- 1 1

Conversions

1 acre = 43560 sf
640 acres = 1 sq. mi

1 cf = 7.48 gal

39.37 in = 1 m
1 in = 2.54 cm

Ex. 1 6 in of rain over 320 ac. watershed

$$6\ in \left(\frac{1\ ft}{12\ in}\right) \times (320\ ac) = 160\ ac\text{-}ft$$

$$160\ ac\text{-}ft \left(43560 \frac{sf}{ac}\right) = 6{,}969{,}600\ cf$$

$$\times \left(7.48 \frac{gal}{cf}\right)$$

$$= 52{,}132{,}000\ gal$$
$$= 52\ mg$$

Ex. 2 7Q10 Brandywine Creek

$$76\ cfs \times \frac{60\ sec}{min} \times \frac{60\ min}{hr} \times \frac{24\ hr}{day} \times 7.48 \frac{gal}{cf}$$

$$= 49\ mgd$$

Ex. 3 How Long to Drain 2 bg Hoopes Reservoir @ 100 cfs

$$2{,}000{,}000{,}000\ gal \Big/ 100\ cfs \left(\frac{7.48\ gal}{cf}\right) = 2{,}673{,}796\ sec \left(\frac{1\ min}{60\ sec}\right)\left(\frac{1\ hr}{60\ min}\right)$$
$$= 742\ hr \div 24 = 31\ days$$

Fahrenheit & Celsius

$$C = \left(\frac{F-32}{9}\right)5 \qquad F = 73°$$

$$C = \left(\frac{73-32}{9}\right)5 = 23°C$$

F	C	
212°	100°	Boiling Point
73°	23°	San Diego
32°	0°	Melting Point.

Fluid Mechanics

$$\gamma = \rho g$$

where γ = specific weight water
ρ = density, 62.4 lb/ft³ water
g = acceleration gravity 32.2 ft/sec²

Static Fluid Pressure

$$P = \gamma H + P_{atm}$$

where:

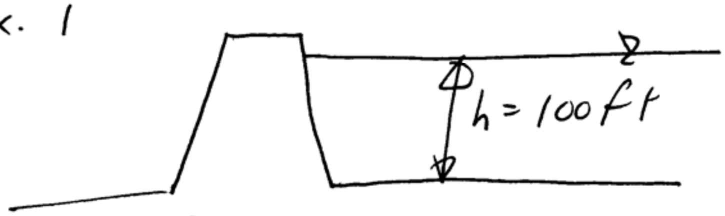
p = pressure (psf), convert to psi

γ_w = sp. wt. H_2O = $62.4\ lb/ft^3$

h = height (ft)

p = atmospheric pressure (14.7psi) ignore in open channel flow

Ex. 1

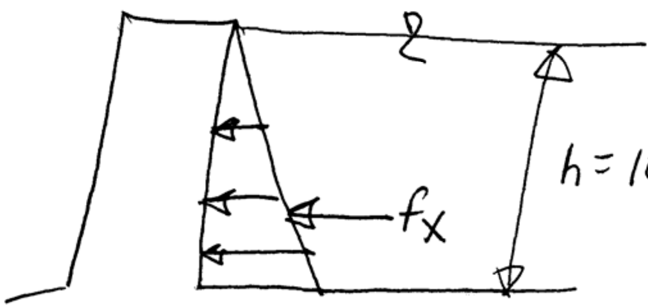


$$p = (62.4\ lb/ft^3)(100 ft)$$

$$= 6240\ lb/sf \left(\frac{1 ft}{12 in}\right)^2 = \underline{43 psi}$$

$$P_{comp\ concrete} = 3000\ psi$$

Hydrostatic Force



$f_x = \frac{\gamma h^2}{2}$, force acts at $h/3$ from bottom

$f_x = (62.4 \, lb/ft^3) \frac{(10 ft)^2}{2} = 3120 \, lb/ft$ of dam

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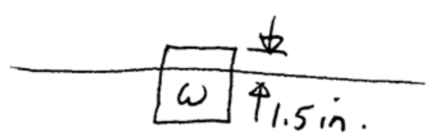
Buoyancy

$W = \gamma_f V$



where: γ_f = sp. wt. of body = $62.4 \, lb/ft^3$ H_2O

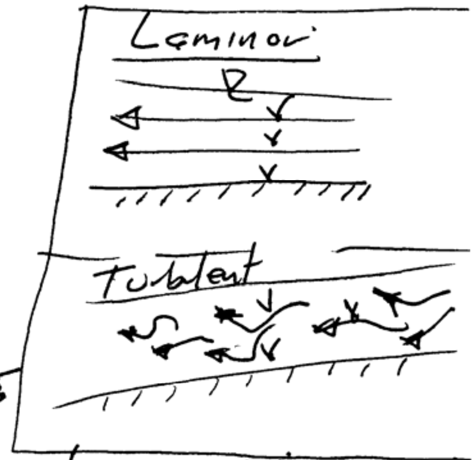
V = Volume of body

W = weight of body

Ex. 1

Buoy - 5 ft long, 5 ft wide, 5 ft deep

Fluid Kinematics



Reynolds Number

$$Re = \frac{\rho V L}{\mu}$$

where: ρ = density of fluid ~~62.4 lb/ft³~~ $= 1.9\ \frac{slug}{ft^3}$
L = Length
V = velocity
μ = dynamic (Kinematic) viscosity $= 1\ \frac{ft^2}{sec}$ @ 73°F

so $Re = \frac{1.9\,(10\,fps)\,(1000\,ft)}{1\ \frac{ft^2}{sec}} = 19000$

Pipe Flow

0 — laminar — 2000 Re — gradual change to turbulent — 4000 Re — turbulent →

Most water resources applications,

Re > 4000 and turbulent.