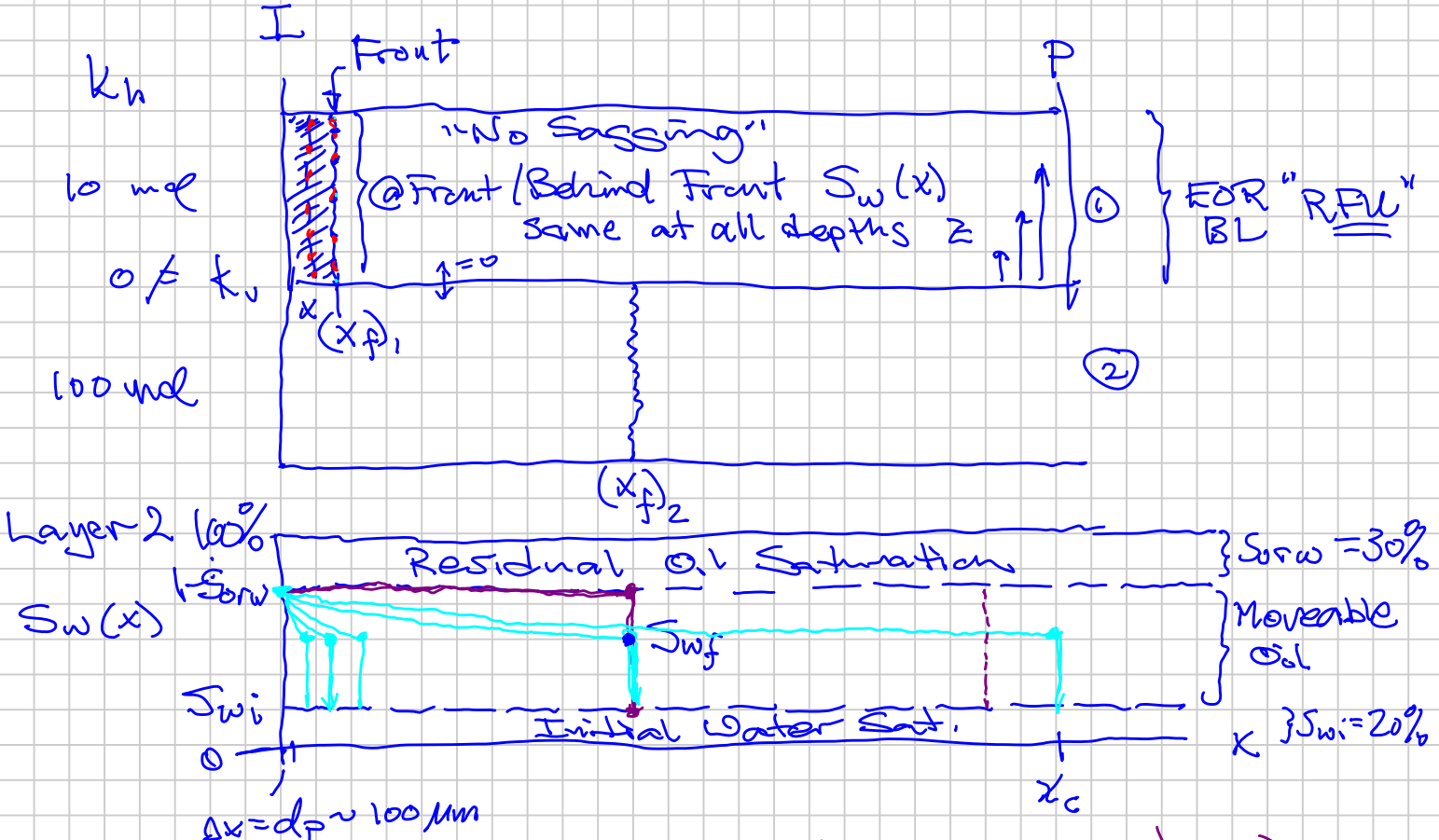
Note Title 10/29/2018

Water-Oil (Gas-Oil) Immiscible Displacement

- Buckley-Leverett Theory (1942)
  - Muskat Comments (1950)
  - Standing notes (197x) "Fractional Flow"
  - Mathematical verification (?) using 'Method of Characteristics'
  - One-dimensional flow theory (H | I | V) $0 < \alpha \leq 90°$

