

Horizontal well Development strategy



Pakawas Mangkang

Team Member

Yoseph Partono

Stephan Otero

Duangdao Chutanukarn

Warin Lobtong

Suarporn Ketpreechasawat

B8/32 Asset, Thailand

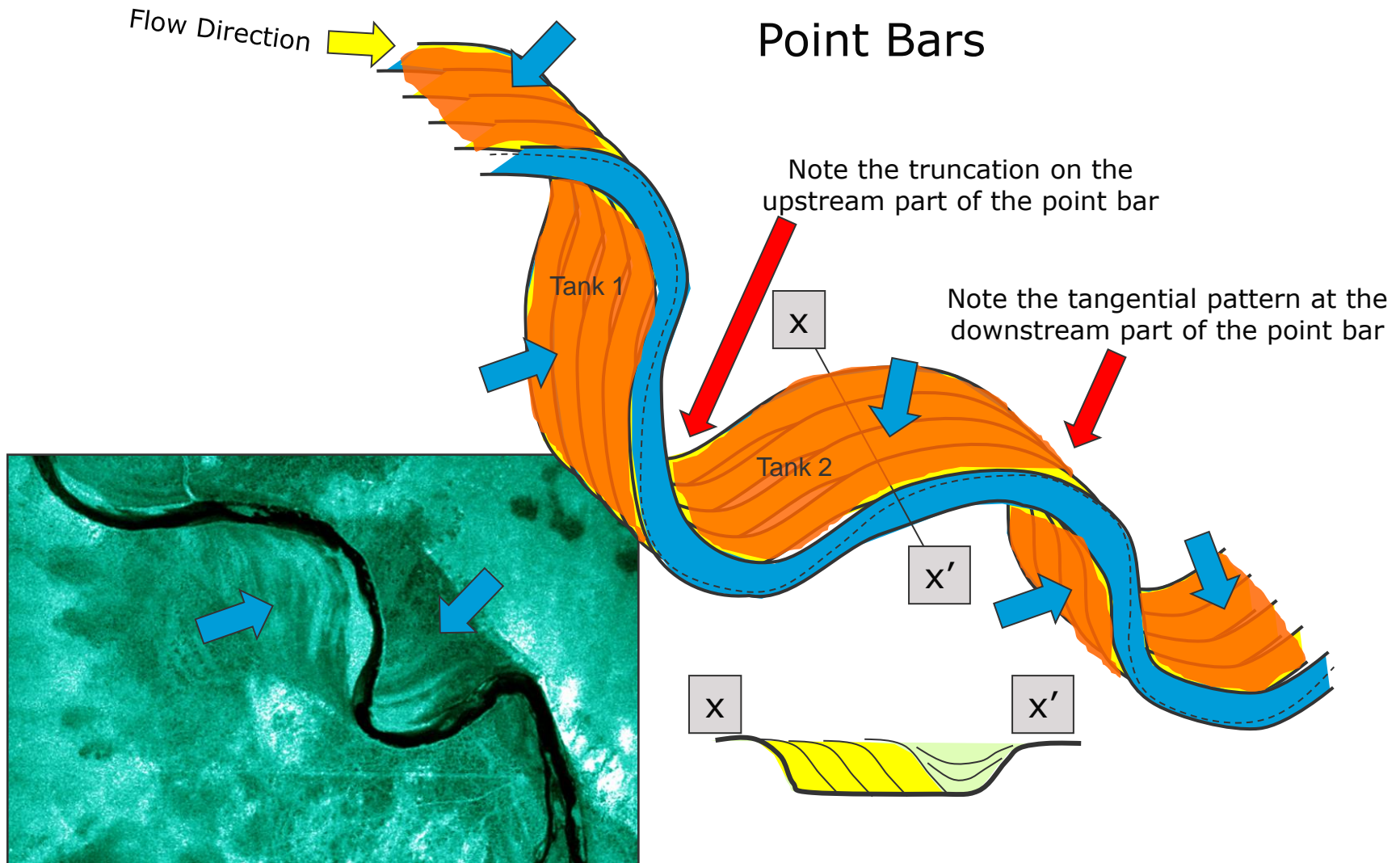
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- The expected recovery factor in strong water drive ranges from 18-40%.
- In OWC reservoir, it is necessary to limit the production rate to minimize water coning and maximize recovery.
- One possible solution that allows higher production rate and prevents premature water breakthrough is to utilize a horizontal well with ICD completion.
- Typical OOIP of horizontal wells in GOT ranges from 1.5-6 MMstb with roughly 30-100 ft of oil column.
- Horizontal wells “A” have been successfully completed in marginal oil reservoir, which have extended the limit of horizontal well placement and have opened up new opportunities to further develop thinner oil sands.

