[EA]Subsurface Process Improvement to Minimize Subsurface Uncertainties for Workover Optimization, A Case Study from Mature Waterflood Field, Central Sumatera Basin, Indonesia*

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Abstract

The workover (WO) opportunity identification in the complicated and mature field with over 40 years of the production and injection is becoming very challenging. With the limited resources and high turnaround of staff in the organization, it creates the unique opportunity to focus on the high priority areas to maximize the production and arrest The Waterflood Field production decline. Internal Team brainstorming suggested that there are three areas that need to be improved: (1) WO success rate, (2) healthy WO backlog, and (3) accelerate the approval process to accelerate the program generation and reduce recycling. After further analysis, the root causes of the problems were: (1) No prioritization of areas of focus in which to deliver big opportunities, (2) Lack of big picture understanding of the remaining opportunities and producer-injector alignment, and (3) Late engagement of approver in the process (Figure 1 left). To illustrate the issue with existing subsurface review process can be seen on the example of small faulted anticline example (Figure 1 right). Current small subsurface closure is divided into smaller review areas based on surface facility constraint. This can lead to multiple personal in-charge (PIC) that can increase the chance of full oil optimization not fully reviewed due to work prioritization and lack of communication. Also, there is a chance that the waterflood water management (e.g. FIFO calculation) might not represent the bigger picture of subsurface closure due to all producer and injector wells not fully counted.

The major change is conducted by dividing the big field into smaller areas based on subsurface (G&G) closures or compartments (Figure 2 left). Once the smaller areas (called “region”) are established, the next step is to prioritize regions to be reviewed that are expected to have higher remaining oil accumulation (Figure 2 right). Typical crestal or attic closure areas become higher priority to be reviewed for oil optimization. Focusing on attic areas will help to reduce remaining oil uncertainty as existing oil saturation log surveillance does not give big benefits historically due to the dynamics of the reservoir. An effort to shut-in attic injectors, focus on dedicated injectors to flank areas, or to re-direct injection to individual sands require injection also is conducted to be aligned with field waterflood management. The next improvement is that the WO proposal should be justified using a good well analog, the analog helps to reduce uncertainty on the remaining oil, the production allocation, and whether the Team can copy success from another area or play to the current area. Preferable well analog should

contain the following: (1) well with single sand production, (2) well with recent wireline log data, (3) commingle well but with production allocation from finger print analysis, or (4) recently WO success job at another area (for new play).

Standard documentation is developed to include informative well cross section consist of both G&G and production information for helping better communication and early engagement to the Approver (both Technical and Cost Approvers). This early engagement helps The Approvers understanding the technical aspect of WO proposal, the associated uncertainties, alignment with team plans, and WO economic impact (oil gain). By bringing together all The Approvers at technical review sessions, it will help them to share their concerns, align the WO proposal with team objectives, and conceptually approve the WO proposals. This helps the subsequent formal approval review process. All the effort of subsurface prioritization and improving subsurface review process gives good results on better WO candidates selection, speed up approvals, and build a healthy WO backlog. Current WO backlog already secured at least 2 (two) months of rig time and give flexibility for team to prioritize the WO job based on oil gain estimation. Ongoing WO executions had been conducted to cover high impact area of Waterflood Field and initial signpost from WO results show improvement of WO success rate.

