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**Vacuum Drying** — Removal of liquid material from a solution or mixture under reduced air pressure, which results in drying at a lower temperature than is required at full pressure.

**Vacuum Filtration** — (Water Quality) A process by which liquid is extracted from a sludge. The filtrate is forced through a filtering material by means of a vacuum.

**Vadose** — Of, relating to, or being water that is located in the *Zone of Aeration* in the earth's crust above the ground water level.

**Vadose Zone** — The subsurface zone between the water table (*Zone of Saturation*) and the land surface where some of the spaces between the soil particles are filled with air. Also referred to as the *Unsaturated Zone* or, less frequently, the *Zone of Aeration*.

**Vadose Water** — Water occurring in the *Unsaturated Zone (Vadose Zone)* between the land surface and the water table.

**Vale** — A valley, often coursed by a stream; a dale.

**Valley** — (1) An area of land that is lower than the land on either side of it. (2) An elongated depression cut by stream erosion and associated water erosion on its sideslopes (stream valley). Also used in the vernacular for *Intermontane* and *Intramontane Basins*. Also see *U-Shaped Valleys* and *V-Shaped Valleys*.

**Valley Fill** — Alluvium or other material occupying areas below mountain slopes.

**Valve** — A device fitted to a pipeline or orifice in which the closure member is either rotated or moved transversely or longitudinally in the waterway so as to control or stop the flow.

**Vapor** — The gaseous state of a substance which under ordinary conditions exists as a liquid or solid.

**Vapor Barrier** — A continuous plastic membrane which surrounds the entire thermal envelope of a house and prevents moisture penetration into the wall cavity. Also referred to as a *Vapor Retarder*.

**Vapor Blanket** — The layer of air which overlies a body of water and, due to its proximity to the water, has a water vapor content higher than that of the surrounding atmosphere.

**Vapor Flow** — The gaseous flow of water vapor in soils from a moist or warm zone of higher potential to a drier or colder zone of lower potential.

**Vaporization** — The change of a substance from a liquid or solid state to the gaseous state.

**Vapor Plumes** — Flue gases visible because they contain water droplets.

**Vapor Pressure** — The partial pressure of water vapor in the atmosphere.

**Vapor Trail** — A visible trail of streaks of condensed water vapor or ice crystals sometimes forming in the wake of an aircraft. Also referred to as *Contrail*.

**Variable** — (Statistics) A series of comparable observations or characteristics of a phenomenon taken as a single set of data; a listing of specific characteristics of a population or a number of observations taken over a specific period of time which may reasonably be expected to vary from observation to observation.

**Variable Source Area** — The flexible zone adjacent to and extending the stream that contributes runoff to the channel during a runoff-producing event.

**Variance ( $\sigma^2$ )** — (Statistics) A measure of the spread or dispersion of a variable about its *Mean* or *Arithmetic Mean* value. The variance is calculated by taking the sum of the squares of the deviations, that is, the sum of the difference between the observed value and the series mean value, and dividing by the sample size (number of observations). The variance for a large data set (the population variance) is calculated as:

$$\sigma^2 = \sum (x_i - \bar{x})^2 / n$$

where:

$x_i$  is an individual observation;

$\bar{x}$  is the mean of all observations; and

$n$  is the number of observations.

For smaller data sets (typically less than 50) the sample variance ( $s^2$ ) is calculated by replacing  $n$  with  $n - 1$  in this equation. The positive square root of the variance is called the *Standard Deviation*. Both the variance and the

standard deviation are non-negative, by definition.

**Varve** — (Geology) (1) A layer or series of layers of sediment deposited in a body of still water in one year. (2) A regular, annual layer of silt or clay deposited in a glacier-fed lake within one year's time. (3) A pair of layers of alternately finer and coarser silt or clay believed to comprise an annual cycle of deposition in a body of still water.

**Vascular Plant** — Any of various plants, such as the ferns and seed-bearing plants, in which the phloem transports sugar and the xylem transports water and salts.

**Vegetation Management** — The practice of manipulating the species mix, age, fuel load, and distribution of wildland plant communities within a prescribed management area. It includes prescribed burning, grazing, chemical applications, biomass harvesting, and any other economically feasible methods of enhancing, retarding, or removing the above-ground parts of plants.

**Vegetative Controls** — *Non-Point Source (NPS) Pollution* control practices that involve vegetative cover to reduce erosion and minimize loss of pollutants.

**Velocimeter** — A device for measuring the speed of sound in water.

**Velocity, Average Interstitial ( $\bar{v}$ )** — The average rate of ground-water flow in interstices, expressed as the product of *Hydraulic Conductivity* and *Hydraulic Gradient* divided by the *Effective Porosity*. It is synonymous with *Average Linear Ground-Water Velocity* or *Effective Velocity*.

