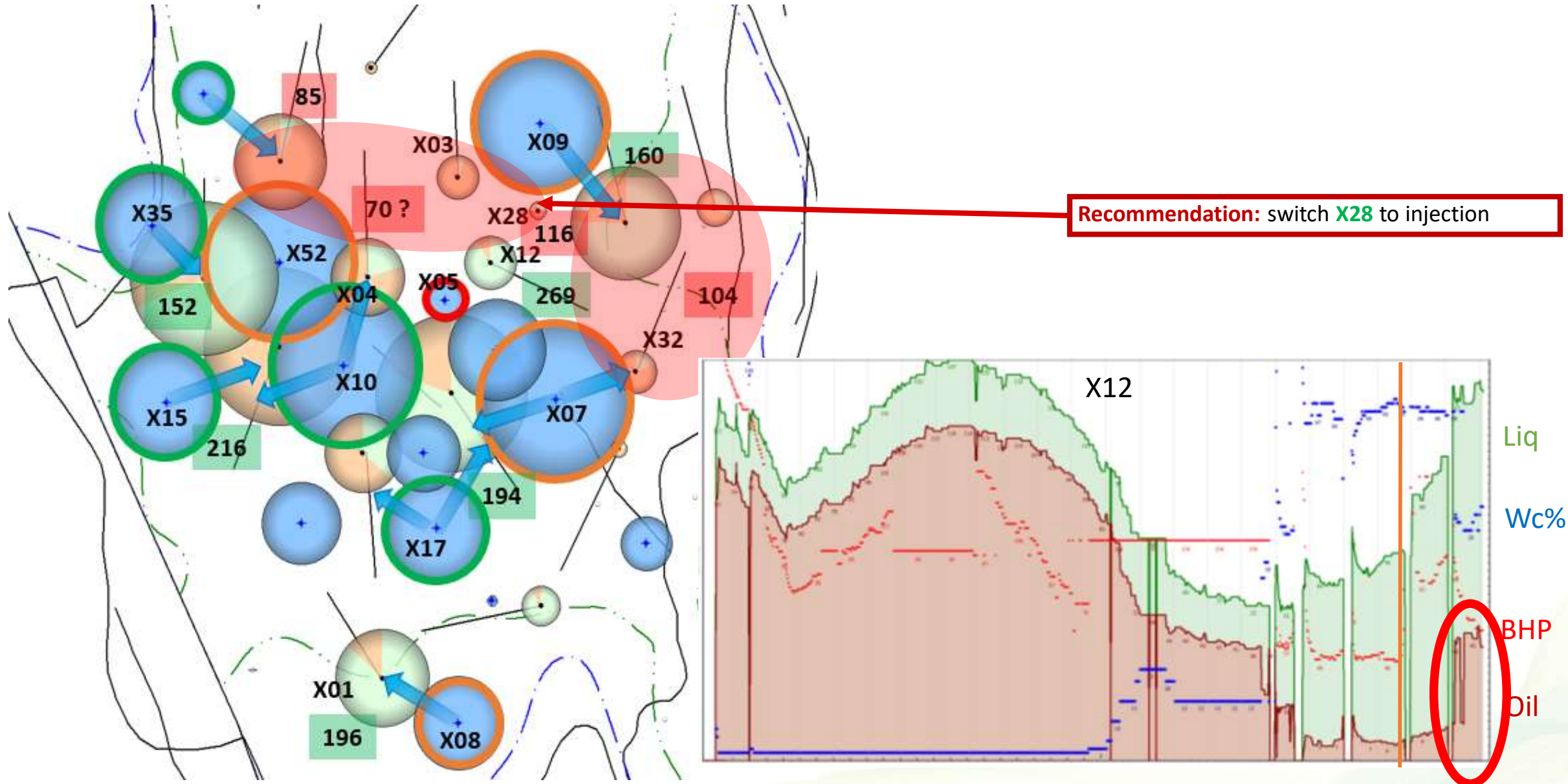
Low P_{frm} zones.

