

Well Flow Performance = WFP

comparative analysis between:

- the [reservoir fluid](#) deliverability (the ability of [reservoir](#) to produce or take-in the [fluid](#)) which is called [Inflow Performance Relation \(IPR\)](#)

and

- [wellbore fluid](#) deliverability (the ability of [well](#) to lift up or lift down the [fluid](#)) and which is called [Lift Curves \(LC\)](#) (also called [Vertical Lift Performance \(VLP\)](#) or [Tubing Performance Relation \(TPR\)](#))

It is based on correlation between surface flowrate q and bottomhole pressure p_{wf} as a function of tubing-head pressure p_s and formation pressure p_r and current reservoir saturation.

Application

- Setting up the [required production or injection regime](#) for each well upon the current formation pressure, reservoir saturation and production target specified by [FDP](#)
- Generating [Lift Curves \(LC\)](#) tables as input for [Reservoir Flow Modelling \(RFM\)](#)

Technology

Most reservoir engineers exploit material balance thinking which is based on long-term well-by-well surface flowrate targets (whether producers or injectors).

In practice, the flowrate targets are closely related to bottomhole pressure and associated limitations and require a specialised analysis to set up the optimal lifting (completion, pump, choke) parameters.

This is primary domain of [WFP](#) analysis.

[WFP](#) is performed on [stabilised](#) wellbore and reservoir flow and does not cover transient behaviour which is one of the primary subjects of [Well Testing](#) domain.

The conventional [WFP – Well Performance Analysis](#) is performed as the $\{p_{wf} \text{ vs } q\}$ cross-plot with two model curves:

- [Inflow Performance Relation \(IPR\)](#) – responsible for [reservoir deliverability](#) (see [below](#))

- **Lift Curves (LC)** – responsible for **well deliverability** (see [below](#))

The intersection of **IPR** and **Lift Curves** represent the **Stabilised wellbore flow** (see **Fig. 1**)

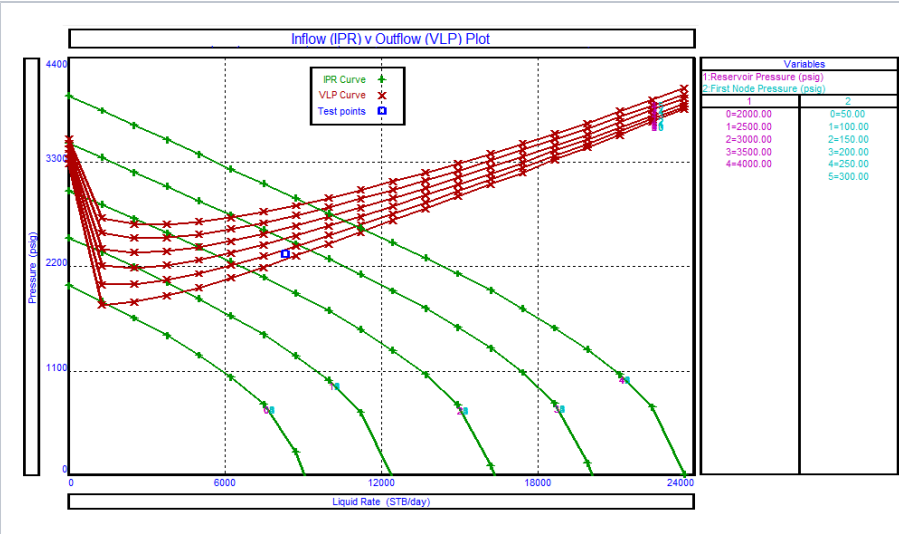


Fig. 1. A sample case of **stabilised wellbore flow** represented by junction point of **IPR** and **Lift Curves**.

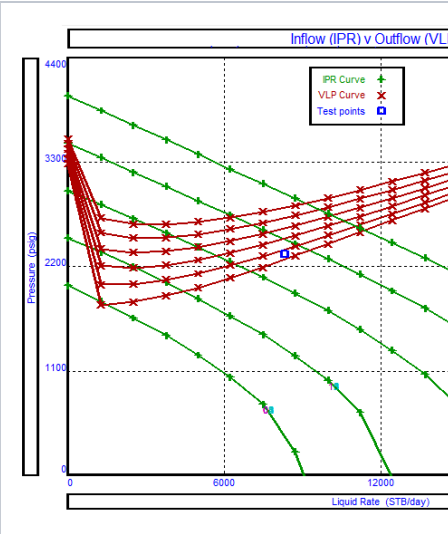


Fig. 2. The dead well scenario.

Given a tubing head pressure p_s the **WFP Junction Point** will be dynamic in time depending on current formation pressure (see Fig. 2) and formation saturation (see Fig. 3).