Gulf of Thailand Depositional Model:

Fluvial Point Bars compartmentalized by shale filled abandonment channels



Tank Definition & Hydraulic Communication

High degree of faulting and stratigraphy results in small compartmentalized tanks

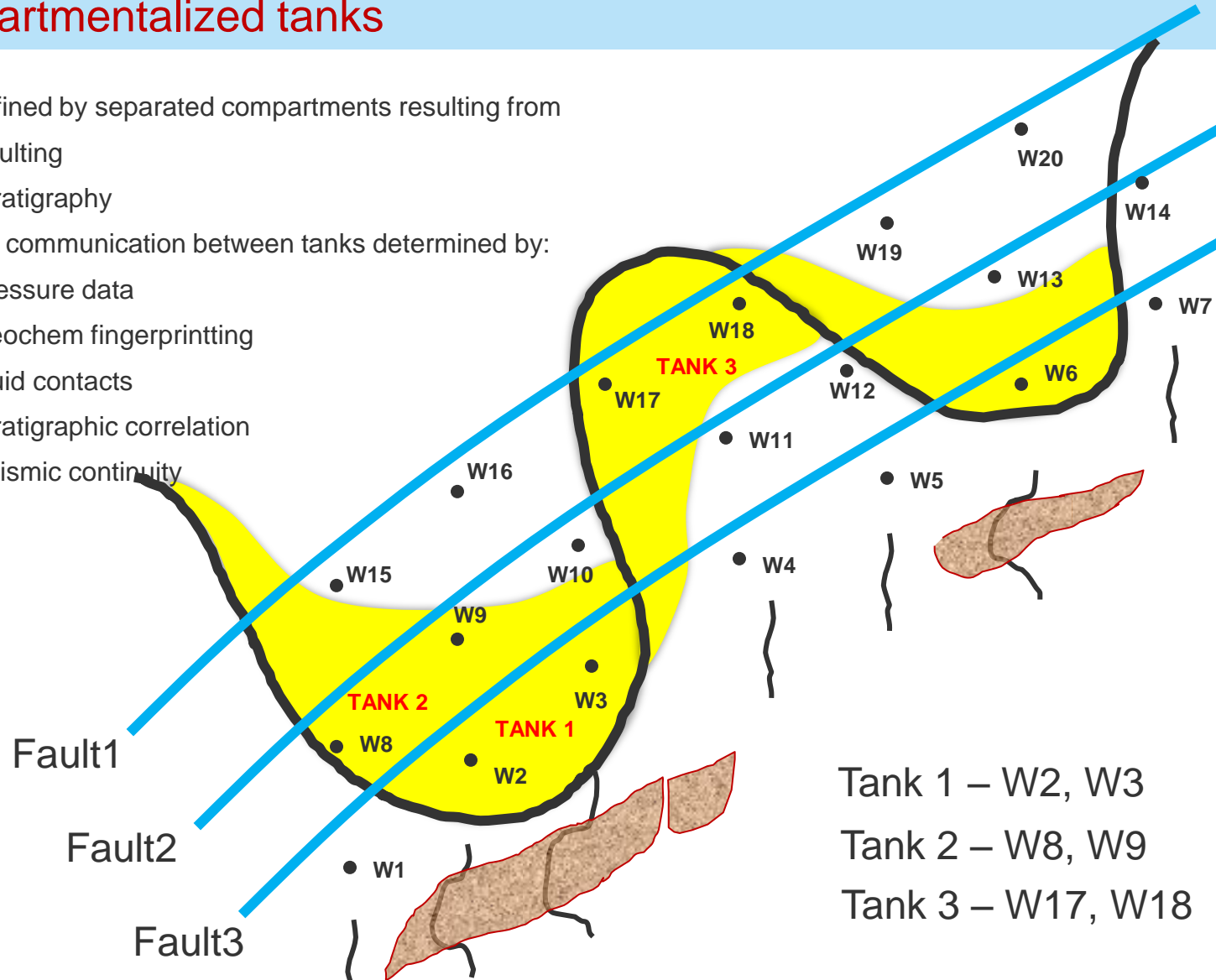


Tanks defined by separated compartments resulting from

1. Faulting
2. Stratigraphy

Hydraulic communication between tanks determined by:

1. Pressure data
2. Geochem fingerprinting
3. Fluid contacts
4. Stratigraphic correlation
5. Seismic continuity

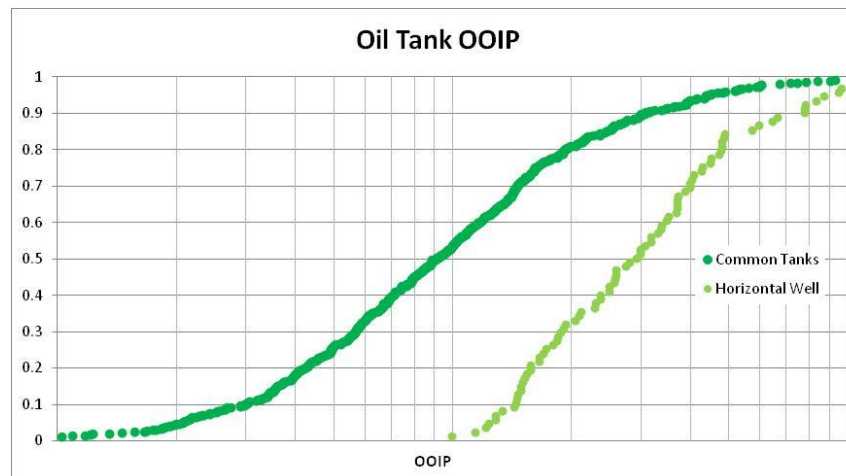


- Tank 1 – W2, W3
- Tank 2 – W8, W9
