

Appendix E

Glossary of Geohydrologic Terms

Numbers at the end of the definitions, in parentheses, indicate the source. References for the glossary terms are listed at the end of this chapter. Definitions by U. S. Department of the Interior, Office of Surface Mining, Permanent Regulatory Program (Title 30, Chapter VII, part 701) have priority over other available definitions, are quoted from the regulations, and are indicated by (9). Almost all other definitions are directly quoted from the source. Minor rewriting exists for greater clarity.

Acid-base accounting—A criterion to evaluate the potential toxicity of overburden materials, which consists of two measurements: (1) total or pyritic sulfur and (2) neutralization potential. (6)

Acidity—The capacity of a water solution to neutralize basic or alkaline solutions. Acidity in water is due to the presence of excess hydrogen ions. (5)

Acid drainage—Water with a pH of less than 6.0 and in which total acidity exceeds total alkalinity, discharged from an active, inactive or abandoned surface coal mine and reclamation operation or from an area affected by surface coal mining and reclamation operations. (9)

Acid-forming materials—Earth materials that contain sulfide minerals or other materials which, if exposed to air, water, or weathering processes, form acids that may create acid drainage. (9)

Acid mine drainage—Water discharged from mines and mine wastes with a pH range of 2.0 to 4.5. Acidity results from the oxidation of sulfides exposed during mining, which produces sulfuric acid and sulfate salts. The acid dissolves minerals in the rocks, further degrading the quality of the drainage water. (8)

Adit—A horizontal passage from the land surface into a mine. Sometimes called a tunnel. (8)

Adjacent area—The area outside the permit area where a resource or resources, determined according to the context in which adjacent area is used, are or reasonably could be expected to be adversely impacted by proposed mining operations, including probable impacts from underground workings. (9)

Affected area—Any land or water surface which is used to facilitate, or is physically altered by, surface coal mining and reclamation operations. It includes the disturbed area; any area upon which surface coal mining and reclamation operations are conducted; any adjacent lands the use of which is incidental to surface coal mining and reclamation operations; . . . any areas upon which are sited structures, facilities, or other property material on the surface result-

ing from, or incident to surface coal mining and reclamation operations; and the area located above underground workings. (9)

Alkalinity—The capacity of a water solution to neutralize acid solutions. This property is attributed largely to the presence of the bicarbonate ion (HCO_3^-) in solution; other ions such as carbonate (CO_3^{2-}) and hydroxyl (OH^-), may contribute to this property. (5)

Alluvial aquifer—An aquifer within unconsolidated stream deposits of comparatively recent time. (10)

Alluvial valley floors—The unconsolidated stream-laid deposits holding streams with water availability sufficient for subirrigation or flood irrigation agricultural activities but does not include upland areas which are generally overlain by a thin veneer of colluvial deposits composed chiefly of debris from sheet erosion, deposits formed by unconcentrated runoff or slope wash, together with talus, or other mass-movement accumulations, and windblown deposits. (9)

Alluvium—A general term for clay, silt, sand, gravel, or other similar material deposited in a streambed, on a flood plain, delta, or at the base of a mountain during comparatively recent geologic time. (14)

Anion—A negatively charged ion; for example, Cl (chloride) and SO_4 (sulfate). (10)

Anisotropy—A condition of having different properties in different directions; example: a geologic stratum that transmits ground water at different velocities in the vertical direction than in the horizontal direction. (8)

Anthracite—Coal of the highest metamorphic rank, in which fixed-carbon content is between 92% and 98% (on a dry, mineral-matter-free basis). It is hard and black, and has a semimetallic luster and semiconchoidal fracture. (8)

Anticline—An upfold or arch of stratified rock, generally convex upward, whose core contains the stratigraphically older rocks. (8)

Apparent specific yield—The specific yield determined near the beginning of the pumping period (the first day) of an aquifer test of a water-table aquifer. This determined value would be less than the maximum specific yield obtained from a long-term pumping test period, for example, several weeks.