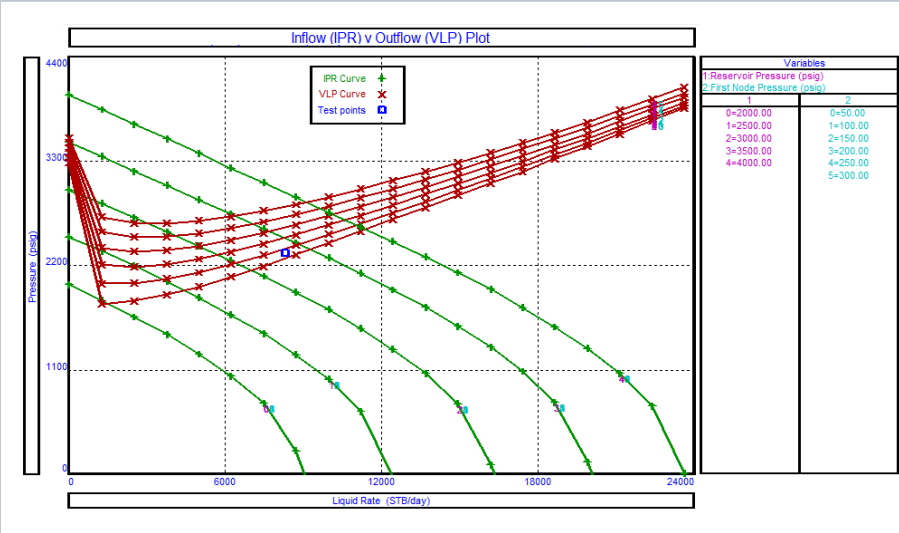


Fig. 3. A sample case of **stabilised wellbore flow** as function of formation pressure.

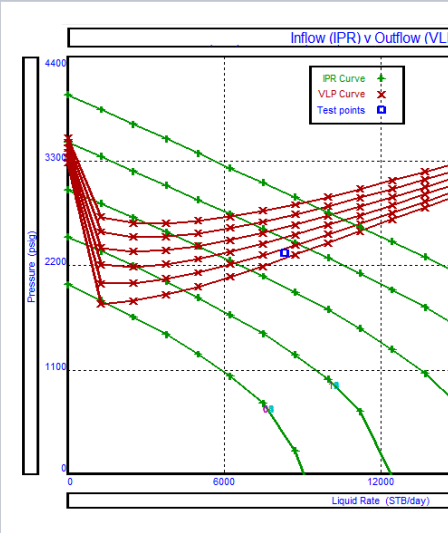
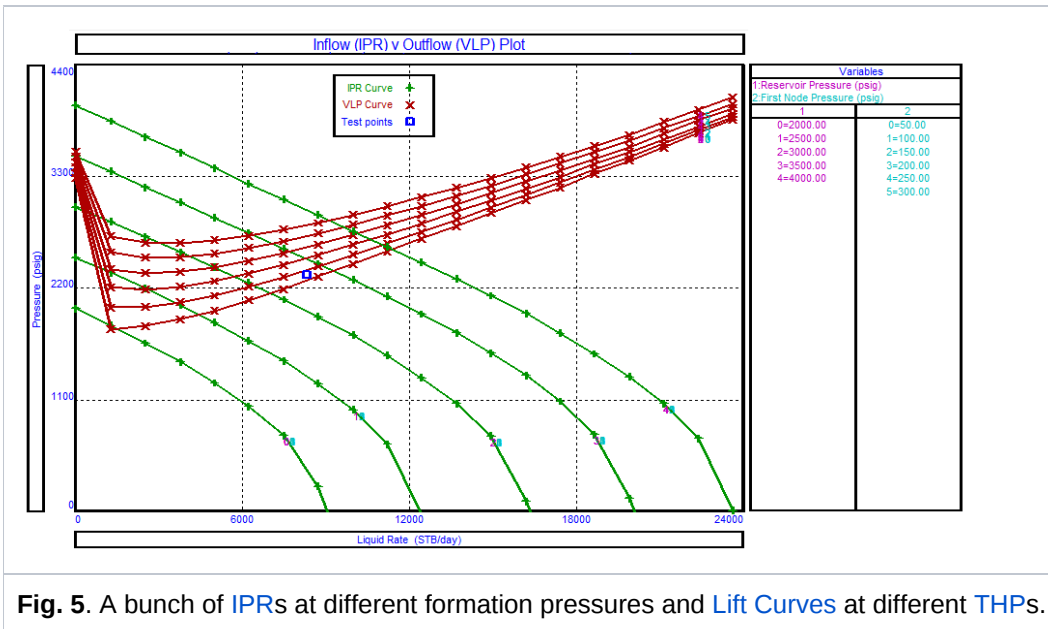


Fig. 4. A sample case of **stabilised wellbore flow** as function of **watercut**.



Workflow

1. Check the current production rate against the production target from FDP
2. If the difference is big enough to justify the cost of production optimization (see point 8 below) then proceed to the step 3 below
3. Assess formation pressure based on well tests
4. Simulate IPR / LC based on the current WOR/GOR
5. Calculate the stabilized flow bottom-hole pressure
6. Gather the current bottom-hole pressure p_{wf}
7. Check up the calculation against the actual p_{wf}
8. Recommend the production optimisation activities to adjust bottom-hole pressure p_{wf} :
 - adjusting the choke at surface
 - adjusting the pump settings from surface
 - changing the pump depth
 - changing the tubing size
 - changing the pump

The above workflow is very simplistic and assumes single-layer formation with no cross-flow complications.

In practise, the [WFP](#) analysis is often very tentative and production technologists spend some time experimenting with well regimes on well-by-well basis.

See Also

[Petroleum Industry](#) / [Upstream](#) / [Production](#) / [Subsurface Production](#) / [Well & Reservoir Management](#)

[Subsurface E&P Disciplines](#) / [Production Technology](#)

[[WFP – Water Injector](#)]

[[Inflow Performance Relation \(IPR\)](#)] [[Lift Curves \(LC\)](#)]

References

Joe Dunn Clegg, Petroleum Engineering Handbook, Vol. IV – Production Operations Engineering, SPE, 2007

Michael Golan, Curtis H. Whitson, Well Performance, Tapir Edition, 1996

William Lyons, Working Guide to Petroleum and Natural Gas production Engineering, Elsevier Inc., First Edition, 2010

Shlumberge, Well Performance Manual