

NTGA Updates: Asset Management Experiences



**Tuwharetoa mai
Kawerau ki te Tai**

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The Trouble With Anti-Scalant Systems

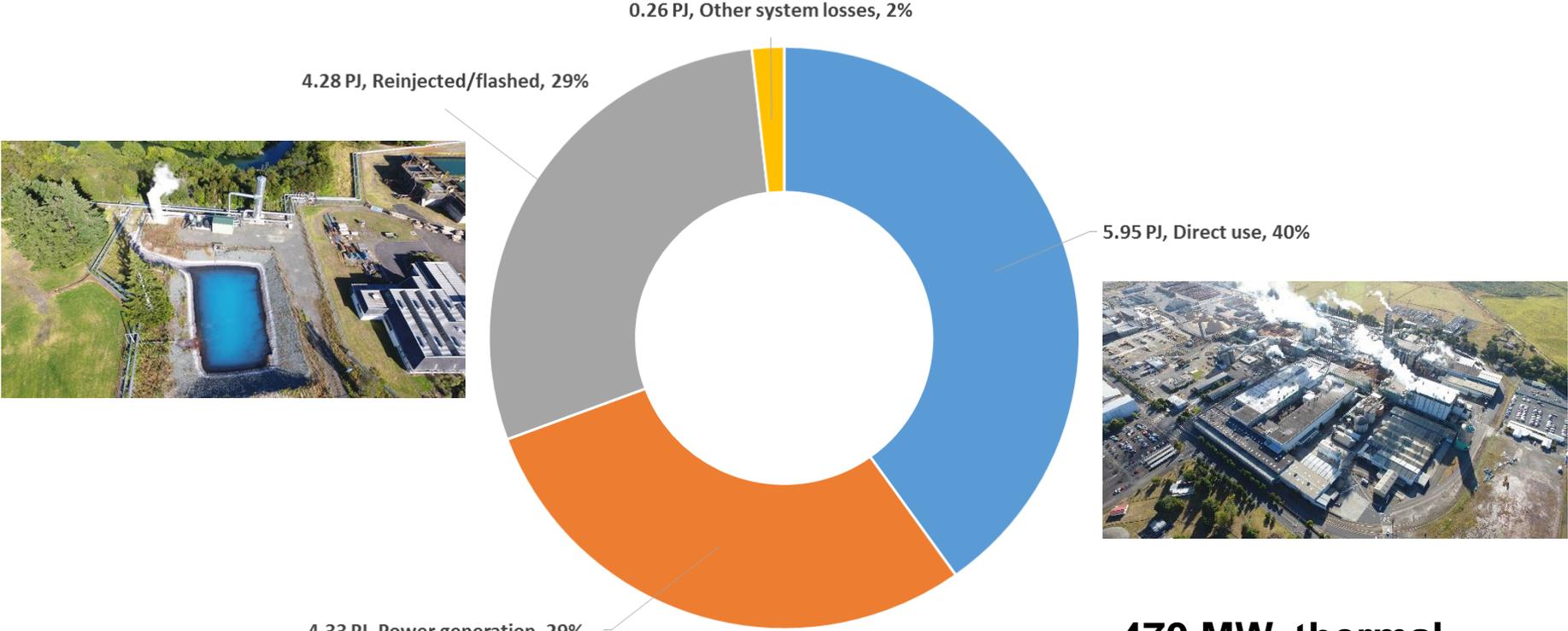
The Acid on KA27

Kawerau Industrial Complex



NTGA Steamfield Operations

NTGA Geothermal Energy for 2017



470 MW, thermal
74 MW, electric

NTGA Steamfield Operations

7 production wells

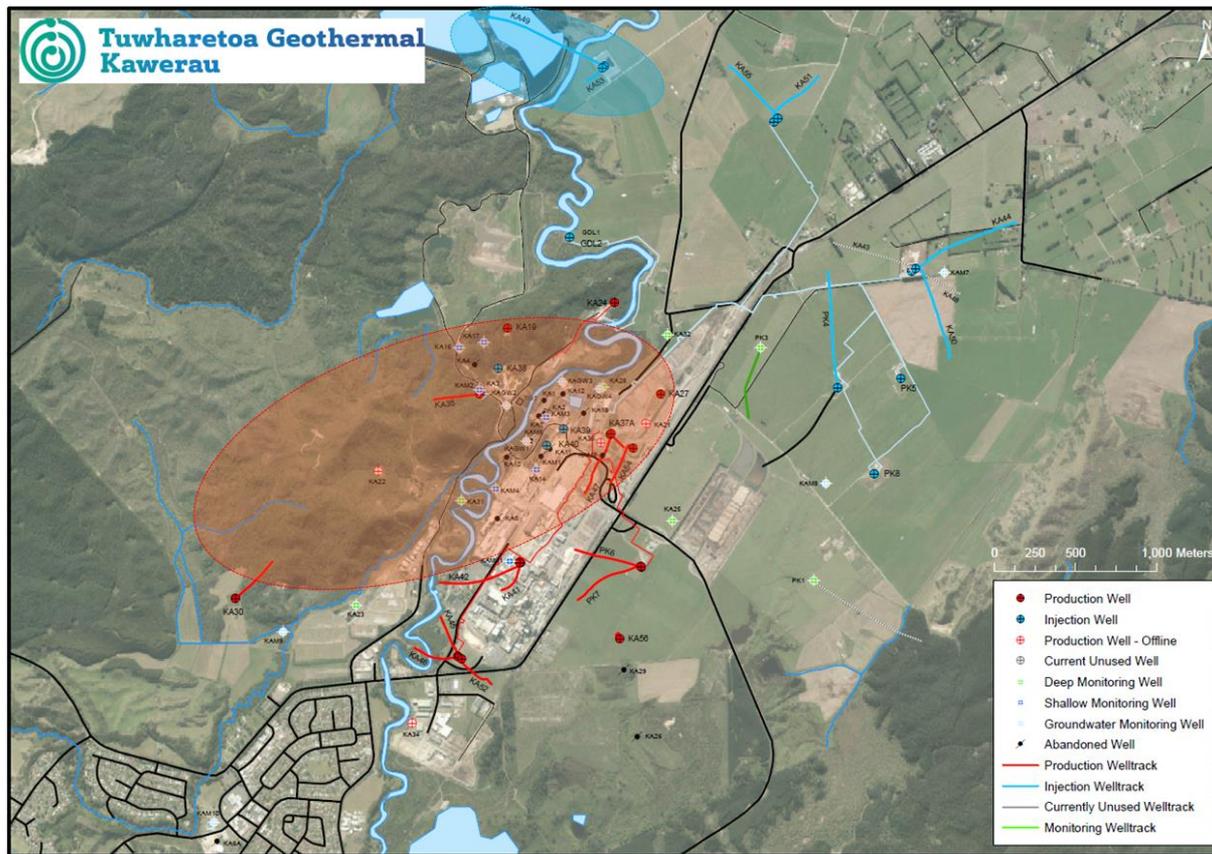
5 re-injection wells

7 two-phase separators

2 high-pressure clean steam plants/reboilers

Pipelines – two-phase,
steam, geothermal water,
steam condensate

DCS-enabled operations



Case Studies

The Trouble With Anti-scalant Systems

Challenges Upgrading Antiscalant Systems at NTGA

Armoured 1/4" Antiscalant tubing installed into NTGAL Production wells.

Original period between HTCCs' was 20 years with very little requirement for regular PTS testing.

Design required wells to be quenched to remove the dispersion head and close master valve

Increased requirements for reservoir data and asset integrity certainty means minimal quenches.

System redesigned to accommodate regular well testing.



Wells With Non-Retrievable Tube

KA35 HTCC 1999 20 year cycle
KA19 HTCC 1995 20 year cycle
KA27 HTCC 1999 20 year cycle
KA47 HTCC 2010



KA47 Well

KA47 Well: Completed January 2008

Large Bore Well 2070 MD

Central to NTGAs' Kawerau Field

600 t/hr TMF (20 MWe)

