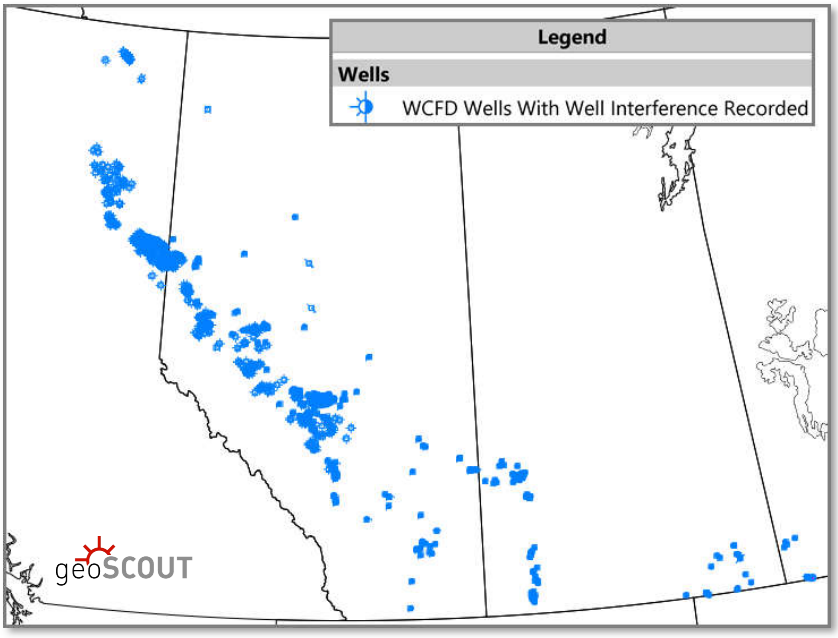
Use of Offset Well Interference Data in Well Planning and Fracture Optimization

Understanding wellbore communication with resulting implications for well planning and fracture optimization is extremely important, both in terms of producibility and safety. Since 2013, Alberta operators have an obligation to monitor offset wells within a certain Fracture Planning Zone (FPZ) to maintain wellbore integrity during hydraulic fracturing operations. This practice is also becoming a standard in other Western Canadian provinces.

Where information is reported in public completions documents, geoLOGIC captures it and makes it available in geoSCOUT's Frac Analysis module that has a unique set of visualization tools. It is also available in gDCweb, a web application that lets you view, search, and export Well, Land, Unit, Frac, Drilling and Production data as well as documents, logs, and more from almost anywhere.

Figure 1: WCFD Wells With Well Interference Recorded



geoLOGIC has flagged over 1,200 wells with interference data reported across Western Canada (see Figure 1). Use interference data, paired with the additional completion information, to assist in well planning and fracture optimization.

Solutions@geologic.com | 1-866-847-3837 | www.geoLOGIC.com | @geoLOGICsystems | geologic-systems

Case Study – Cardium Pad Completions

Let's examine a six well pad in the Cardium Pembina using geoSCOUT's Frac Analysis module. Figure 2 assumes perpendicular fracturing, while Figure 3 assumes a 45° frac angle for the same well pad. The fracture length has a custom size and varies based on the percentage of proppant placed (actual vs. designed). Unique posting options are fully customizable in the geoSCOUT Frac Analysis module.

