APPS 2018
ASIA PACIFIC PERFORATING SYMPOSIUM

Crossflow May HIT Your Back !

By Cheryl Perng (Murphy Oil Corp.)

PERFORATORS.ORG
INTERNATIONAL PERFORATING FORUM

APPS-20-18

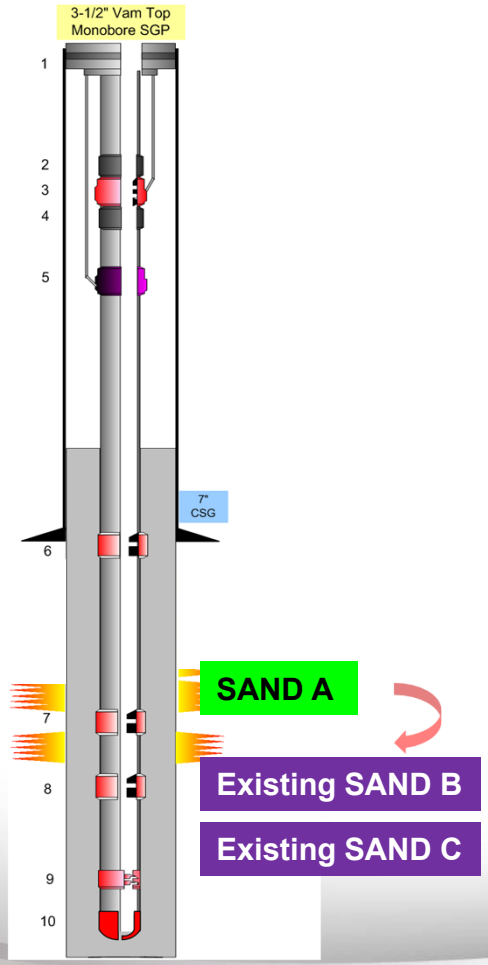
AUTHORS: Cheryl Perng, Jon Blacklock, Kasim Selamat

Murphy Oil Corporation

Presentation Outlines

- Well Overview
- Operational
- Implemented Lesson Learned
- Best Practices
- Conclusion

Well Overview

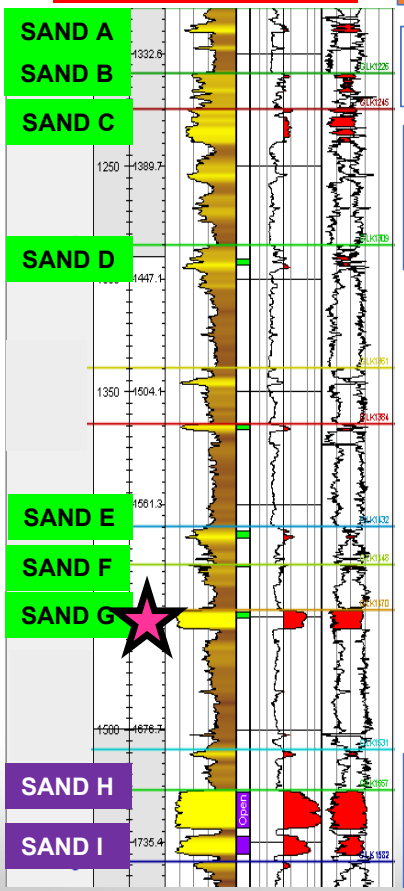


Well 'A' focused on an integrated marginal gas field development located in Sarawak.

- Small platform
- Monobore completion - triple wellhead
- Multi-stacked reservoirs
- New zones were proposed after current zone almost depleted
- Up hole/ bottoms-up completion strategy
- Underbalanced perforation technique is preferred
- Existing perforated zones were not isolated
- Existing perforated zones were not killed to ensure wellbore state undisturbed
- Downhole pressure data was unavailable - pressure estimation from other offset wells
- Equalization shot was planned to equalize/ pressurize the wellbore prior perforating main gun.