Supplies Clean Steam Plant and CHH
Wood products



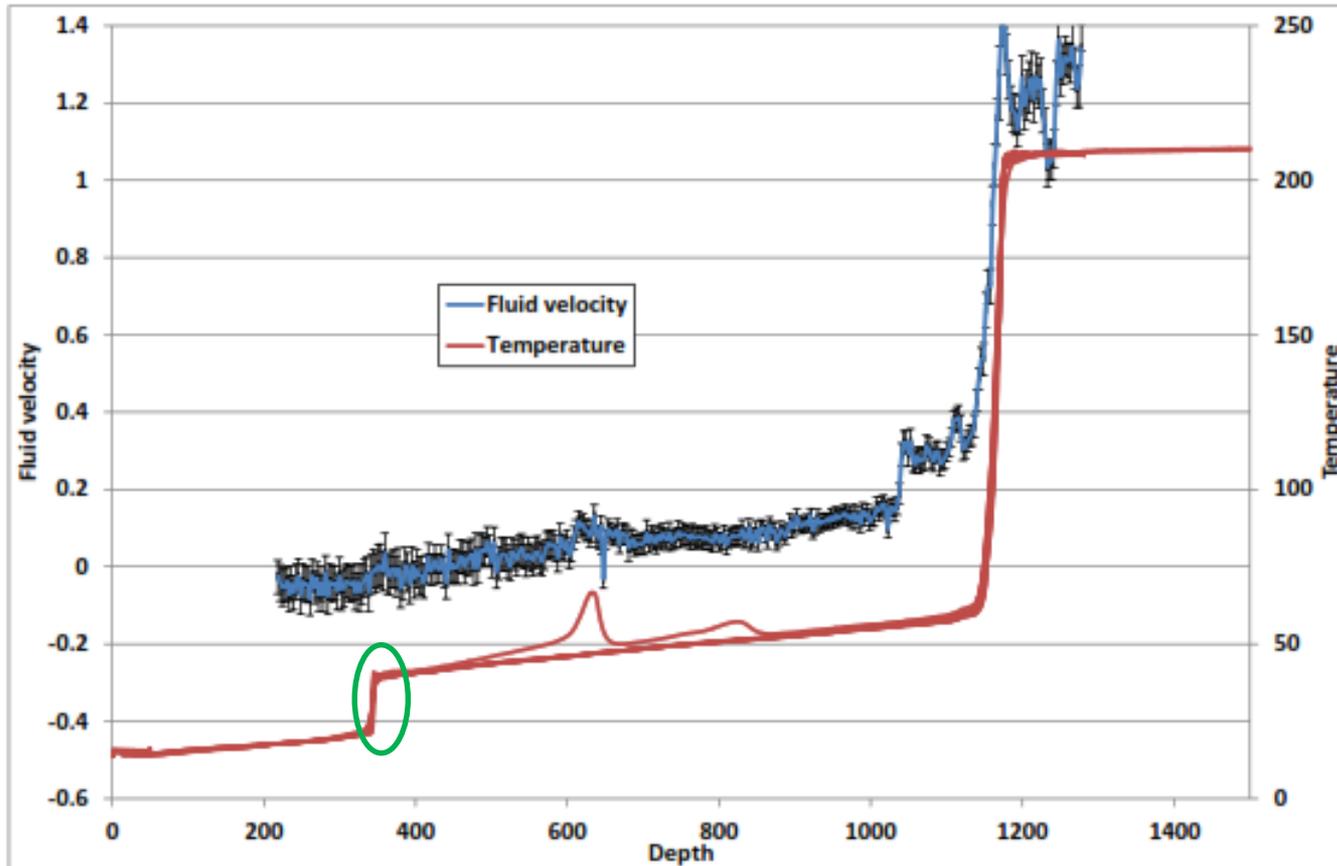
KA47 time line

- Post commissioning, hot fluids permeated the well pad outside of the cellar and 30"/20" annulus
- Chemical analysis determined fluids likely originated from near surface aquifers with ground water mixing
- 2009 annulus was tested for tracers injected into KA38,39 and 40 shallow reinjection wells. +ve returns found, reinforcing shallow aquifers were the cause.
- 2010 Annular cement sealing attempted but unsuccessful.
- Casing annulus gland sealing caps fitted with valves to allow sampling.
- Could not carry out integrity testing because of anti-scalant design and lack of capacity to take well out of service.