X05 breakthrough to **X12**, causing pressure drop in **X03** and **X28**.

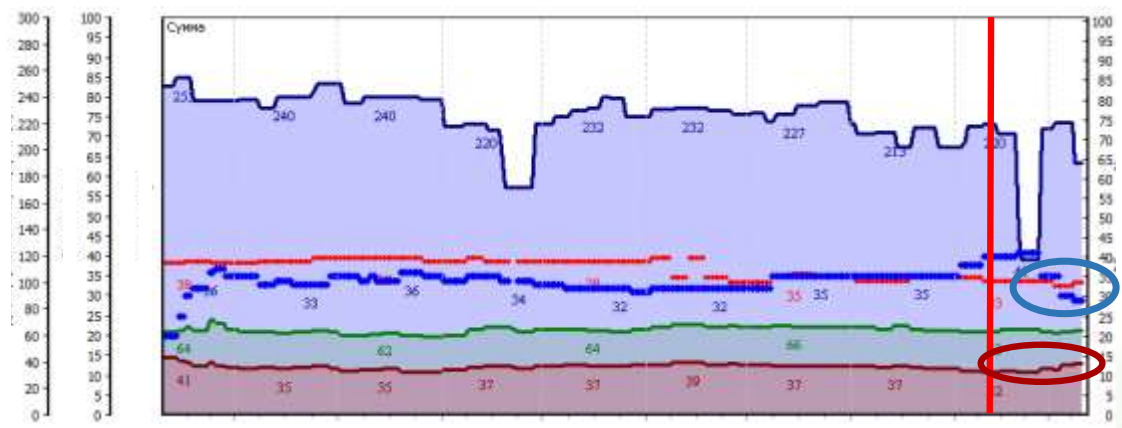
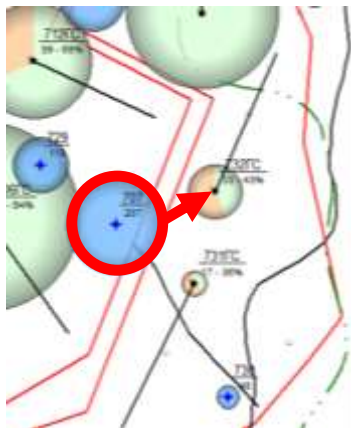
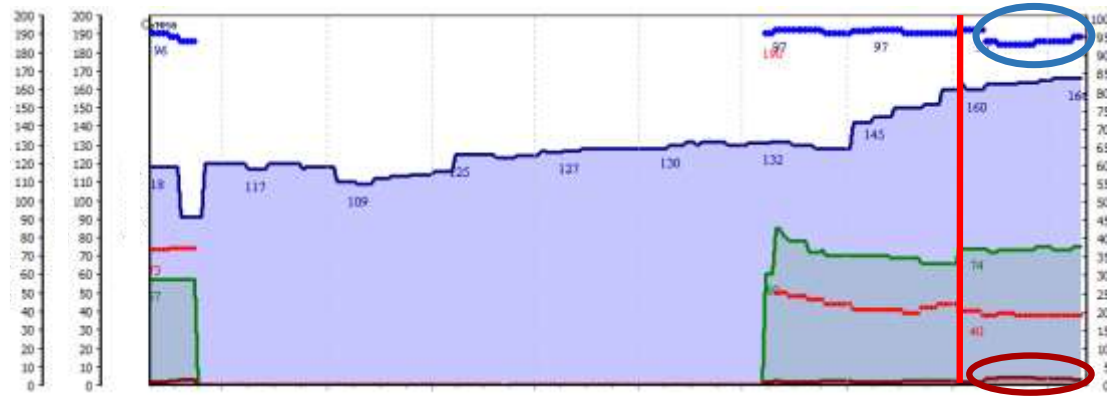