Operations

Well A



Plan

778 to 2100psi
(K=1300mD)

- EQ shot
- 7 gun runs
- Gross interval : 301m
- Net interval : 25m

Existing Open Perfs
Net Interval : 28.5 metres
Flowrate: 2 MMSCFD
***P*avg 750 psi (K=1200mD)**

EQ1 depth at SAND G (2 shots)

THP
Before : 500psi
After : 550psi

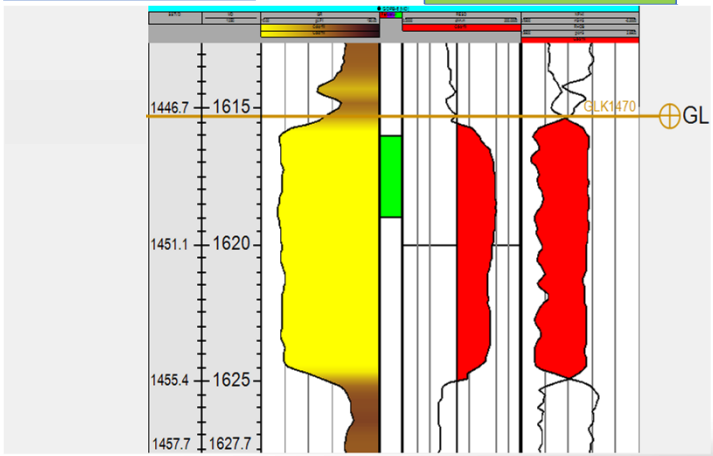
BHP
Before : 483psi
After : 525psi

Pressure increased – 50 psi

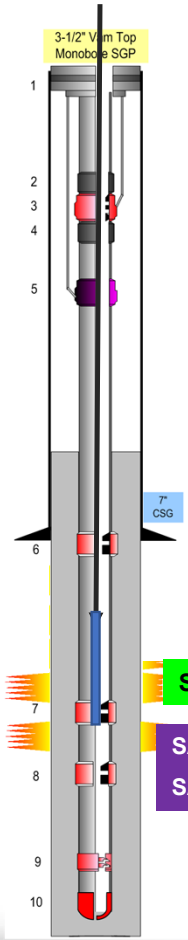
Main Gun at SAND G

THP
Before : 550psi
After : 1700psi

Pressure increased – 1150 psi



EQ shot did not generate pressure increase as expected.



2 shots

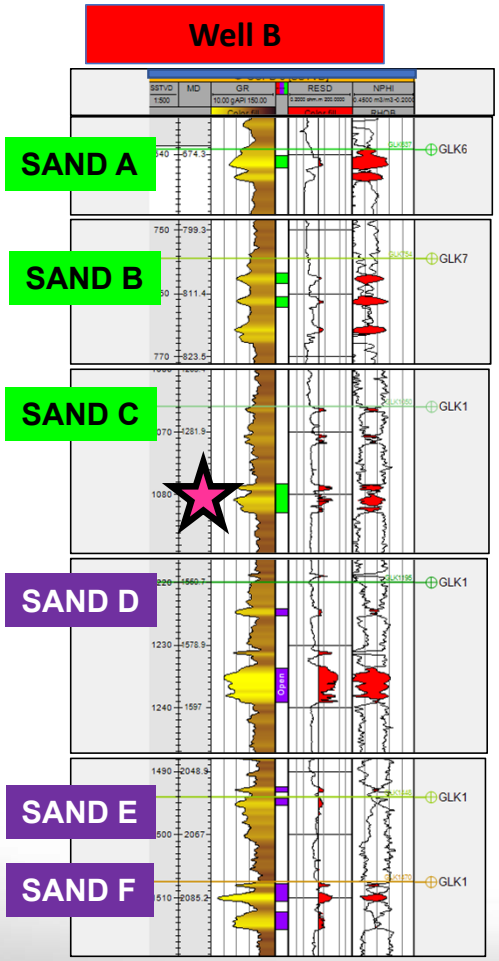
SAND G

SAND H
SAND I

561 shots
AOF x 280
!!!!!

