



CASE STUDY

Successful injection profiling diagnosis to identify location of a matrix bypass event (MBE)

The Challenge

The operator of a mature field in Alaska was experiencing a water breakthrough, or *matrix bypass event (MBE)*, from one of their horizontal injector wells to a nearby producer. This was causing a sudden increase in water production reaching 100% of water cut, 2% solids and a drastic jump in the flowing bottom hole pressure.

The MBE could pose a well integrity threat if left unresolved and could compromise the hydrocarbon production of the nearby well. The injector well was completed with swell packers and nine Inflow Control Devices (ICDs).

READ has been successfully supporting operators in Alaska since the 1990s. Based on our strong track record in production logging and data analysis, and our depth of experience working in the Alaskan oil and gas market, the client engaged with us to develop an innovative solution.

The Solution

The first step was to run an injection profile to determine which ICD(s) were contributing to the direct communication. As part of the investigation process, the operator performed a red dye test which confirmed the existence of a direct matrix communication from the injector to the producer, which had occurred within just a four hour period.

READ then stepped in to run a full injection profile logging survey, utilizing an effective combination of PL technologies from our in-house portfolio. We acquired the data in surface read out mode and deployed the tools downhole on e-line tractor due to the horizontal nature of the well.

During the logging intervention, we acquired baseline data under shut-in conditions followed by dynamic passes and station stops between the different ICD units, recorded while the well was put on injection. The injection survey was performed at the maximum tolerable injection rate in order to ensure visibility of the MBE. Additionally, the suspect nearby producer well was put on a constant production rate while recording the injection survey to stimulate the MBE event.

Client Overview

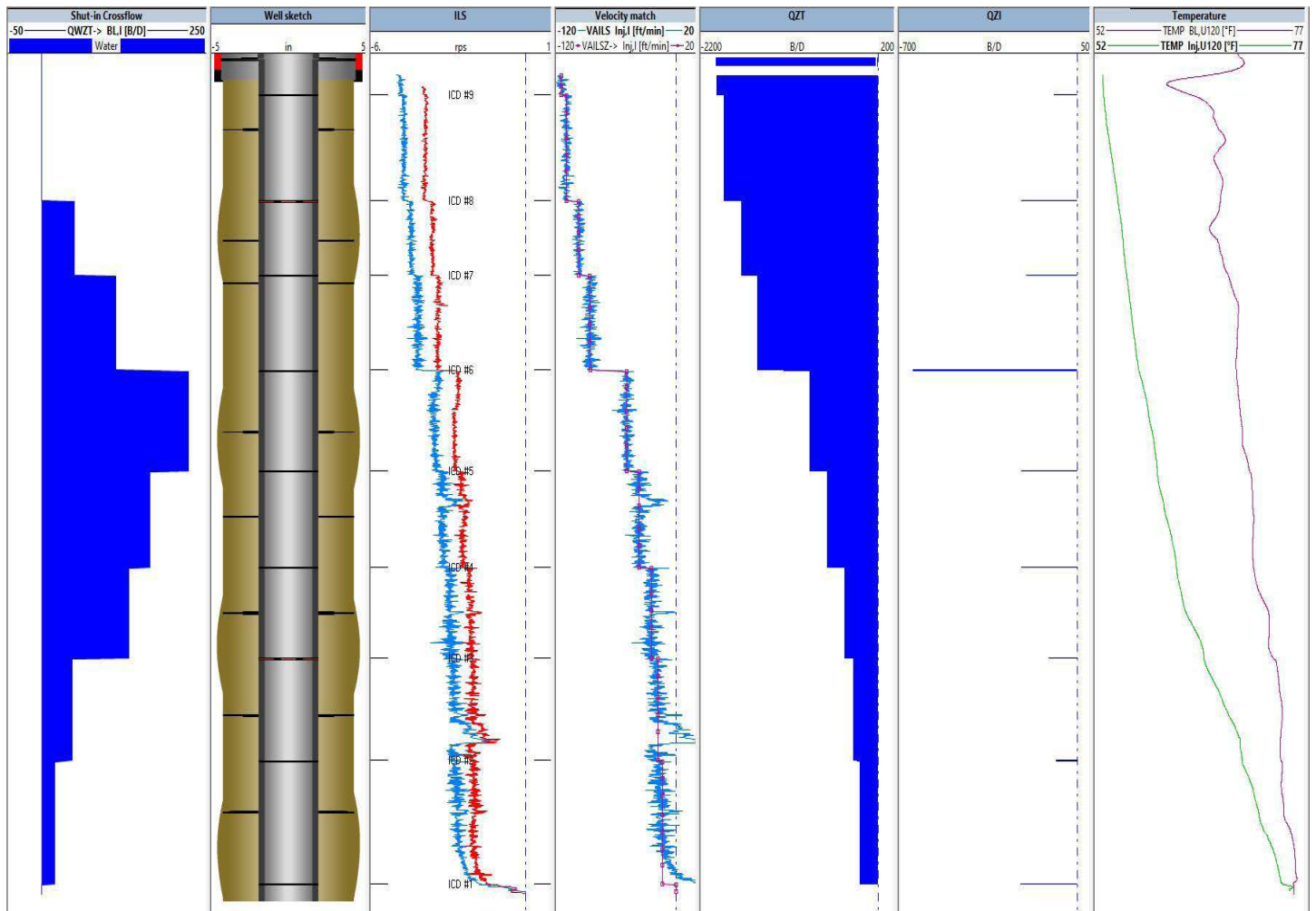
**Independent energy company
North Slope Alaska**

Services

- Production logging (PLT)
- ANSA expert data analytics

Technology Involved

- PL logging platform including Fullbore and Inline Spinner Flowmeters, Quartz Pressure Sensor, Temperature Sensor and Gamma Ray/CCL



Data analysis of the recorded survey successfully identified the likely location of the MBE event, which was causing increased water cut and higher solids production at surface in the nearby producer well (as shown in Track 5, ICD #6 is taking 650 bpd of water which is over 30% of the total injection).

The Results

The well operation was completed successfully with an optimized logging plan, which enabled the downhole survey to be performed safely and in a timely manner, whilst recording the necessary data for the required diagnostics.

The READ ANSA team completed a full analysis of the survey. The baseline shut-in revealed an upward cross-flow from the lower ICDs to several uphole ICDs, with one single ICD unit acting as the main thief zone by taking half of the crossflow amount. This suggested that this ICD streak had the lowest reservoir pressure and hence was constituting the least flow resistance path in the formation.

During the injection period, the dynamic data showed that while all ICDs were taking some portion of the injection, the same single ICD was taking almost a third

of the total water injection and was the likely source of the water breakthrough to the nearby producer. We provided a full tabular breakdown to the customer with detailed contribution percentages for each ICD.

Thanks to READ's production diagnostic service, the client was able to pinpoint the likely location of the matrix bypass event (MBE) and close the subject ICD and the one immediately above it, which appeared to 'short circuit' behind the pipe past the swell packer to the MBE once the first ICD was closed. Taking the appropriate remedial action successfully isolated the near wellbore portion of the MBE, with injection rates and pressures returning to pre-MBE norms. The offset producer also responded favourably, dropping to a 73% water cut.

Key Results

- Successful identification of location of water breakthrough
- Successful quantification of zonal injection contributions and crossflow in a horizontal well with nine ICDs
- Expert and impartial data analysis from READ ANSA