- Tank 3 – W17, W18

Platform “A” Development Drilling



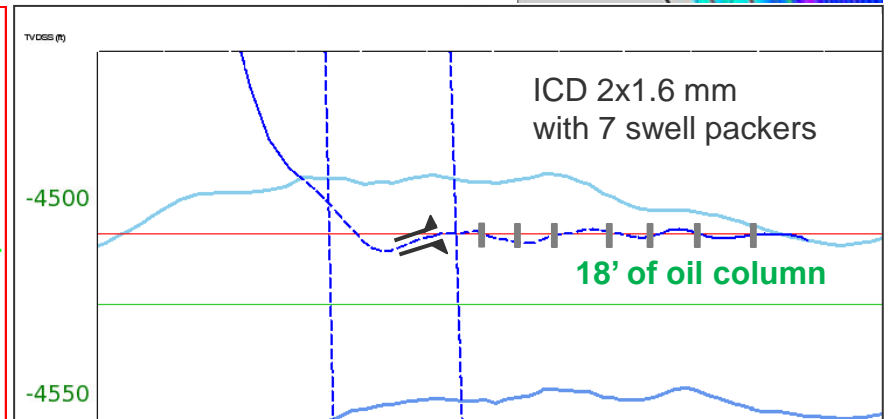
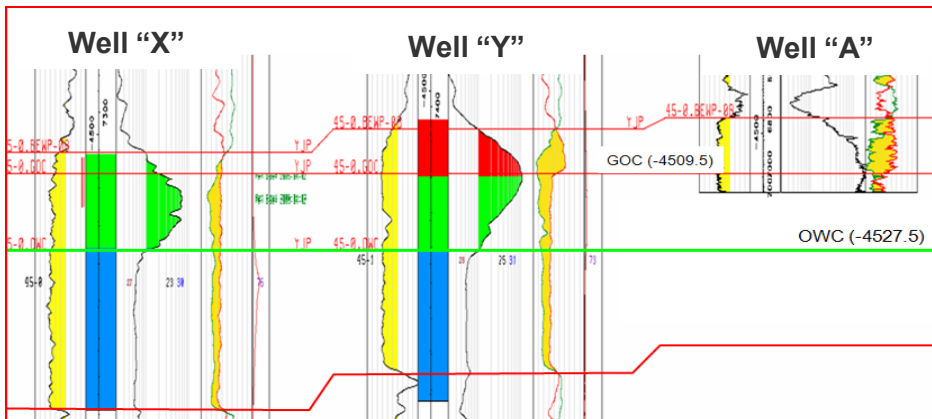
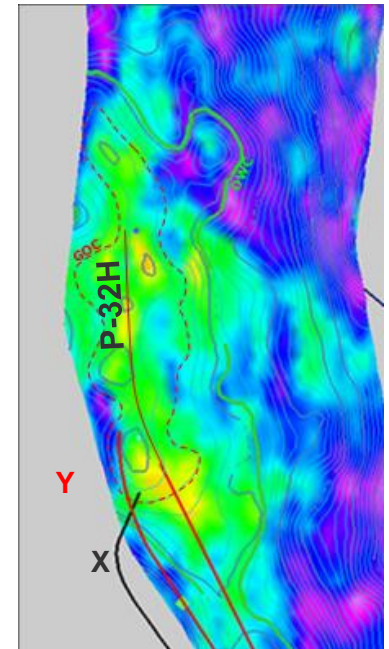
- Platform “A” primary program was developed in 2004 with heavily commingled production and several ESP wells.
- Platform “A” infill was completed in 2012 and recent RFT data show very small pressure depletion in most reservoirs.
- Well logs in twin wells show clean bottom water encroachment (low residual oil).
- Horizontal well “A” well targeted a shallow reservoir which has OOIP of 1.65 MMstb with 16’ oil column and gas cap.