Existing zones
Proposed zones

Implemented Lesson Learned on Well B

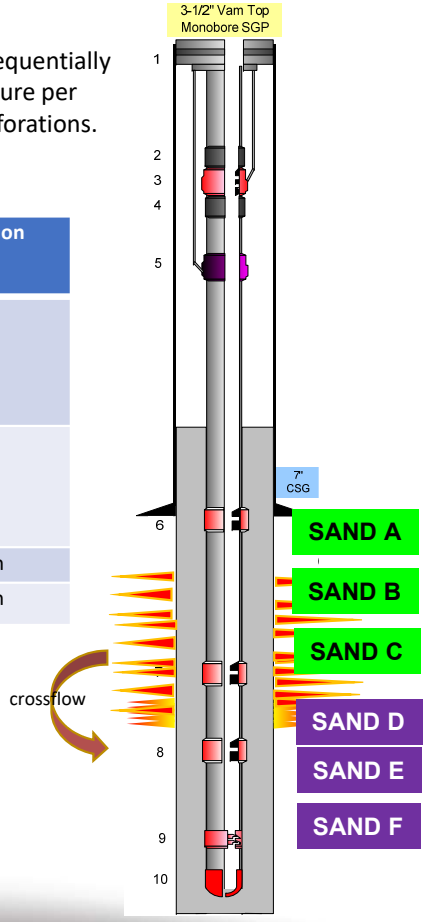


Expected Reservoir Pressure	BHP post EQ
	EQ 6: 1,020 psi
943.6 psi (K=653mD)	EQ 5: 966 psi
	EQ 4: 930 psi
1139.5 psi (K=385mD)	EQ 3: 852 psi
	EQ 2: 796 psi
1557.0 psi (K=151mD)	EQ 1: 728 psi

Current Well Pressure Flowrate: 0.2 MMSCFD
635psi
664psi
665psi

In Well B, total of six equalizing shots were sequentially added in selective until full well system pressure per model was achieved before adding gross perforations.

Sand	Run Sequence	Perforation design
SAND C	Perf Run #1	
	EQ#1 (Sel. Bottom)	2 shots
	EQ#2 (Sel. Mid)	4 shots
	EQ#3 (Sel. Top)	4 shots
SAND C	Perf Run #2	
	EQ#4 (Sel. Bottom)	4 shots
	EQ#5 (Sel. Mid)	4 shots
	EQ#6 (Sel. Top)	4 shots
SAND B	Perf Run #3	Main gun
SAND A	Perf Run #4	Main gun



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Best Practices

Prior perforating,

- To predict estimated influx rate (based on kh) and couple the influx rate with the tool lift calculation.
- Consider installing check valve to temporarily isolate depleted/ almost depleted zones.

IF pressure response for EQ is not as expected;

- Make multiple EQ shots runs to observe sufficient pressure increase before perforating main gun.

Conclusion

- Crossflow can mask pressure response.
- Engineered EQ shot strategy can mitigate risk.

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QUESTIONS?
THANK YOU!