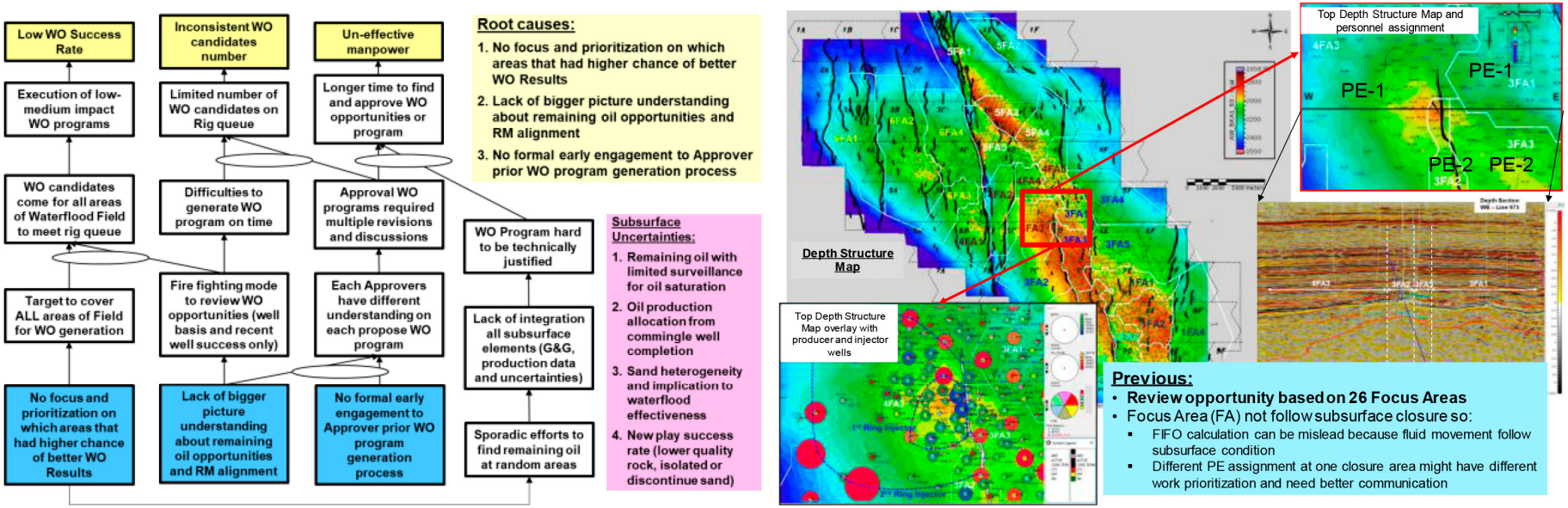

Figure 1. Root causes of WO optimization issue (left) and example of subsurface process issues (right).

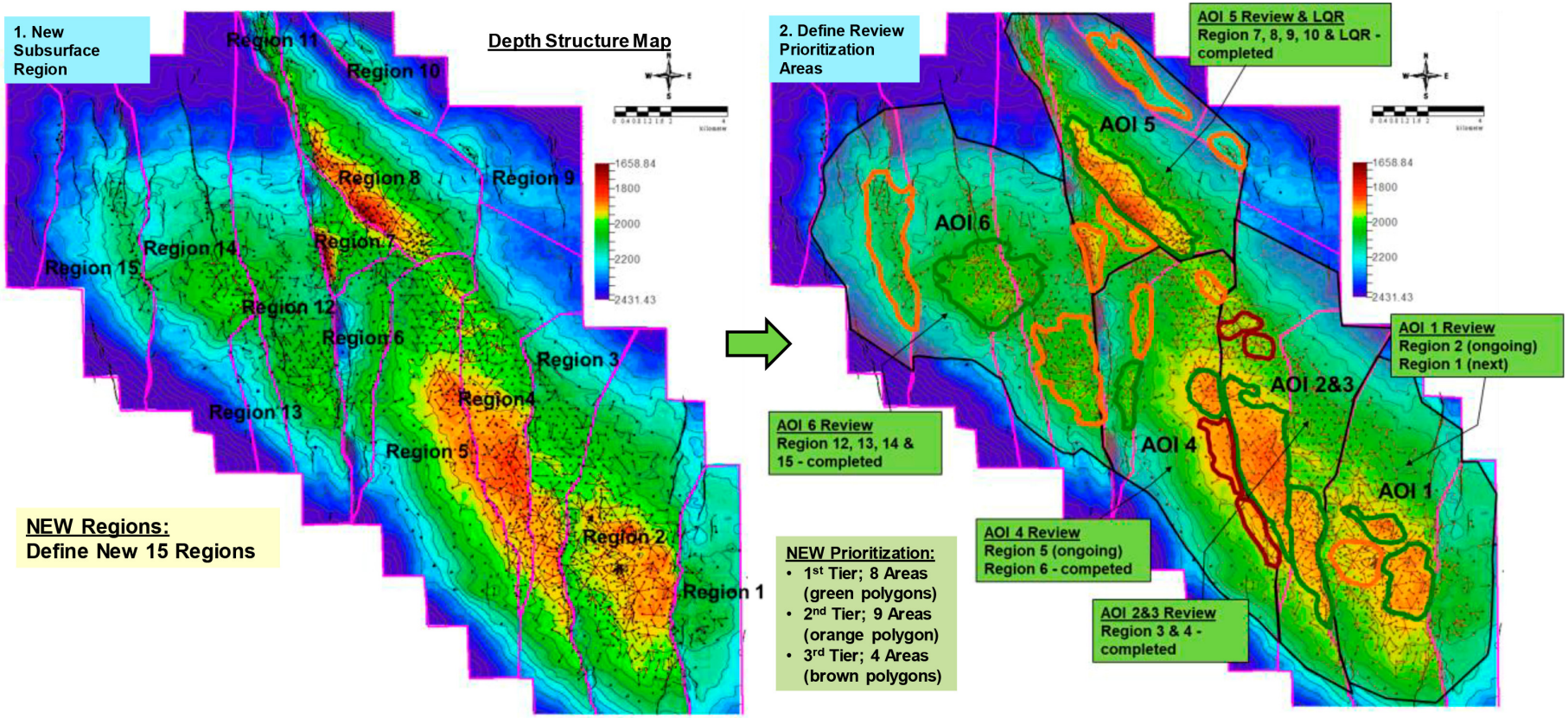

Figure 2. New subsurface regions (left) and area prioritization area and review status (right).