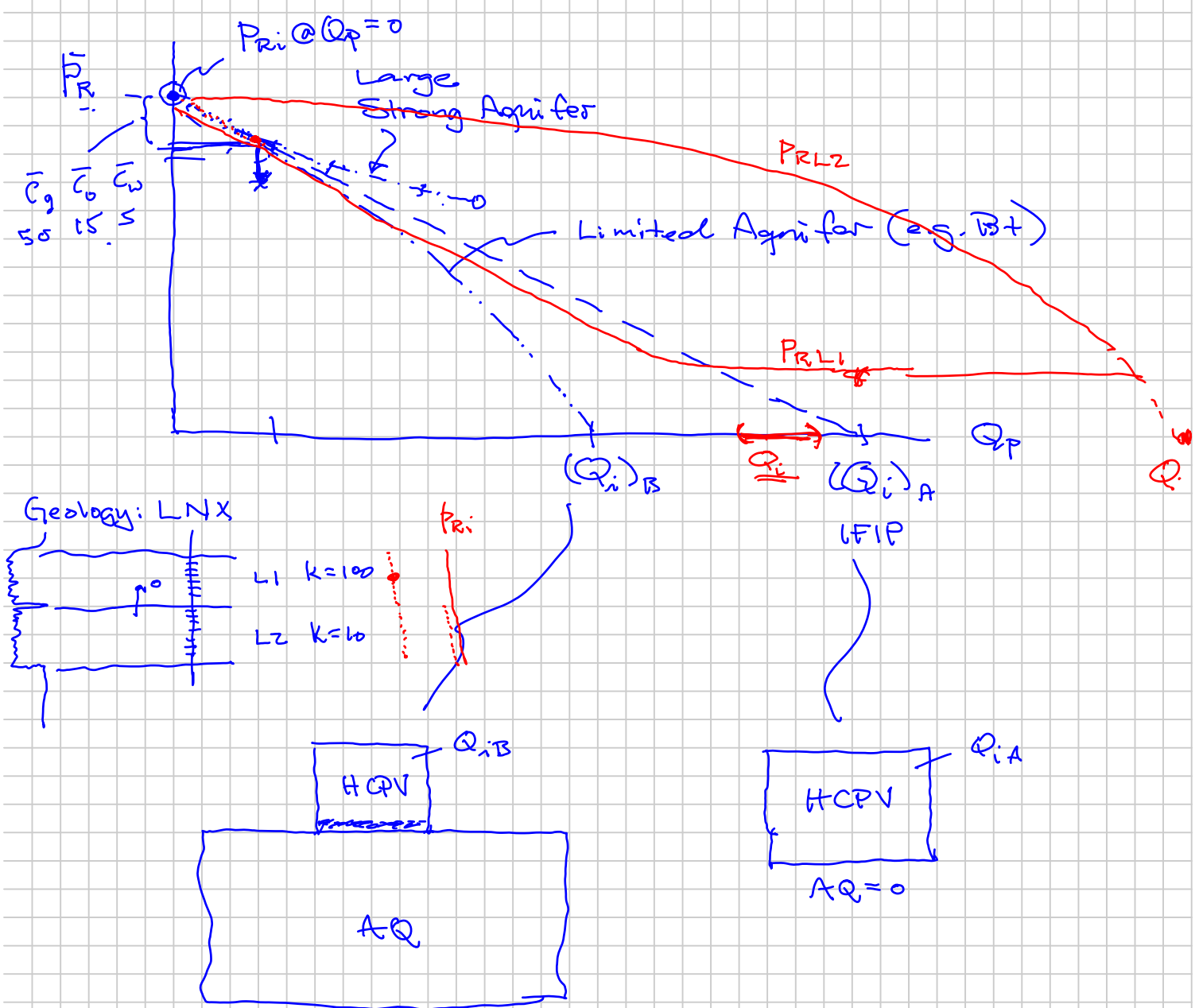


APPLICATIONS OF MATERIAL BALANCE: " $\bar{P}_R(Q_p)$ "