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BACK-UP

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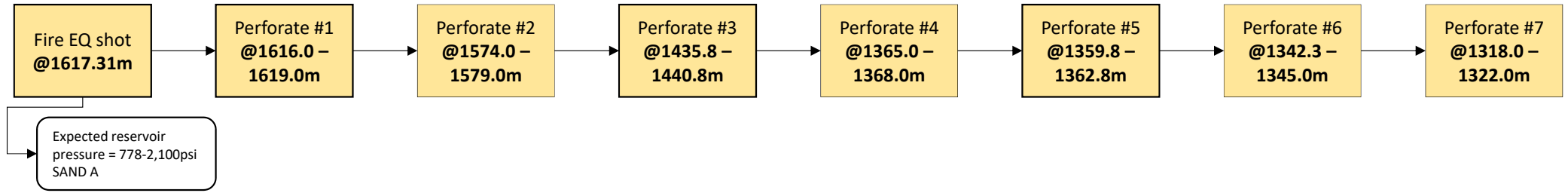
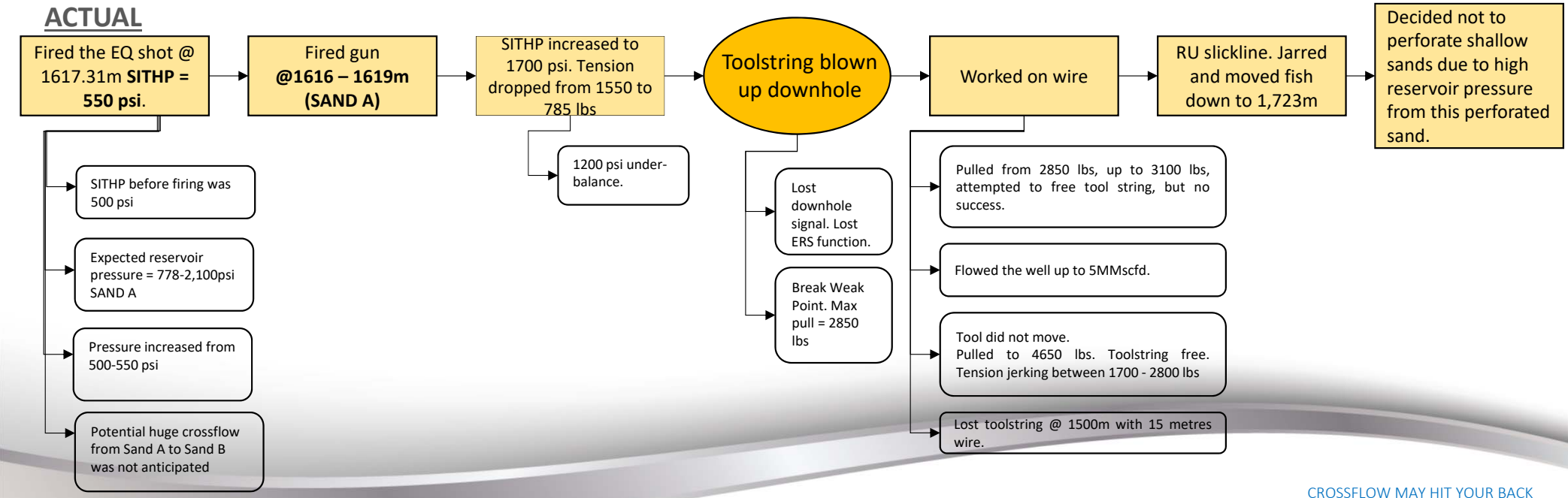
Plan vs Actual for Well A

PLAN

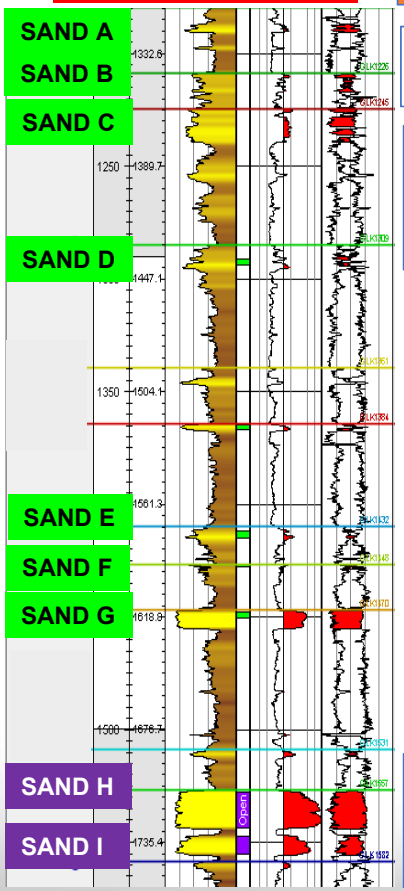


ACTUAL



Operations

Well A



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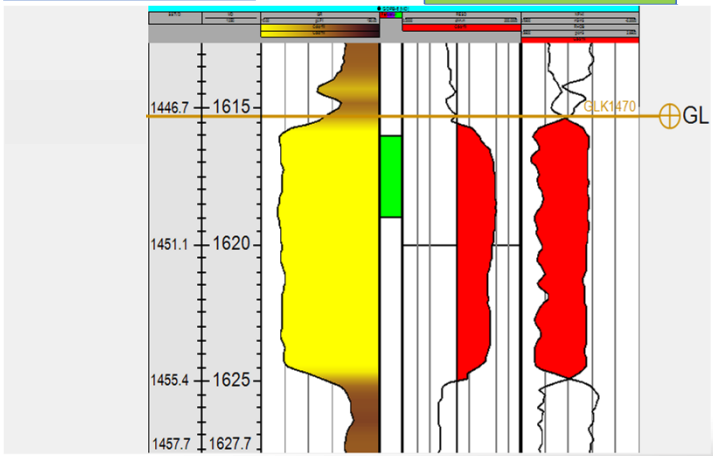