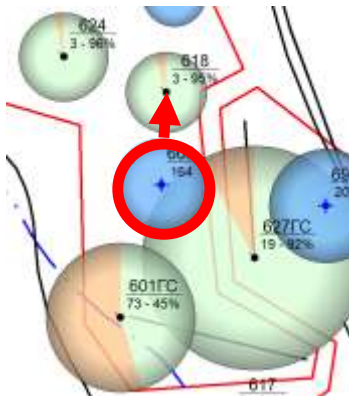
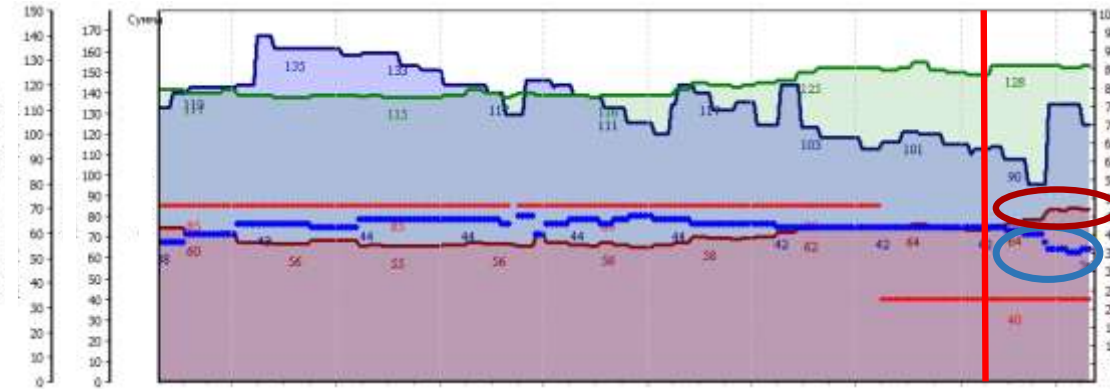
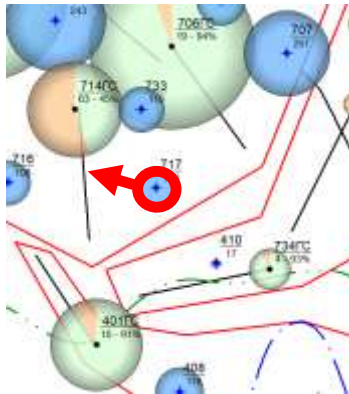
Recommendation: switch **X28** to injection