(a) HC's (b)
 ① Estimating WFIP (Q_i, N) & non-HC Pressure Support
 & Forecasting based on historical performance
 (c)

② Forecasting $\bar{P}_R(Q_p)$ behavior based on
 (uncertain) reservoir parameters and
 (uncertain) development strategies



① More water assumed, the smaller IFIP predicted based on early p_R decline

$$\underbrace{(c_w V_{WR} + c_g V_{GR}) \Delta p_R}_{\text{constant}} = (Q - Q_p) B \quad ?$$

ΔQ_p

→ gives p_R for ΔQ_p

To minimize uncertainty in IFIP est, get a "best estimate" of all water connected to your HC reservoir:

- Connate water
 - Interbedded (NMP)
 - Aquifer
- logs } & mapping
logs }
wells & regional geology }
t

t	Well	PTA BU $\frac{p}{p_R}$	$Q_{PF} = \{ \epsilon_p N_p W_p \}$	$Q_{inj.F} = \{ W_{inj} G_{inj} \}$
2018	⋮	⋮	⋮	⋮
2019	⋮	⋮	⋮	⋮
2020	⋮	⋮	⋮	⋮

1c & 2 : Forecasting

MBAL

Assume :

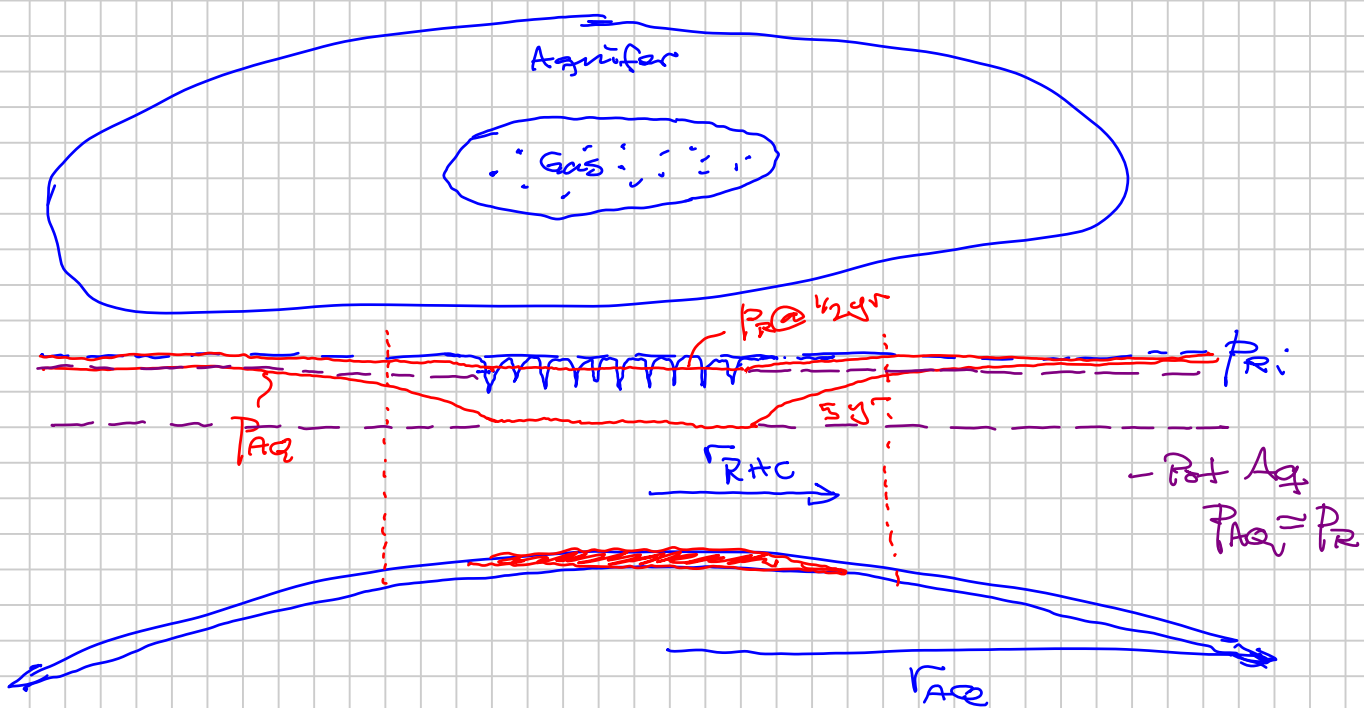
- IFIP (G_g, G_o, N_g, N_o)
- V_w (S_w, map, NNP, VA_{aq})
- C_w, C_f
- k_{aq} : Control rate of aquifer influx
- Well - RU mapping
- Commingled Production (Injection)
- PI / II
- well "PI" $\left[\frac{kh}{(s+w)} \right]_{RU}$