Aquifer—A zone, stratum, or group of strata that can store and transmit water in sufficient quantities for a specific use. (9)

Aquifer boundaries—Recharge (positive) and impermeable (negative) boundaries modify groundwater flow conditions:

— Recharge boundary is a boundary in which there is significant increase in transmissivity; for example, where a permeable material is in direct connection with a surface body of water or a permeable material is faulted against a more permeable material. This boundary influences a discharging well by retarding drawdown or stopping the expansion of the cone of depression; increases specific capacity at the well; the drawdown stabilizes between the well and the boundary. (13)

— Impermeable boundary is a boundary in which there is significant reduction in transmissivity; for example, where a permeable material abuts against a buried valley wall of impermeable granite or shale. This boundary influences a discharging well by retarding or stopping the expansion of the cone of depression, which results in increased drawdown between the well and the boundary; decreases specific capacity at the well. (13)

Aquifer system—A heterogeneous body of intercalated (interbedded) permeable and less permeable material that acts as a water-yielding hydraulic unit of regional extent. (8)

Aquifer test—A test or controlled field experiment involving either the withdrawal of measured quantities of water from, or addition of water to, a well (or wells) and the measurement of resulting changes in head in the aquifer both during and after the period of discharge or addition. (7)

Artesian aquifer—See confined aquifer.

Artesian water—Groundwater that has artesian pressure head; groundwater that is under sufficient pressure to rise above the zone of saturation. (3)

Artesian well—A well deriving its water from an artesian or confined aquifer. The water level in an artesian well stands above the top of the artesian aquifer tapped by the well. (1)

Backwater—At a stream site, backwater is the difference in elevation between the observed stage and the stage that should exist at the site for the discharge measured, as indicated by the stage-discharge relation (which applies to normal or natural flow conditions). Backwater, or the backing up of stream water, can be caused by temporary obstructions such as ice, uprooted trees, and trash blocking a bridge opening or caught on the stream reach control. (2)

Base flow (or base runoff)—Sustained or fair-weather flow in a stream composed largely of groundwater discharge. (10)

Bedding—The arrangement of a sedimentary rock in beds or layers of varying thickness and character; the general physical and structural character or pattern of the beds and their contacts within a rock mass, such as cross bedding and graded bedding; a collective term denoting the existence of beds. (8)

Bedding plane—A planar or nearly planar bedding surface that visibly separates each successive layer of stratified rock (of the same or different lithology) from the preceding or following layer; a plane of deposition. (8)

Bedrock—A general term for the rock, usually solid, that underlies soil or other unconsolidated surficial material. (8)

Brackish water—Water having a dissolved material content in the range 1,000 to 30,000 mg/L (milligrams per liter), but not necessarily corresponding to ocean water with respect to ionic ratios. (4)

Brine—Water having more than 30,000 mg/L (milligrams per liter) dissolved material, but not necessarily corresponding to ocean water with respect to ionic ratios. (4)

Cation—A positively charged ion; for example, Na⁺ (sodium) and K⁺ (potassium). (10)

Clastic—Pertaining to a rock or sediment composed principally of broken fragments that are derived from preexisting rocks or minerals and that have been transported some distance from their places of origin. (8)

Clastic dike—A sedimentary dike consisting of a variety of clastic materials derived from underlying or overlying beds. (8)

Clay—A rock or mineral particle in the soil, having a diameter less than 0.002 mm (2 microns). (8)

Clay vein—A body of clay, usually roughly tabular in form like a dike or vein, that fills a crevice in a coal seam. (8)

Cleat—In a coal seam, a joint or system of joints along which the coal fractures. There are usually two cleat systems developed perpendicular to each other. (8)

Coal—A readily combustible rock containing more than 50 percent by weight and more than 70 percent by volume of carbonaceous material, including inherent moisture, formed from compaction and induration of variously altered plant remains similar to those in peat. (8)

Coal classification—(a) The analysis or grouping of coals according to a particular property, such as degree of metamorphism (rank), constituent plant materials (type), or degree of impurity (grade); (b) the analysis or grouping of coals according to the percentage of volatile matter, caking properties, and coking properties. (8)

Coal cleat—A joint, or system of joints, along which the coal fractures. (9)

Coal well—A well that receives ground water from a coal bed.