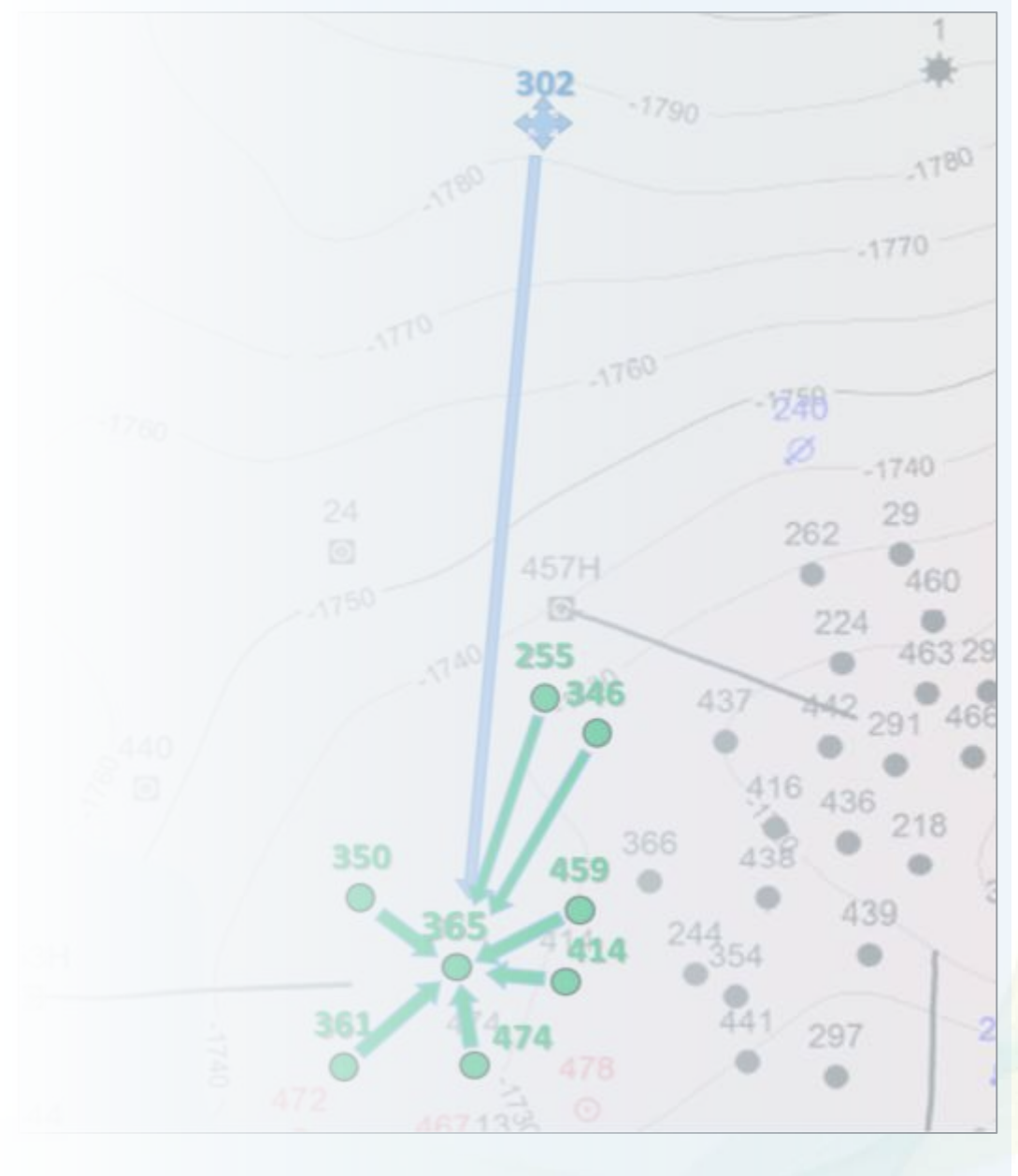
Waterflood fine tuning with MRT



Waterflood fine tuning with MRT



Adjusting target rates with MRT



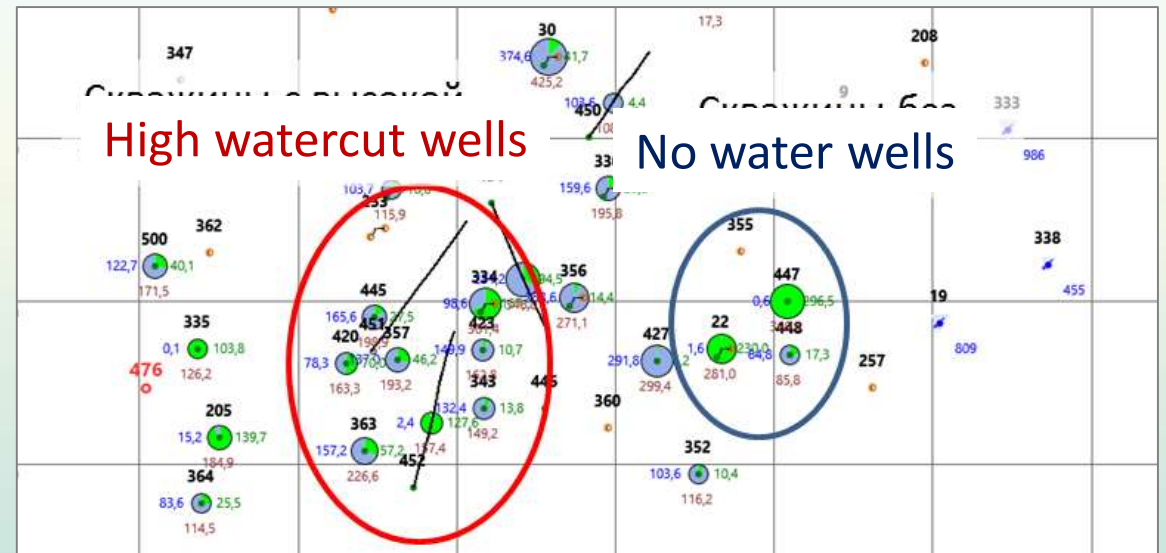
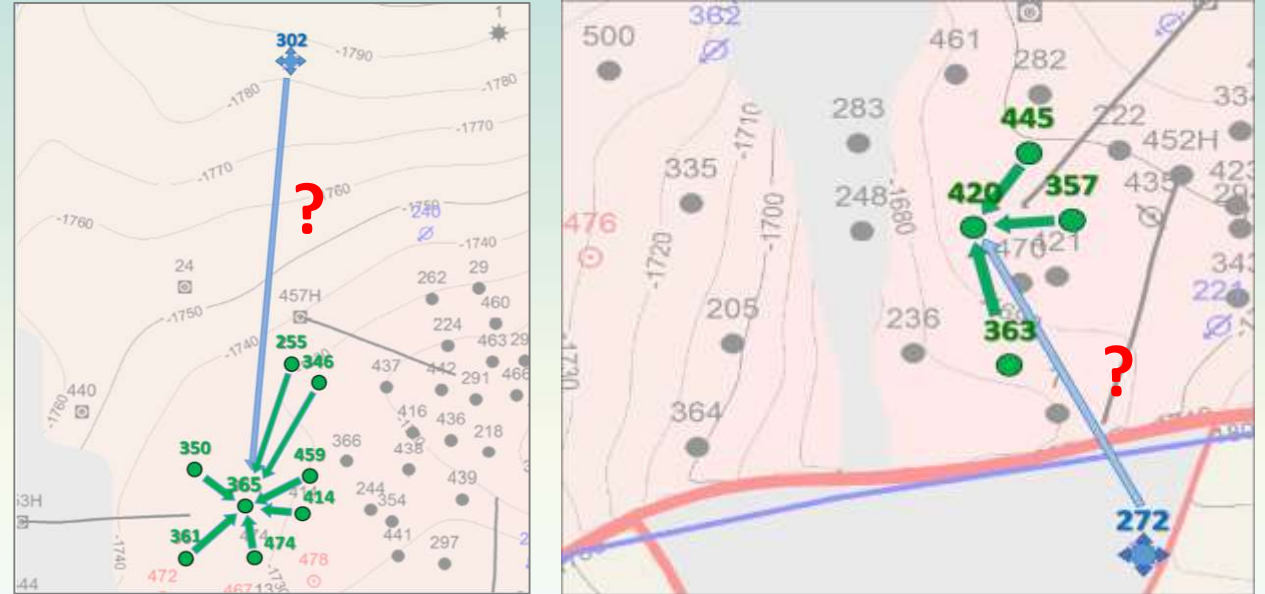
Adjusting target rates with MPT

ISSUES:

1. Non-uniform reservoir pressure drop
2. Unclear injection impact
3. Possible anisotropy of well interference
4. Oil production decrease

GOALS:

1. Identify injection impact
2. Assess cross-well pressure impact
3. Assess reservoir properties



Results: well and reservoir properties

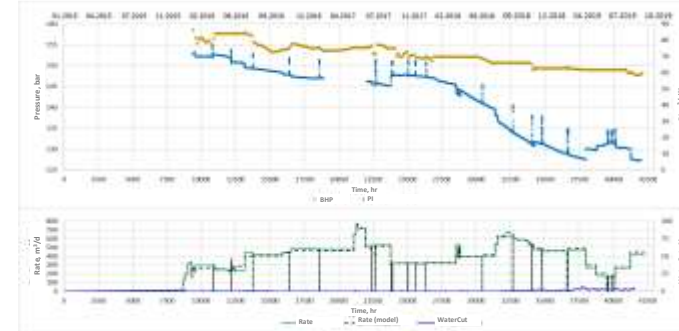
✓ FORMATION PRESSURE HISTORY RECONSTRUCTION



