

Fixed Radius Calculation

Fixed radius calculation for 1, 3 and 10 year time of travel intervals for waiver applications.

Variables:

Fixed Radius = r

Cubic feet per year = Q_a

Time of Travel = T (years)

$\pi = \pi = 3.14$

Specific Yield = n = 0.15 (default) (dimensionless)

The length of well below the water table = Kl

Fixed Radius Equation:

$$r(T) = \sqrt{\frac{Q_a * T}{\pi * n * Kl}}$$

Example:

The following example calculation is for a fixed radius at a 10 year time of travel. In order to calculate fixed radius you will need to know the maximum pump capacity in gallons per minute (gpm), the depth of the well and the depth to groundwater.

Max pump capacity in the well = 50 gpm

Conversion factor from gpm to cubic feet per year (f^3 /year) = 70,267

$Q_a(T) = \text{Max pump capacity} * \text{Conversion factor} = 50 \text{ gpm} * 70,267 = 3513350 \text{ (} f^3/\text{year)}$

$Q_{a(10)} = Q_a * T = 3513350 \text{ (} f^3/\text{year)} * 10 \text{ (year)} = 35133500 \text{ } f^3$

Depth of well = 430 f

Depth to water = 260 f

$Kl = 430 \text{ f (D well)} - 260 \text{ f (D water)} = 170 \text{ f}$

n = specific yield = 0.15

$(\pi * n * Kl) = 3.14 * 0.15 * 170 \text{ f} = 80.07$

$$r_{(10)} = \sqrt{\frac{35133500 \text{ (} f^3)}{80.07 \text{ (f)}}} = \sqrt{438784 \text{ (} f^2)} = 662 \text{ f}$$

The fixed radius calculation cannot be used for wells in hard rock geology such as granite and basalt where fracture flow predominates. The capacity of the pump and well construction information must be known to use this calculation. If the fixed radius calculation cannot be used the default is ½ mile.