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Decision Support for Optimizing Unconventional Development Planning and Water Management

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Summary

There has been a steady increase in the number of Exploration and Production companies operating in unconventional shale plays in recent years along with significant expansions in the more lucrative existing plays (e.g., Montney, Duvernay, Permian and Delaware Basins). As the volume of data and information related to the unconventional operations and reservoir performance continues to expand, we must understand challenges and opportunities to improve operational efficiency.

Achieving lower CAPEX and OPEX through higher efficiency is the key value-driver in today's challenging business environment. Excluding the subsurface, efficiency in unconventional play development is governed by the physical layout and the configuration of surface assets, and constrained by water availability, storage, transportation, treatment, reuse/recycling and disposal. There is growing awareness within the industrial community that water must be conserved and managed more effectively. Water scarcity, water quality degradation, high operational costs, and stringent discharge regulations are all drivers for industry. In short, without having water where when you need it, when you need it and in the right volumes, hydrocarbon extraction and consequently cashflow will be curtailed.

Traditional surface asset planning and water management tools and approaches struggle to address these challenges, and do not easily allow operators to explore multiple options, contingencies and tradeoffs to determine optimal solutions through scenario planning, while also considering the key social, environmental, technical and economic factors that potentially influence design decisions. As a result, projects may experience unplanned setbacks, increased regulatory complexity, drilling and fracking delays, or water undersupply and oversupply (i.e. inadequate storage and disposal capacity) during desired activity periods.

Introduction

Golder Associates Ltd. (Golder), Stantec Consulting Ltd. (Stantec) and Process Ecology have teamed for the purposes of collaborating on and executing a practical approach to unconventional footprint optimization and strategic water management planning.

The objective of this work is to:

1) determine how best to manage water resources that are being used for hydraulic fracturing by operators both operationally and over long-term planning timeframes (e.g., >5 years);

2) assist the operators in determining strategies to minimize the size of the project footprint layout as well as resource use (e.g. water and energy) through planning and configuring a more compact and efficient water management system including water sourcing, storage, treatment, recycling/reuse, transportation, disposal and associated volumes;

3) determine the best well pad (WP) phasing approach, development pacing and sequencing of activities for development; and

4) provide a water regulatory strategy and operational water plan to move forward under the proposed Alberta Energy Regulator (AER) Area Based Regulation (ABR), including a possible approach to developing "Multi-Operator Water Plans (MOWP)".

Theory and/or Method

The team has developed and implemented a proprietary approach and suite of optimization tools based on GIS and dynamic (time based) simulation. A workflow diagram illustrating our approach is provided in Figure 1.

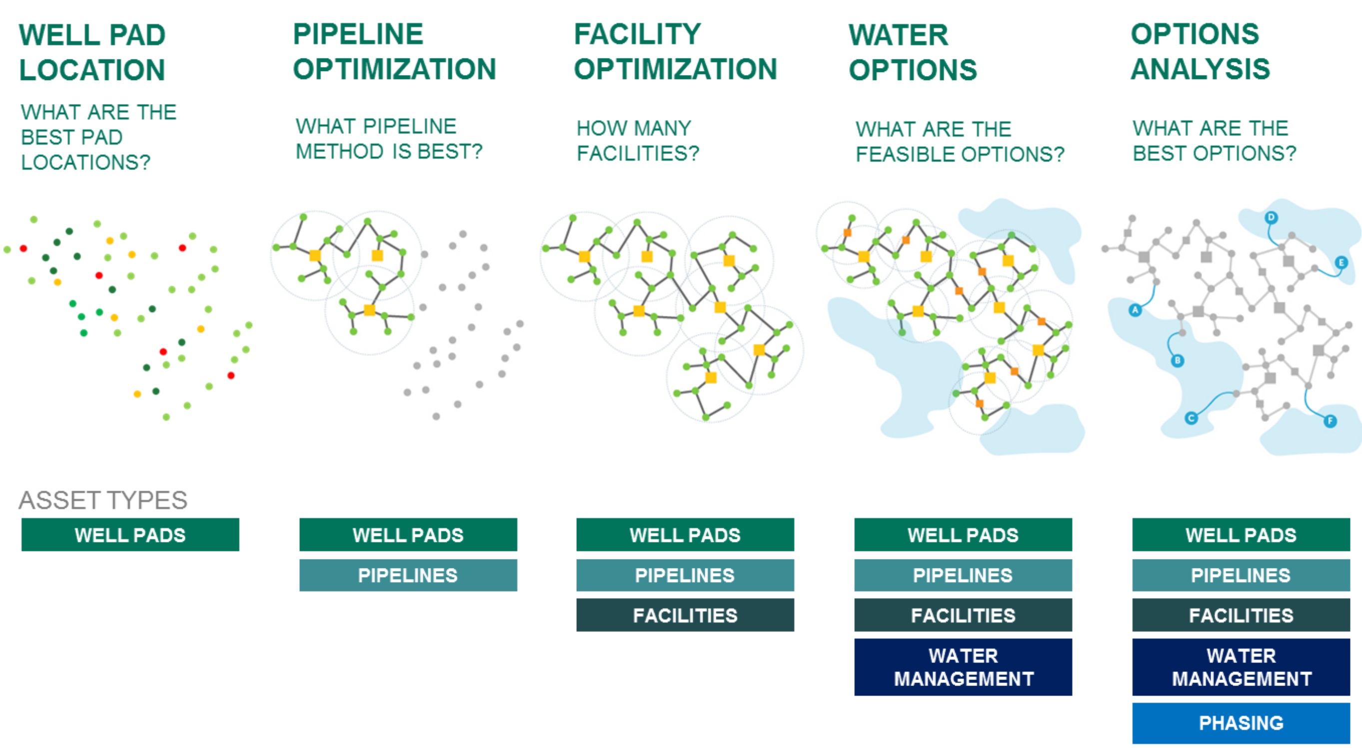

Figure 1: Optimization Method for Unconventional Footprint Design and Water Management

Examples

The approach has been successfully applied to large-scale developments in the Kaybob-Duvernay and Willesden-Green Duvernay in Alberta, as well as the Horn-River in northeast British Columbia. Selected case study examples will be presented and discussed.

Conclusions

Successful application of this approach in the Kaybob-Duvernay, Horn River and Willesden Green have led to significant reductions to early phase planned capital expenditures (10-30%) through achieving a more compact and suitable footprint layout and improved water use. The approach can be developed and deployed in under 6 months (typically 2-4 months) versus 12-18 months in a typically engineering and design cycle. Additionally, multiple cost effective footprint and water management options can be considered in near real-time through these tools..

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