Each Non-Communicating Reservoir has its own M.B. "Reservoir Units"

Estimate the Production-Injection forecast Well (Field basis if 1 RU)

... Alternative is a "simple" reservoir simulation model

Water Influx Models

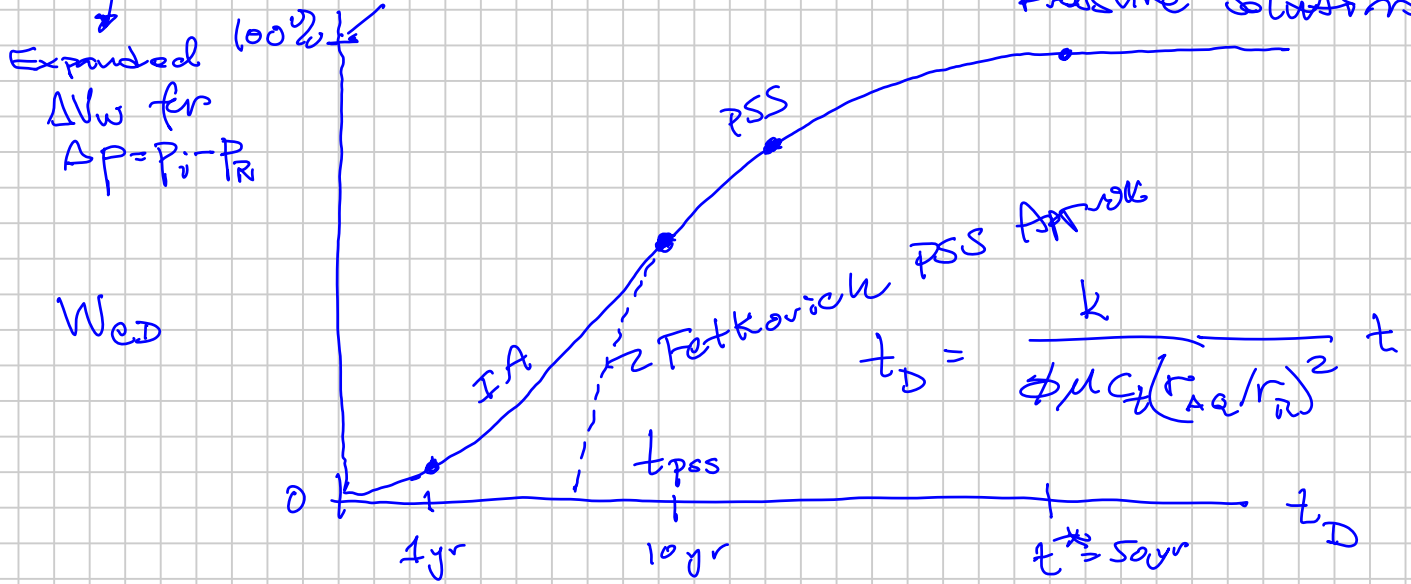


Van Everdingen & Hurst "Exact" Function

AQ into the R
 Expanded
 Δw for
 $\Delta P = P_i - P_R$

Pot. Arg. Model

Constant Inner Boundary Pressure Solution
 $r_w = r_{RHC}$



All potential AQ expansion done

Superposition