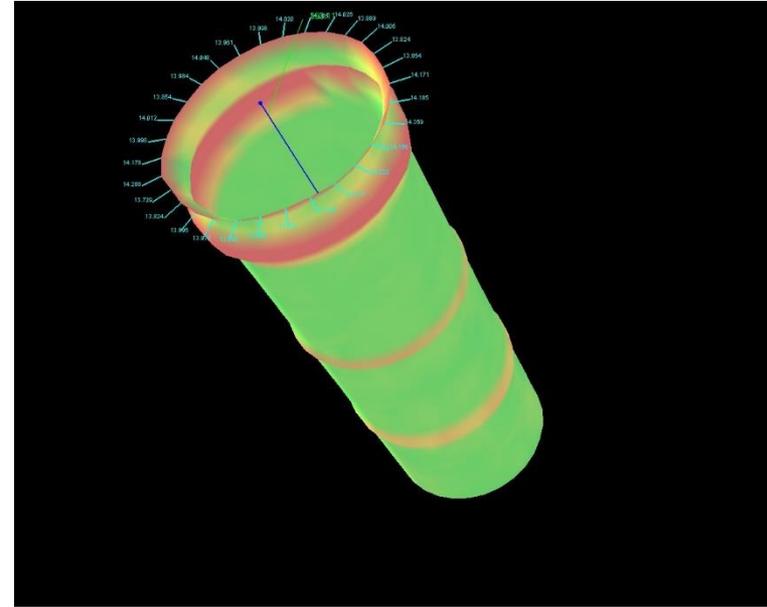
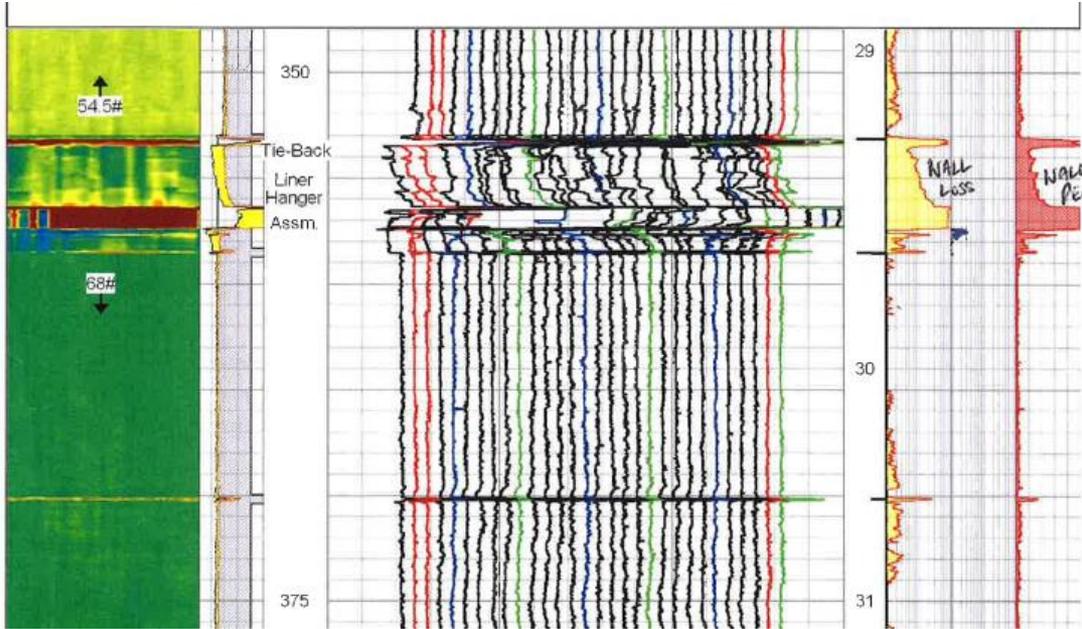
KA47 time line and plan

- KA54 well was commissioned on 5th June 2016
- KA47 taken out of service on 8th June 2016
- Work package for KA47 included:
 - Quench
 - Remove 1.9” hangdown string and old armoured tubing/Install new design
 - Well integrity testing
 - HTCC
 - Injection PTS
 - Kinley Caliper
 - Camera

KA47 injection PTS



KA47 Kinley Caliper



KA47 repair plan

Run a 10 3/4" Scab Liner the full length of the 13 3/8 casing. Cement back to surface with high density cement slurry

Challenges:

Master Valve was fitted 2 meters above ground level.

No available rig could fit over. CHF needed to be lowered to just above GL and the Master Vv refitted.

KA37 Production well was too close to KA47.