Sharp production increase in 2018

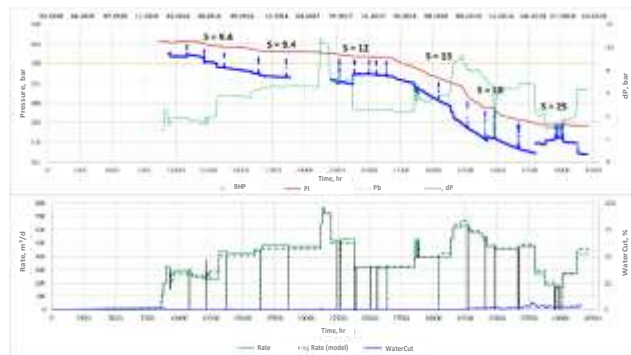
Formation pressure dropping at 0.23 bar/mnth

✓ PRODUCTIVITY INDEX HISTORY RECONSTRUCTION



PI drop 20-30%

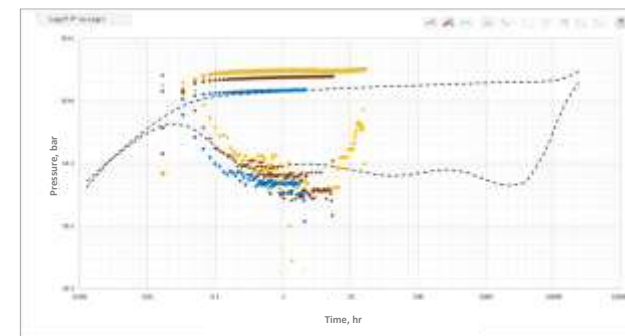
✓ PI DECREASE DUE TO SKIN RAISE



Skin raises from +9.4 to +25

Gas liberating with P_{wf} going below P_b , causing skin raise

✓ WELL AND RESERVOIR PROPERTIES



Skin = 25
Transmissibility = 34222 mD·m/cP
Permeability = 1920 mD
Drainage volume $5.37 \cdot 10^8 \text{ m}^3$
Drainage radius 9050 m

Results: formation pressure forecast



AROUND X20

Low actual injection, NFA forecasts reservoir pressure drop at 1.15 bar/mnth.



AROUND X65

Dramatic reservoir pressure drop in last 1.5 years (around 50% of overall drop through the field history) due to production increase. NFA forecasts reservoir pressure drop at 0.23 bar/mnth.