Horizontal Well Strategy



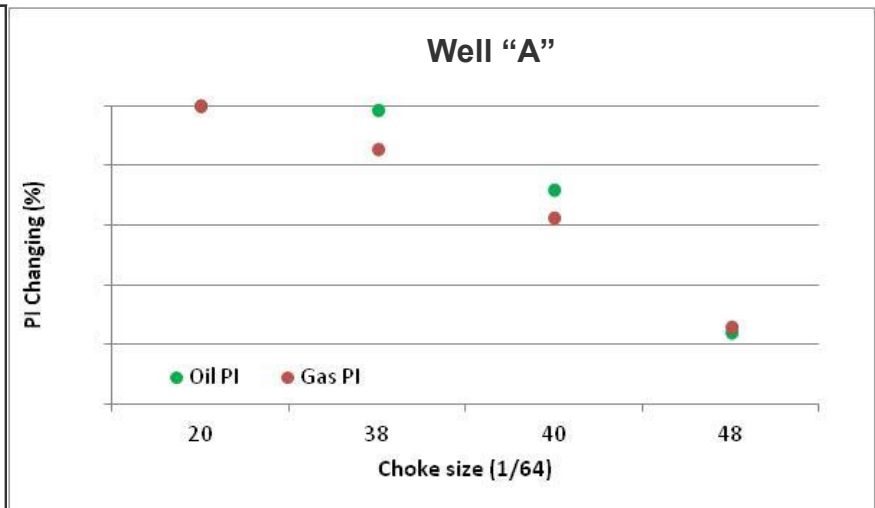
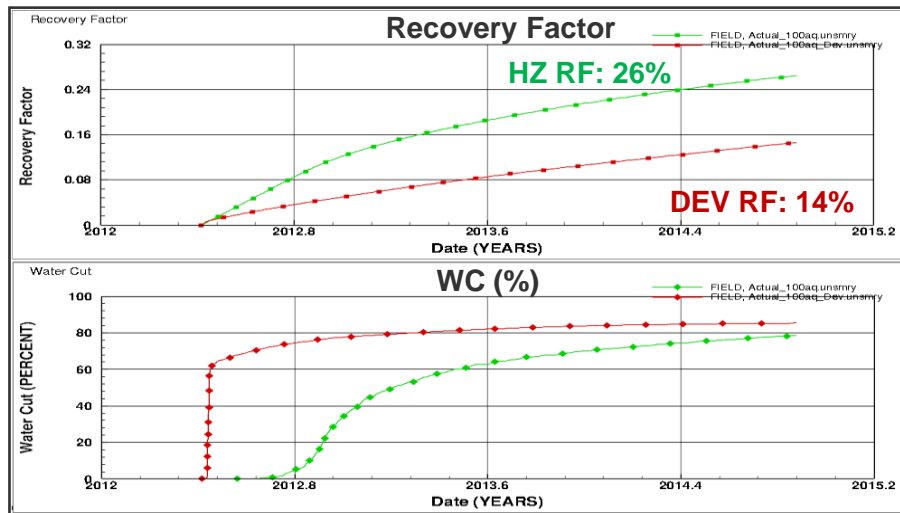
- Horizontal wells “A” well was placed at the GOC as the strong water drive is expected. The ICD completion was used to avoid premature water coning through high permeability streaks.
- Due to the thin oil column, accurate well placement is critical to maximize the vertical distance from the aquifer. Therefore, a 4-string horizontal completion was selected.
- Real time geosteering was selected.
- The well was successfully placed within a 4’ TVD window with total lateral section of 2,000 ft and ICD completion.