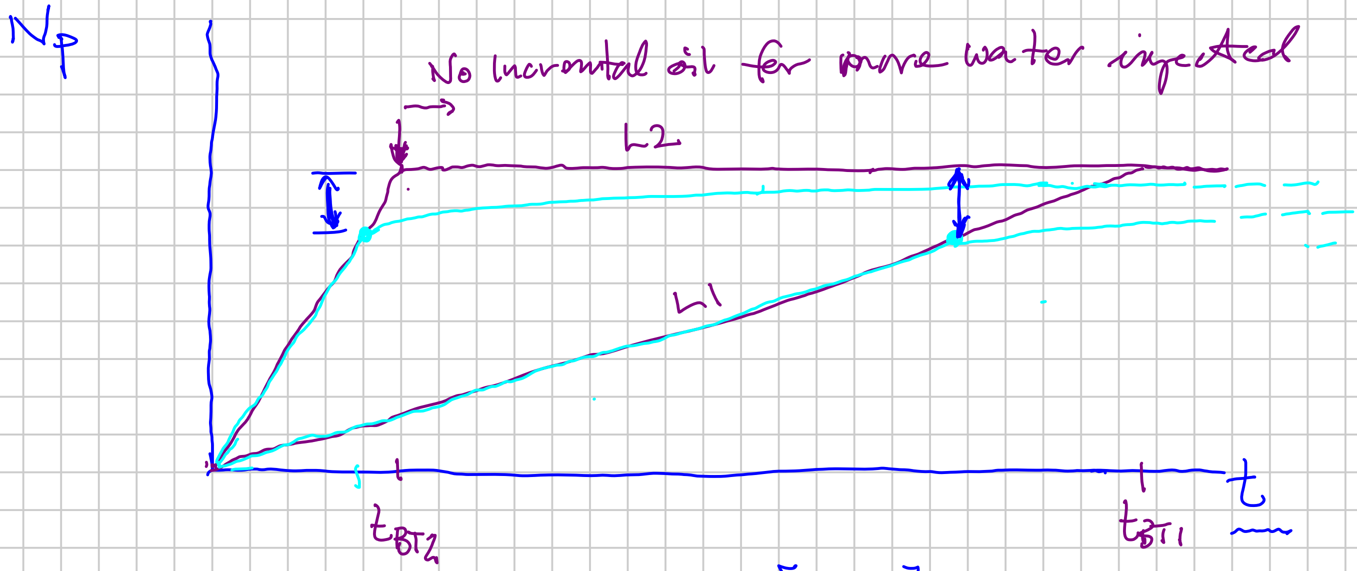
$q, k, \phi, h, k_r, \Delta\rho \ldots\} \rightarrow 1DV$

- Alternative: "Leaky Piston" (Muskat)



— Leaky Piston (optimistic, RF_0 & t_{BT})

— BL: $S_w \rightarrow 1-S_{orw}$ requires "infinite" amount of water passing the pore

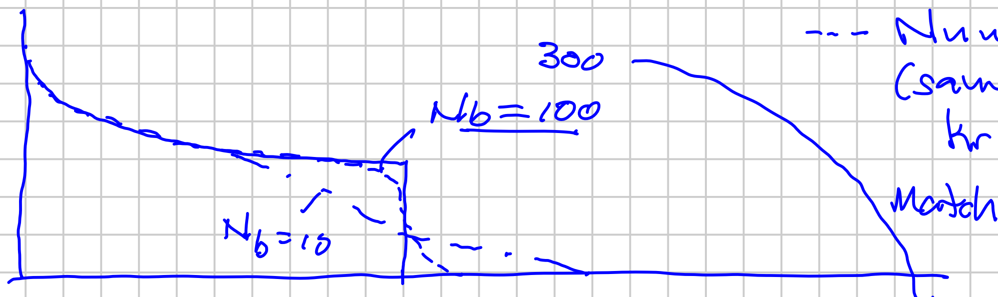


$[q_i(t)]_l$ for BL vs LP

Assuming the same water rate injected into L1 & L2 prior to BT

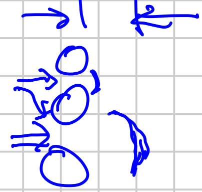
— Analytical BL

--- Numerical (same BL k_r, μ ...)



Match

Physical Dispersion



Injectant Utilization Efficiency

$$\frac{\$80/bbl \; \Delta q_o}{\$10/bbl \; \Delta q_{iw}} = \text{constant (max)} \sim 1 \longrightarrow 0.x \longrightarrow 0$$

constant (max): before BT w/o [illegible]

0.x: BL

0: Leaky Piston

Oil Stripping After BT

Standing Fraction Flow Notes

① Fractional Flow Eqs.

② Frontal Advance Eq. (BL) $S_w(x, t)$ → PVI / "dimensionless time"

③ Average Saturation ($\bar{S}_w \Rightarrow \bar{S}_o$) Behind Front

④ Injection Volume (PVI | V_{iD}) - Recovery $\frac{N_p}{N}$ Relationship