Too close to allow for a larger MBC rig or IDC rig due to sub base design.

Cementing the liner back to surface.

10 3/4 " Liner collars machined at AIE to give extra clearance for cement.

Economy: Mobilisation costs of a large rig such as MBCs' or IDCs'

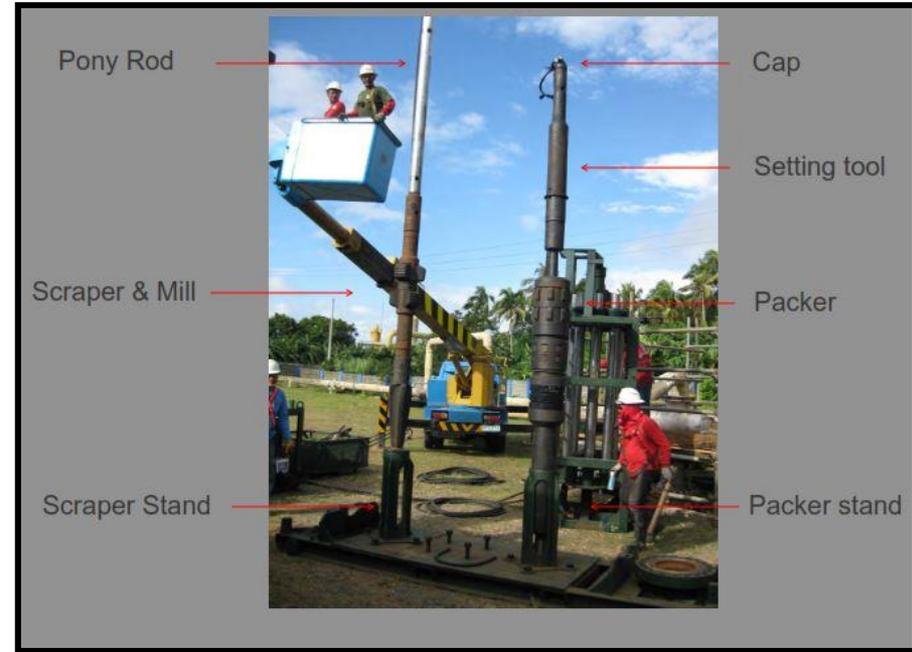
A rig similar to MBCs old rig 16 would be needed but that is decommissioned.

