

CHAPTER 1

Water Definitions

In many hydrology textbooks, the glossary of terms usually is an appendix in the back of the book. The glossary in this book is up front because people need to be familiar with the terminology if they wish to understand the rest of the text. It isn't expected that everyone grasp each of these terms from the short definitions provided here, but this chapter can be a reference to come back to during later chapters.

As mentioned in the preface, science, and in this case, hydrology, has its own language. The concepts are often quite simple, but the scientific terms can confuse and inhibit some people from understanding a water discussion. For example, the term "ET" is used a lot. No, it is not referring to a little alien in a science fiction movie; it refers to "evapotranspiration", which is a very important component in a "hydrologic budget".

Therefore, this is a list of some of the more common hydrologic terms. You can refer back to this chapter if a term is used that may not be familiar to you later in the book. The goal was to describe each term in simple words, but it was important to make sure each was scientifically accurate. Many of the definitions come from years of teaching the subject, using a variety of sources of information, and scanning through numerous USGS publications. The most important references used are Heath (1989) and information contained in hydrology textbooks such as Fetter (1988) and Freeze and Cherry (1979).

ADSORPTION

Attraction of fluids, such as water and contaminants, to rocks and sediments.

ALLUVIUM

Sediments deposited by rivers. These sediments typically fill valleys between mountain ranges.

AQUIFER

Rock or sediment that is saturated and can transmit sufficient water to supply wells.

AQUIFER TEST

A test performed by pumping a well for a certain length of time and observing change in the elevation of water level in the aquifer (amount of change in the water levels in observation wells).

AQUITARD

A geologic layer that has a low permeability and can transmit water slowly to adjacent aquifers.

ARTIFICIAL RECHARGE

Adding water to an aquifer through injection to wells or by adding water to ponds.

BASEFLOW

The portion of streamflow that comes from ground-water discharge.

CAPILLARY FRINGE

Saturated area above the water table where water is drawn upward by capillary action (water resists the pull of gravity due to attraction between water molecules and surrounding sediment).

CONFINED AQUIFER

An aquifer that is overlain by a layer of low-permeable material (such as clay or fine silt) that inhibits the movement of water through it.

CONFINING UNIT

The geologic layer of low permeability that is adjacent to an aquifer and prohibits flow into and out of the aquifer (can be either above or below an aquifer).

CONNATE WATER

Deep water in an aquifer that has been out of contact with the atmosphere for a long period of time.

CONTAMINANT

An addition to water that makes it unusable for a specific use.

DARCY'S LAW

Equation used to calculate properties of ground-water flow.

DISCHARGE

Volume of water flowing in a stream or moving through an aquifer at some specific time. For ground water, discharge often is used to describe water leaving a system (due to ET, baseflow, and ground-water flow out of a basin). Discharge is often abbreviated as Q.

DRAINAGE BASIN

Area in which surface runoff (precipitation and snowmelt) drains into a single surface-water body.

DRAINAGE DIVIDE

Boundary line (highest elevation) separating drainage basins.

DRAWDOWN

Lowering of water level or potentiometric surface by pumping a well.

EQUIPOTENTIAL LINE

A line connecting points of equal water levels or potential head.

EVAPORATION

Process of water transforming from liquid to vapor.

EVAPOTRANSPIRATION

Combination of evaporation and transpiration from plants. Evapotranspiration often is abbreviated as "ET".

FINITE-DIFFERENCE MODEL

A digital computer simulation which divides an area based on a grid of rectangular cells and attempts to mimic actual conditions.

FLOW NET

A set of intersecting equipotential lines and flow lines used to indicate directions and gradients of ground-water flow.

GAINING STREAM

A stream whose flow is increasing due to inflow from ground water.

GROUND WATER

Water held in spaces, pores, and openings in rocks and sediments beneath the surface of the Earth. Ground water often is abbreviated as "GW".

GROUND-WATER MINING

Withdrawing ground water at a rate exceeding natural recharge.

HARDNESS

Amount of calcium, magnesium, and iron in water. Hardness makes it difficult for soap to form lather.

HEAD

Water level in an unconfined aquifer or amount of pressure (potential) in a confined aquifer. Head typically is the measure of elevation of a water level in a well open to either a confined or unconfined aquifer. Often referred to as "hydraulic head".

HYDRAULIC CONDUCTIVITY

Rate at which water can move through a permeable material. Hydraulic conductivity is different from permeability (see definition below) because hydraulic conductivity considers the properties of the medium and the properties of the fluid (viscosity and density). Hydraulic conductivity often is abbreviated as “K”.

HYDRAULIC GRADIENT

Change in head over distance, usually measured as water levels in wells and shown as difference in heads over that distance. Hydraulic gradient often is abbreviated as dh/dl .