**Velocity Head** — Energy contained by fluid because of its velocity; usually expressed in feet of fluid (foot-pounds per pound).

**Velocity (of Water in a Stream)** — Rate of motion of a stream measured in terms of the distance its water travels in a unit of time, usually expressed in feet per second.

**Vena Contracta** — The minimum cross section of a jet of fluid discharging from an orifice or over a weir.

**Vent** — An air release valve or stand used to release air trapped at high points in a pipeline.

**Venturi** — A short tube with a constricted throat used to determine fluid pressures and velocities by measurement of differential pressures generated at the throat as a fluid traverses the tube.

**Venturi Effect** — The increase in the velocity of a fluid stream as it passes through a constriction in a channel, pipe, or duct. Calculated by the *Continuity Equation*, or

$$Q = VA$$

where  $Q$  is the volumetric flow rate,  $A$  is the Area of flow, and  $V$  is the fluid velocity. Because  $Q$  does not change, as  $A$  gets smaller then  $V$  must increase.

**Venturi Flume** — A calibrated measuring flume having a contracted throat section which produces a differential head that can be related to discharge.

**Venturi Meter** — A meter, developed by Clemens Herschel, for measuring flow of water or other fluids through closed conduits or pipes. It consists of a venturi tube and one of several forms of flow registering devices.

**Venturi Scrubbers** — Air pollution control devices that use water to remove particulate matter from emissions.

**Venturi Tube** — A closed conduit that gradually contracts to a throat, causing a pressure head by which the velocity through the throat may be determined.

**Verglas** — A thin coating of ice, as on rock.

**Vernal Pools** — (1) *Wetlands* that occur in shallow basins that are generally underlain by an impervious subsoil layer (e.g., a clay pan or hard pan) or bedrock outcrop, which produces a seasonally perched water table. (2) A type of *Wetland* in which water is present for only part of the year, usually during the wet or rainy seasons (e.g., spring). Also referred to as *Temporary Wetland*.

**Vertical Separation Distance** — (Water Quality) A phrase used to describe the distance between the bottom of a sewage septic system's drain field and the underlying water table. The separation distance allows *Pathogens* (disease-causing bacteria, viruses, or protozoa) in the effluent to be removed by the soil before it comes in contact with the groundwater. Many different factors can affect pathogen removal and directly impact the separation distance needed for removal, including temperature, seasonal high groundwater tables, groundwater mounding, and soil type.

**Vertical-Velocity Curve** — A curve showing how the down-gradient velocity varies with depth along a vertical depth-observation line in a surface stream.

**Vessel** — (1) A hollow utensil, such as a cup, vase, or pitcher, used as a container, especially for liquids. (2) (Nautical) A craft, especially one larger than a rowboat, designed to navigate on water.

**Vested Water Right** — (1) The water right to use either surface or ground water acquired through more or less continual beneficial use prior to the enactment of water law pertaining to the source of the water. These claims become final through *Adjudication*. (2) A fully executed or finalized appropriative right to use the waters of a state

for a beneficial purpose. Also see *Certificated Water Right* and *Perfected Water Right*.

**Vibrio Comma** — The waterborne microorganism which causes asiatic cholera.

**Vicariance** — (Biology) The separation or division of a group of organisms by a geographic barrier, such as a mountain or a body of water, resulting in differentiation of the original group into new varieties or species.

**Vichy Water** — (1) A naturally effervescent mineral water originally from the springs at Vichy, France. (2) A sparkling mineral water resembling this effervescent beverage.

**Virgin Flow** — The streamflow which exists or would exist if man had not modified the conditions on or along the stream or in the drainage basin.

**Virus** — The smallest (10–300  $\mu\text{m}$  in diameter) life form capable of producing infection or diseases in man or other larger species. Complex macromolecules which are able to reproduce themselves only in living cells and are capable of producing infection and diseases.

**Viscosity ( $\zeta$ )** — A measure of the resistance of a fluid to flow. For liquids, viscosity increases with decreasing temperature. For gases, viscosity increases with increasing temperature. Expressed as mass per length-time (e.g., kilograms per meter-second). A common viscosity unit is the *Poise*. One poise equals 1.0 gram per centimeter-second. Also referred to as *Dynamic Viscosity*.

**Visibility** — Broadly, the distance to which an observer can distinguish objects from their background. The concept may apply to both air and water. The determinants of visibility include the characteristics of the target object (shape, size, color, pattern), the angle and intensity of sunlight, the observer's eyesight, and the extent of light absorption and scattering caused by air and water contaminants.