KA47 repair



KA47 repair

Packer before insertion into lubricator



KA47 repair

Adjusting the CHF position for the rig with the packer set



KA47 repair

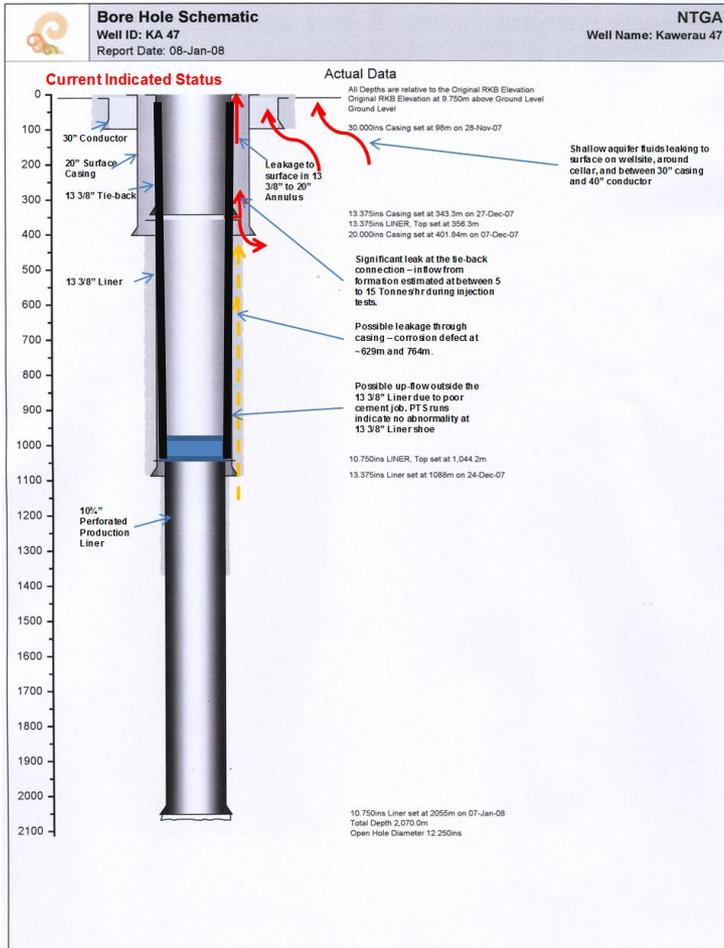


KA47 repair

Webster VR 500 Nova -1 Rig



KA47 repair



Case Studies

The Acid on KA27

KA27 Well

KA 27 Well: Completed May 1979

Large Bore Well 1546 MD

240 t/hr TMF (7 MWe)

Supplies Norske Skog Mill



KA27 time line & plan

- May 2017 - KA27 taken out of service
- Work package for KA27 included
 - Quench
 - Remove old armoured tubing/Install new design.
 - Well integrity testing
 - HTCC
 - PTS
 - Top heat/compress and return to service

Risks: Scaling potential /well history.

Reserve funds approved for an acid job should tube prove stubborn to remove.

Scaling potential was analysed, risk was low.....

KA27 scale

30th June: Scale from KA27 Tube



KA27 acid flush

22nd June: 74000 Litres of Acid Mix applied to well and then flushed.

23rd June: Tubing pulled minus the 4 meter dispersion head and 11 meters of tubing. !! Water still flowing down the well.

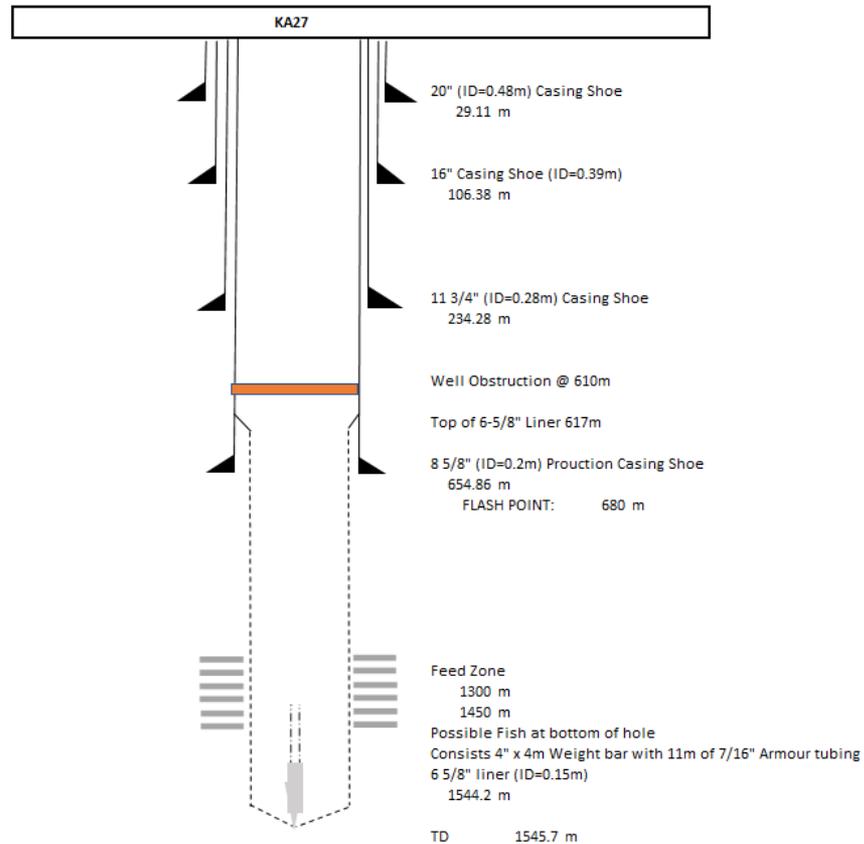
Gauge ring runs Commenced. 7, 6.5

Multiple blockages occurred and cleared by pumping .

7" broach was run which dislodged scale blocking well. Had to be pumped several times up to 100 bar to break free. Finally blocked and would not clear.



KA27 blockage



KA27 mechanical clean-out

Coiled Tubing Unit at work on KA27



KA27 mechanical clean-out

NTGALs Silencer Arrangement



KA27 lives again!



Kia ora!