INFILTRATION

Movement of water from the Earth’s surface into the ground.

KARST

Openings in rocks, typically in carbonate (limestone) rocks, caused by dissolution of the rock. Karst is most often referred to as caves and caverns.

LOSING STREAM

A stream where flow is decreasing due to water infiltration into the ground.

MODEL

A representation of the real world. Hydrologists often use various models for explaining a system. Conceptual models try to explain what variables or conditions affect the inputs and outputs of a system (where the water is going). Numerical or digital models try to quantify those variables or conditions.

MODEL CALIBRATION

Process of changing values in a model, such as hydraulic conductivity, in order to match the model to known variables, such as water levels.

OBSERVATION WELL

A well used to observe water levels or heads in aquifers. These wells can be of various diameters and also can be used to collect water samples.

PERCHED AQUIFER

Ground water that is trapped or “perched” above the water table due to a clay layer (or zone of low permeability) separating the two layers.

PERMEABILITY

Rate at which water can move through a material. Unlike hydraulic conductivity, permeability only considers the properties of the medium and not the properties of the fluid.

PHREATOPHYTE

A plant that has a taproot extending to the water table. Indicates a relatively shallow water table.

POROSITY

Ratio of volume of void spaces (pores) to total volume of a sediment or rock. Porosity can affect the amount of water that can be held by the sediment or rock.

POTENTIOMETRIC SURFACE

Surface to which water would rise in a well open to a particular aquifer. In a confined aquifer, the potentiometric surface is above the top of the aquifer.

RECHARGE

Usually refers to water entering a ground-water system. Infiltration of precipitation and streamflow often are components of recharge.

RUNOFF

Total amount of water flowing in a stream resulting from rainfall or snowmelt.

SAFE YIELD

Refers to the amount of water that can be withdrawn from an aquifer without impairing water quality or creating unacceptable effects from lowering water levels. Safe yield is the balance between water withdrawn and recharge or leakage from surrounding units. The terms “safe yield” and “perennial yield” are open to various interpretations and remain a point of contention between water professionals.

SEMICONFINED AQUIFER

An aquifer where the confining unit allows a certain amount of discharge and recharge to occur. Also referred to as a leaky confined aquifer.

SPECIFIC YIELD

Ratio of the volume of water either sediments or rocks will produce due to gravity drainage to the total volume of the sediments or rocks. In unconfined aquifers, specific yield represents how much water will come out of storage during pumping.

SPECIFIC STORAGE

This term refers to how much water will go into or out of a porous medium (such as an aquifer) per unit volume of the medium per unit change in head. In other words, if you pump an aquifer and lower the head, specific storage is the amount of water that will come from the aquifer due to the change in head. Specific storage is often abbreviated as “Ss”.

SPRING

Point of ground-water discharge to the surface. Many different types of springs exist depending on the type of feature that causes the spring. For example, a “water table spring” is where the water table intersects the land surface (often on a steep slope), a “fracture spring” occurs where a bedrock fracture intersects land surface, and a “bedding spring” is where water runs along the top of a geologic bed and discharges to the surface where the bed outcrops.

STORATIVITY

The volume of water that an aquifer can take in or release per unit surface area of the aquifer per unit change in head. This is specific storage times the aquifer thickness. Storativity often is abbreviated as “S”.

TRANSMISSIVITY

Rate of water movement through a unit width or thickness of aquifer. Transmissivity often is abbreviated as “T”. Transmissivity is equal to hydraulic conductivity times aquifer thickness. Transmissivity is essentially a measure of the aquifer’s ability to transmit water.

TRANSPIRATION

Process of plants taking up ground water and soil moisture through their roots and emitting water vapor through their leaves.

UNCONFINED AQUIFER

Aquifer with direct connection to the atmosphere (no confining unit between aquifer and the Earth’s surface). Water level in an unconfined aquifer is referred to as the water table.

VADOSE ZONE

Zone of unsaturated rock or sediments above the water table.

WATER BUDGET

The summary of recharge and discharge components to either a drainage basin or an aquifer. Recharge minus discharge should equal zero, plus or minus changes in storage.

WATER TABLE

The upper limit of fully saturated ground that is in equilibrium with the atmosphere in an unconfined aquifer.

WELL CASING

Pipe (usually steel or PVC plastic) used to keep well open through sediments and unstable rock.

WELL LOG

A log (list) of geologic material encountered during well construction, listed from land surface to the bottom of the well.

WELL SCREEN

Well casing with slots or holes to allow water to enter the well while keeping sediment out. Typically used in unconsolidated sediments and unstable rocks.

XEROPHYTE

Desert plant that requires minimal amounts of water and has an extensive shallow root system.



MX Well in southern Railroad Valley near Nyala. Photograph by D.H. Schaefer, 2005.