**Visual Resource** — The composite of basic terrain, geologic features, hydrologic features, vegetative patterns, and land use effects that typify a land unit and influence the visual appeal that the unit may have for visitors.

**Visual Resource Management (VRM)** — The VRM system is an analytical process that identifies, sets, and meets objectives for maintaining the visual quality of public lands. The system is based on research that has identified ways to assess aesthetic qualities of the landscape and public concern for these qualities.

**VOC** — See *Volatile Organic Carbon (VOC)*.

**VOCs** — See *Volatile Organic Chemicals (VOCs)*.

**Void** — The pore space or other openings in rock. The openings can be very small to cave size and are filled with water below the *Water Table*.

**Void Ratio** — Ratio of volume of intergranular voids to volume of solid material in a sediment or sedimentary rock.

**Voids** — A general term for pore spaces or other openings in rock.

**Volatile** — Describes a substance that evaporates or vaporizes rapidly at room temperature, as a volatile liquid.

**Volatile Organic Carbon (VOC)** — (Water Quality) A measure of the amount of particulate material in a water sample that is lost upon heating. The measure is obtained by passing a given quantity of water through a glass fiber filter and then drying and weighing the solids retained on the filter. The pre-weighed filter is then heated to about 500–600°C (930–1,110°F) and a second weight is obtained. The amount lost during the heating process is termed VOC.

**Volatile Organic Chemicals (VOCs)** — These are chemicals of an organic nature (containing hydrogen, oxygen, and carbon) which readily volatilize, or travel from the water into the air. Most such substances are industrial chemicals and solvents. They include light alcohols, acetone, trichloroethylene, perchloroethylene, dichloroethylene, benzene, vinyl chloride, toluene, and methylene chloride. These potentially toxic chemicals are used as solvents, degreasers, paints, thinners, and fuels. Because of their volatile nature, they readily evaporate into the air, increasing the potential exposure to humans. Due to their low water solubility, environmental persistence, and widespread industrial use, they are commonly found in soil and water. The *U.S. Environmental Protection Agency (EPA)* maintains a listing of VOCs that are regulated with respect to *Maximum Contaminant Levels (MCLs)* as part of the *Safe Drinking Water Act (SDWA)*. Also referred to as *Volatile Organic Compounds (VOCs)*.

**Volatile Organic Compounds (VOCs)** — Organic compounds that can be isolated from the water phase of a sample by purging the water sample with inert gas, such as helium, and subsequently analyzed by gas chromatography. Many VOCs are manmade chemicals that are used and produced in the manufacture of paints, adhesives, petroleum products, pharmaceuticals, and refrigerants. They are often components of fuels, solvents, hydraulic fluids, paint thinners, and dry cleaning agents commonly used in urban settings. VOC contamination of drinking-water supplies is a human health concern because many are toxic and are known or suspected human carcinogens. Also referred to as *Volatile Organic Chemicals (VOCs)*.

**Volatile Solids** — The quantity of solids in a sample which is lost by ignition of the dry solids at 600°C.

**Volatility** — A measure of the tendency of a *Solvent* or other material to evaporate at normal temperatures.

**Volatilization** — The process by which a substance is passed off as vapor; *Evaporation*.

**Volcanic Rock Aquifer** — An aquifer composed of rock that originated from a volcano, such as basalt. This type of rock may or may not be very permeable.

**Volcanic Water** — *Juvenile Water* (new water) furnished by lava flows and volcanic activity.

**Volumetric Flow Rate** — For a liquid or a gas, the volume moving past a point per unit time. The actual flow rate ( $Q$ ) may be expressed as

$$Q = AV$$

where  $A$  is the cross-sectional area of the pipe or conduit and  $V$  is the velocity of the liquid or gas.

**Volumetric Tank Test** — One of several tests to determine the physical integrity of a storage tank; the volume of fluid in the tank is measured directly or calculated from product-level changes. A marked drop in volume indicates a leak.

**Volumetric Water Content** — That portion of the volume of a soil sample that is occupied by water, expressed as percent by volume.

**Vortex** — A revolving mass of water which forms a *Whirlpool*. A spiral motion of fluid within a limited area, especially a whirling mass of water or air that sucks everything near it toward its center. This whirlpool is caused by water flowing out of a small opening in the bottom of a basin or reservoir. A funnel-shaped opening is created downward from the water surface.

**Vortex Rocks** — Rocks placed in a streambed to help direct flows for the formation of meanders and creation of riffles and pools. The rocks are so named for their ability to contribute to sediment transport through the channel.

**V-Shaped Valleys** — Valleys typically eroded by stream action. *U-Shaped Valleys*, by contrast, are characteristic of glacial erosion.