Water Influx from a Pot Aquifer

Cumulative water influx from a small (pot) aquifer for a pressure drop at the oil–water contact, from its size, porosity, compressibilities and encroachment angle.

Input parameters

Unit system: SI

Parameter	Value	Unit
Outer radius of the aquifer	8,000.0	ft
Radius of the reservoir	3,000.0	ft
Aquifer thickness	40.000	ft
Aquifer porosity	20.000	%
Water compressibility	3.5000e-06	1/psi
Rock (pore) compressibility	4.0000e-06	1/psi
Encroachment angle	360.00	°
Pressure drop at the oil–water contact	500.00	psi

Calculated results

Parameter	Value	Unit
Initial water in the aquifer	246.20	MMbbl
Fraction of the circle open to the aquifer	100.00	%
Cumulative water influx	923,244	bbl

Notes for this case

• Only for aquifers comparable in size to the reservoir: the pressure drop is felt instantly through the whole aquifer. Larger aquifers respond with a time lag and need an unsteady model (van Everdingen–Hurst, Fetkovich).

Formula and method

$$W_i = \pi(r_a^2 - r_e^2)h\phi, \quad W_e = (c_w + c_f)W_i f(p_i - p), \quad f = \frac{\theta}{360^\circ}$$

Variables

r_a	Outer radius of the aquifer	m
r_e	Radius of the reservoir	m
h	Aquifer thickness	m
ϕ	Aquifer porosity	-
c_w	Water compressibility	1/Pa
c_f	Rock (pore) compressibility	1/Pa
θ	Encroachment angle	rad
$p_i - p$	Pressure drop at the oil–water contact	Pa
W_i	Initial water in the aquifer	m³
f	Fraction of the circle open to the aquifer	-
W_e	Cumulative water influx	m³

Method and standards

Pot aquifer (compressibility) model.

Assumptions and limits

- Instant pressure equalisation in the aquifer.

Report details

Report reference	FCC-FZBW-DB0N (the same inputs always give the same reference)
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Calculator	Water Influx from a Pot Aquifer
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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/chemical/reservoir-engineering/pot-aquifer-water-influx

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.