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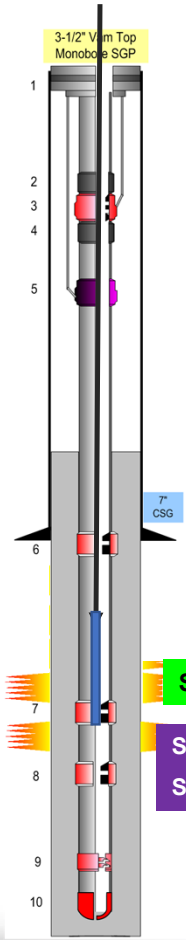

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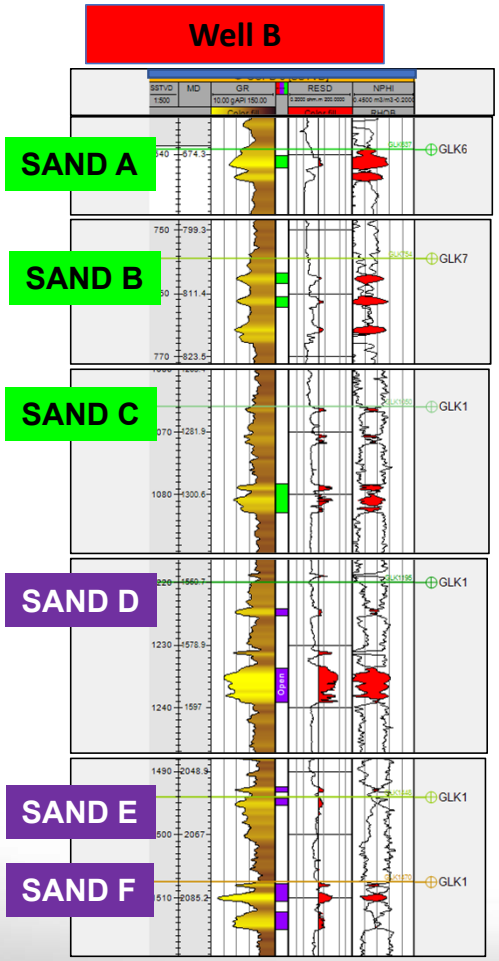
Proposed zones

Implemented Lesson Learned on Well B



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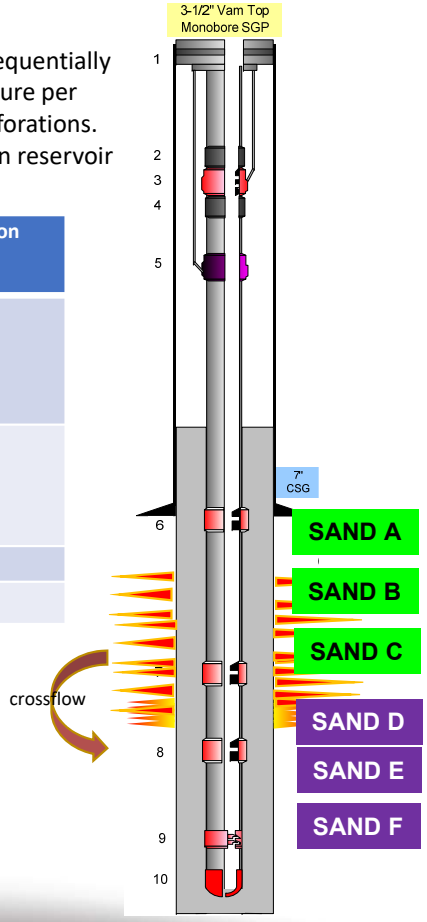

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