Figure 2: Well Interference With Perpendicular Frac Angle

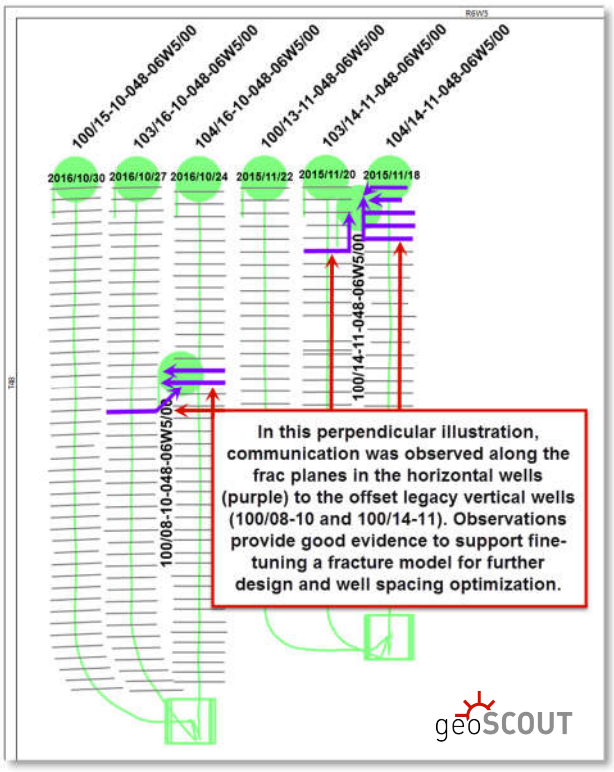
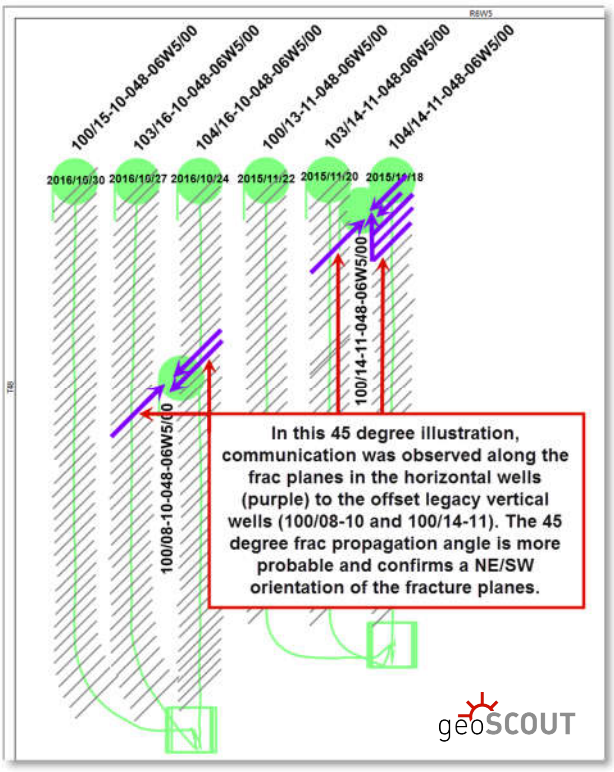


Figure 3: Well Interference With 45° Frac Angle



Well Pad Observations

- The three (3) wells on the right side of the well pad were drilled and completed in 2015 and fractured sequentially from right-to-left.
- The three (3) wells on the left of the well pad were drilled and completed in 2016, and again fractured sequentially from right-to-left.
- The actual frac start dates are posted to the bottom hole locations.
- The short frac lengths indicate that not all of the intended proppant was placed.

- Legacy vertical wells (100/8-10 and 100/14-11) have been producing oil from the Cardium since the 1960s. They were shut in and monitored during fracturing operations.
- Wellbore interference between new frac stages and the legacy vertical wells was observed in both 2015 and 2016. For example:
    1. Communication was observed five times between the first fractured well (104/14-11) and the legacy vertical well (100/14-11).
    2. Communication was observed twice between the second fractured well (103/14-11) and the legacy vertical well (100/14-11).

    This decrease in communication may be due to the development of a “stress halo” around the first fractured well, which would deter future communication.
- Wellbore communication was not observed between any of the horizontal wells.
- The horizontal wells are spaced 280m apart, indicating that the total fracture length is less than 280m.
- The distance between the legacy verticals and the horizontal stages for which there was communication, varies from 100m and 160m.

After observing all the communications patterns, the 45^{o} frac propagation angle is more probable than the perpendicular one. All of the perpendicular observations provide good evidence to support the fine-tuning of a fracture model for further design and well spacing optimization.

Conclusions

1. geoLOGIC delivers comprehensive fracture data, including wellbore interference flags ensuring the right information is available to make better decisions.
2. With geoSCOUT’s Frac Analysis visualization tools, it’s easy to customize and illustrate communication patterns, and use well offset data for the refinement of future completion programs.

Author: Melanie Popp, P.Eng., Director of Engineering, geoLOGIC systems ltd.

For more information about geoLOGIC’s products, contact our sales team at sales@geologic.com.