MRT results highlighting the urgency to increase injection

Results: well interference

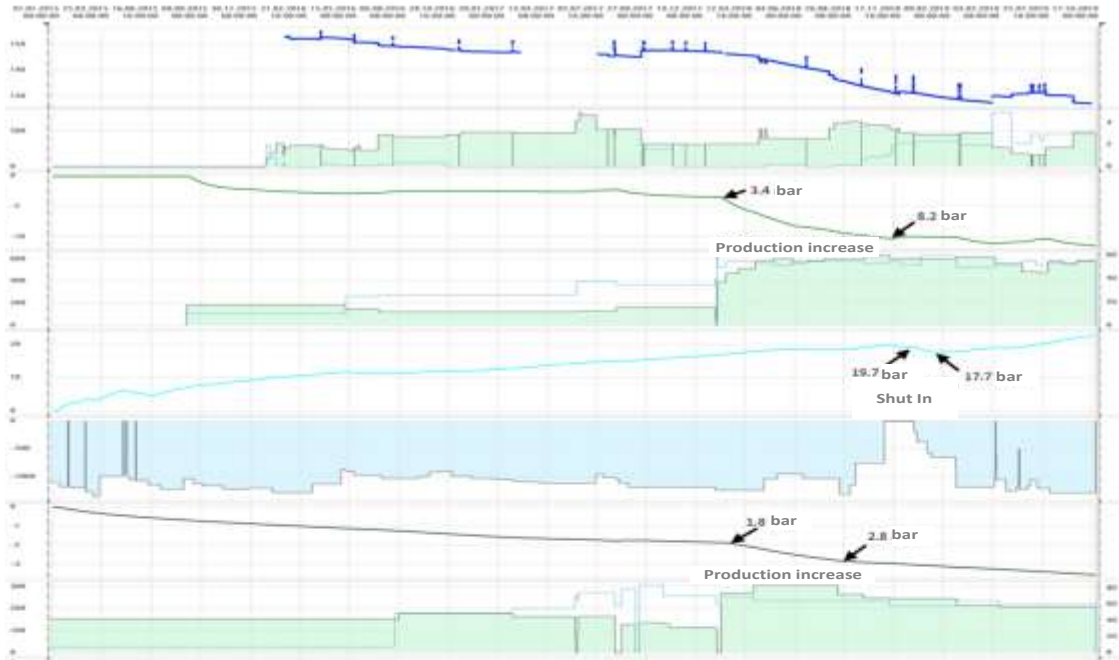


1. Well interference tends to be higher in N-S direction
2. Well **X72** has no impact on producing area during the tested time
3. Some wells are closely connected, stealing production from each other
4. High and fast producer-producer pressure impact points to NOT converting producers to new injectors



New rate targets

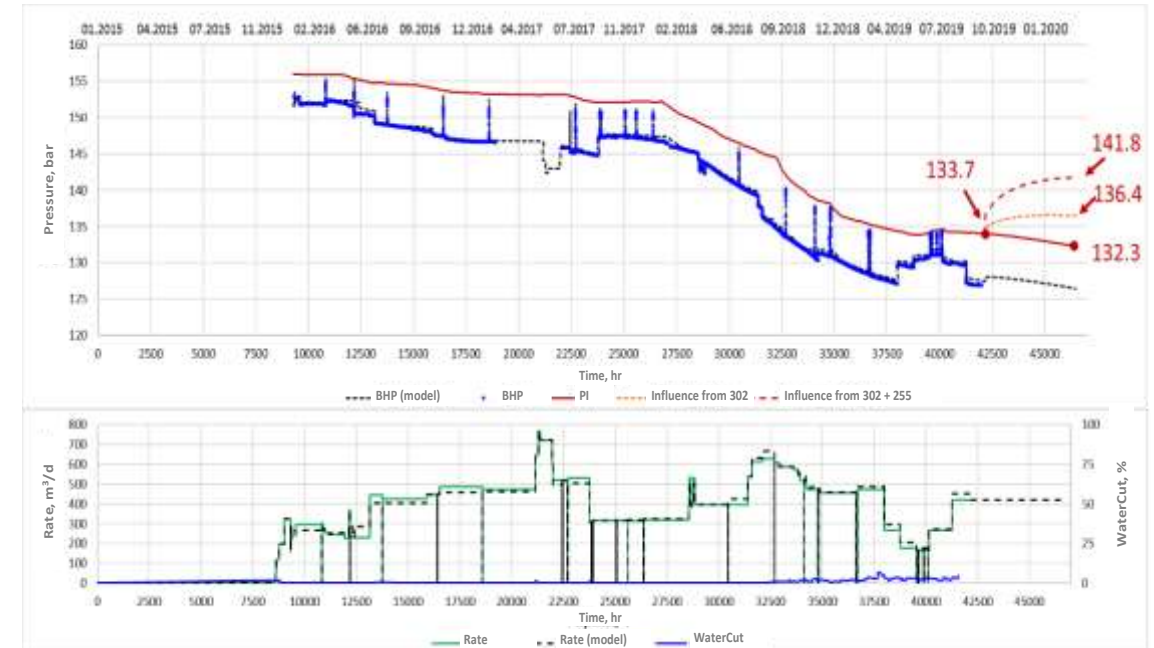
✓ WELL-TO-WELL IMPACT INDIVIDUALLY ASSESSED



RESULTING IN:

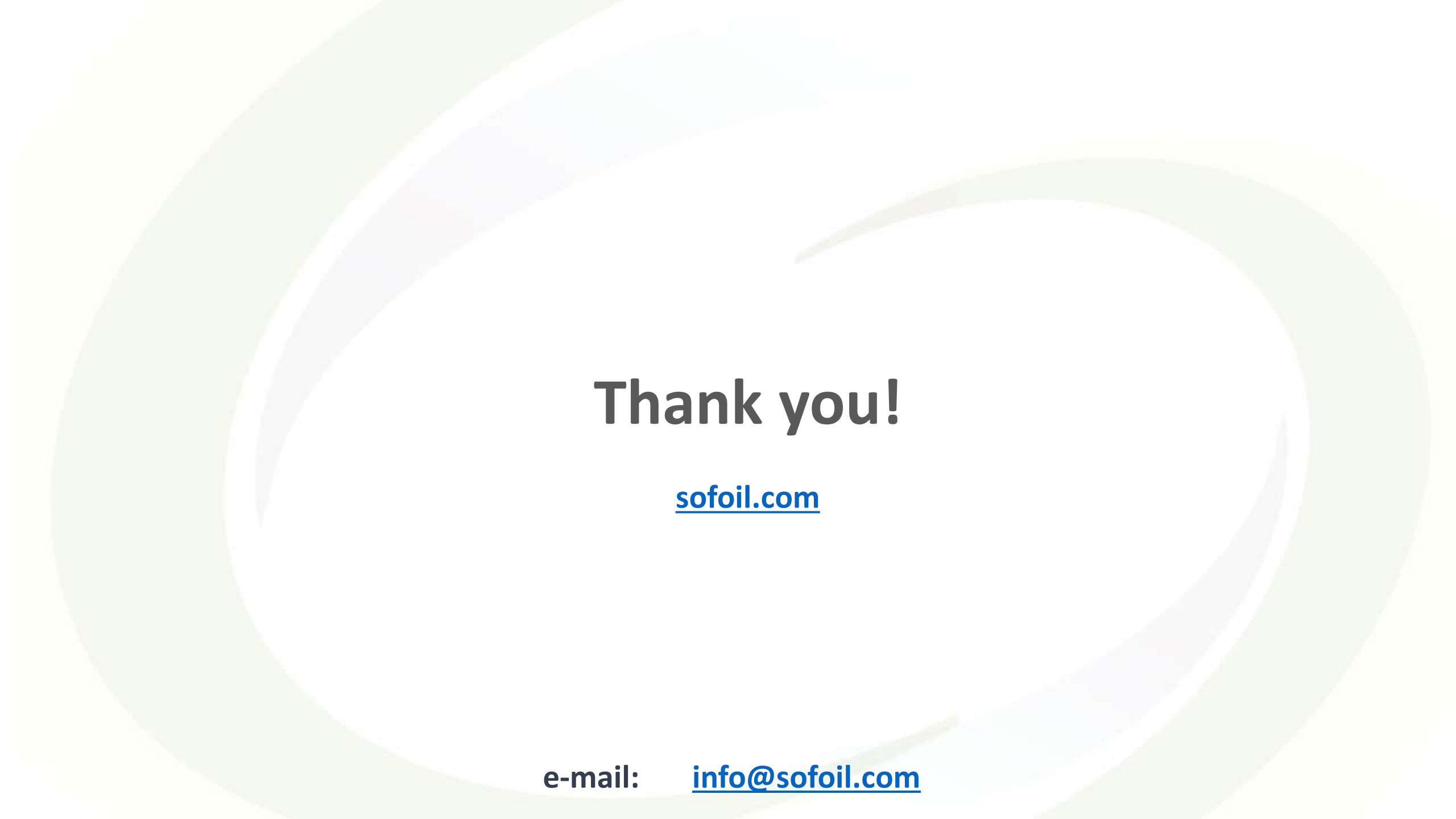
1. Finding high watercut wells with fast connection with good oil producers and redistribute liquid production to increase oil cut (wells **255** and **459**)
2. Understanding individual injector's performance

✓ MULTI-SCENARIO PRODUCTION FORECAST



IN 3 SCENARIOS:

1. No further activity
2. **302** injection increase
3. Reducing production of **255** and **302** injection increase



Thank you!

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