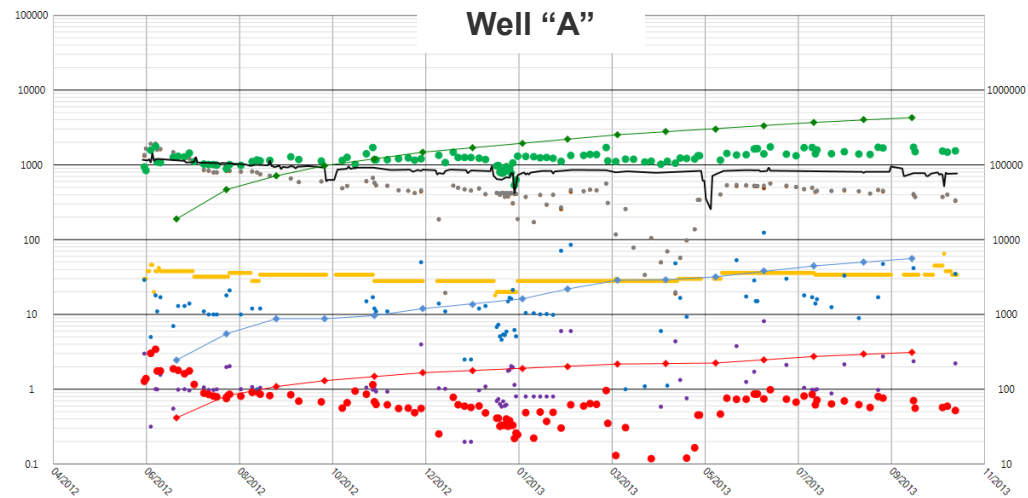
Conceptual Model & Well Test



- Based on conceptual simulation model, Horizontal wells “A” provides significant incremental reserves comparing with two deviated wells.
- Deviated wells induce water production faster than horizontal well especially in thin oil column reservoir.
- Well test results show ICD creates higher pressure drop along the lateral section in the gas cap compare to oil leg, resulting in greater PI reduction which helps to minimize gas production.



- Initial production showed high gas rate and started to decrease over time. So far, no water production with small amount of gas rate. Moreover well has produced with constant oil rate (more than 1.5 year)
- Current RF is around 26% which exceeds historical expected RF.
- A recent drilling campaign, 2 deviated wells were penetrated into this reservoir and found 4 ft of OWC moving from original. Estimated volumetric RF is around 40%.



Lesson Learned:

The successful application of this horizontal well technology to the Horizontal wells "A has improved confidence in future development of thin oil columns bounded by underlying water and overlying gas.

For highly accurate well placement, 4-string completion is recommended.

Best Practice:

Pre-conference with the asset team, DE, DSM, DD, and MWD provides a benefit in communicating the overall goals and expectations.

Challenges:

Understanding of geology and reservoir behavior is a key enabler for successful development strategy.