## Data Definitions

**Area (SubArea Name):** U.S. location or region of aquifer system or agricultural and land drainage area.

**Groundwater depletion volume:** Expressed in cubic kilometers km^3.

**Average rate of groundwater depletion:** Expressed in cubic kilometers per year (km^3/yr)

**Depletion Intensity:** Expressed in meters per year (m/yr)

## Methods applied to estimate long-term depletion

**Water-level change and storativity:** Integrate measurements of changes in groundwater levels over time and area, combined with estimates of storativity (specific yield for unconfined aquifers or storage coefficient for confined systems), to estimate the change in the volume of water stored in the pore spaces of the aquifer.

**Gravity:** Estimate large-scale water loss from gravity changes over time as measured by GRACE satellite data.

**Flow model:** Use calculations of changes in volume of stored water made using a deterministic groundwater-flow model calibrated to long-term observations of heads and parameter estimates for the system.

**Confining unit:** Apply the method of Konikow and Neuzil (2007), which requires estimates of specific storage and thickness of the confining unit, as well as head changes in the adjacent aquifer, to estimate the depletion from confining units. For confined aquifer systems, leakage out of adjacent low-permeability confining units may be the principal source of water and the largest element of depletion (Konikow and Neuzil, 2007).

**Water budget:** Use pumpage data in conjunction with a water budget analysis for an aquifer system to estimate depletion. This approach is limited to systems for which there are reasonable estimates of other fluxes in and out of the system; the approach is applied most often in arid to semiarid areas where natural recharge is small or negligible.

**Pumpage fraction:** Use pumpage data in conjunction with an assumption that the fraction of pumpage derived from storage can be correlated with the fraction during a control period or for a control area.

**Extrapolation:** In cases where data do not extend through 2008, extrapolate rates of depletion through the end of the study period using the observed rates calculated for the most recent multi-year period. Adjust rates for extrapolation accordingly if recently observed water-level changes do not support a linear extrapolation. In cases where sufficient data exist, the annual rate of depletion is estimated through correlation with the observed rates of water-level change and (or) annual rates of pumpage.

**Calculate** a volume of subsidence in areas where land subsidence is caused by groundwater withdrawals; the depletion volume must equal or exceed the subsidence volume, so this serves as a cross-check and constraint on calculated depletion volumes (Kasmarek and Strom, 2002; Kasmarek and Robinson, 2004).

*[Source: https://water.usgs.gov/GIS/metadata/usgswrd/XML/sir2013-5079_Groundwater_Depletion.xml]*

Data Conversion Factors

# Conversion Factors

Inch/Pound to SI

| Multiply | By | To obtain |
|---|---|---|
| foot (ft) | 0.3048 | meter (m) |
| acre-foot (acre-ft) | 1,233 | cubic meter ($m^3$) |
| cubic foot per second ($ft^3/s$) | 0.02832 | cubic meter per second ($m^3/s$) |

SI to Inch/Pound

| Multiply | By | To obtain |
|---|---|---|
| | Length | |
| millimeter (mm) | 0.03937 | inch (in) |
| centimeter (cm) | 0.03281 | foot (ft) |
| meter (m) | 3.2808 | foot (ft) |
| kilometer (km) | 0.6214 | mile (mi) |
| | Area | |
| square kilometer ($km^2$) | 0.3861 | square mile ($mi^2$) |
| | Volume | |
| cubic meter ($m^3$) | 35.315 | cubic feet ($ft^3$) |
| cubic kilometer ($km^3$) | 0.2399 | cubic mile ($mi^3$) |
| cubic kilometer ($km^3$) | 810,713 | acre-feet (ac-ft) |
| | Flow rate | |
| millimeter per year (mm/yr) | 0.03937 | inches per year (in/yr) |
| centimeter per year (cm/yr) | 0.03281 | feet per year (ft/yr) |
| meter per year (m/yr) | 3.2808 | feet per year (ft/yr) |
| cubic meter per second ($m^3/s$) | 35.315 | cubic foot per second ($ft^3/s$) |
| cubic meter per day ($m^3/d$) | 35.315 | cubic foot per day ($ft^3/d$) |
| cubic kilometer per year ($km^3/yr$) | 723.75 | Billion gallons per year (Ggal/yr) |
| cubic kilometer per year ($km^3/yr$) | 1,119.8 | cubic foot per second ($ft^3/s$) |

*[Source: https://pubs.usgs.gov/sir/2013/5079/SIR2013-5079.pdf]*