Coefficient of permeability—See hydraulic conductivity.

Coefficient of storage—See storativity.

Coefficient of transmissibility—See transmissivity.

Colluvium—Any . . . loose, incoherent mass of soil material and (or) rock fragments deposited by rainwash, sheetwash, or slow continuous downslope creep, usually collecting at the base of gentle slopes or hillsides. (8)

Columnar section—See geologic column.

Cone of depression—A depression in the potentiometric surface of a body of groundwater that has the shape of an inverted cone and develops around a well from which water is being withdrawn. It defines the "area of influence" of a well. The shape of the depression is due to the fact that the water must flow through progressively smaller cross sections as it nears the well, and hence the hydraulic gradient must be steeper. (8)

Confined aquifer—An aquifer bounded above and below by impermeable beds, such as clay or unfractured shale, or by beds of distinctly lower permeability than that of the aquifer itself; an aquifer containing confined groundwater. (8)

Confined groundwater—Groundwater under pressure significantly greater than that of the atmosphere. Its upper surface is the bottom of an impermeable bed or a bed of distinctly lower permeability than the material in which the water occurs. (8)

Confining bed—A body of "impermeable" material stratigraphically adjacent to one or more aquifers. The hydraulic conductivity of the confining bed is distinctly lower than that of the adjacent aquifers. This term supplants the terms aquiclude, aquitard, and aquifuge. (1)

Connate water—Water entrapped in the interstices of sedimentary rock at the time of its deposition. (8)

Consolidation—Any process whereby loosely aggregated soft or liquid earth materials become firm and coherent rock; . . . the lithification of loose sediments to form a sedimentary rock. (8)

Contaminant—Any physical, chemical, biological, or radiological substance in water. (9)

Cumulative hydrologic impact assessment (CHIA)—A premining analysis of the probable cumulative hydrologic impacts of the proposed operation and all anticipated mining upon the surface water and groundwater systems within the cumulative impact area; and prepared by the regulatory authority.

—An assessment sufficient to determine, for purposes of permit approval, whether the proposed (mining) operation has been designed to prevent material damage to the hydrologic balance outside the permit area. (9)

Cumulative impact area—The area, including the permit area, within which impacts resulting from the proposed operation may interact with the impacts of all other nearby mining, on surface water and groundwater systems. (9)

Dip (structural geology)—The angle that a structural surface, such as a bedding or fault plane, makes with the horizontal, measured perpendicular to the strike of the structure and in the vertical plane. (8)

Discharge—Outflow, or rate of flow, measured in volume per time unit, such as cubic feet per second, that describes the flow of water from a pipe, a mine entry, a drainage basin, or at a stream site. (2)

Discrete groundwater zones—The occurrence of groundwater in distinct and separate zones within an anisotropic and heterogeneous media.

Dissolved material—All material which passes through a filter having a pore size of 0.45 μm . (4)

Dissolved solids—A term that expresses the quantity of dissolved material in a sample of water, "either the residue on evaporation, dried at 180°C, or, for many waters that contain more than about 1,000 parts per million, the sum of determined constituents," generally reported in milligrams per liter. (8)

Disturbed area—An area where vegetation, topsoil, or overburden is removed or upon which topsoil, spoil, or coal processing waste, underground development waste, or non-coal waste is placed by surface coal mining operations. (9)

Divide (groundwater)—A ridge in the water table or other potentiometric surface from which the groundwater represented by that surface moves away in both directions. (8)

Divide (stream)—The line of separation, or the ridge, summit, or narrow tract of high ground that marks the boundary between two adjacent drainage basins or dividing the surface waters that flow naturally in one direction from those that flow in the opposite direction; the line forming the rim of, or enclosing a drainage basin; a line across which no water flows. (8)

Drainage area (of a stream at a specific stream site)—That area, measured in a horizontal plane, enclosed by a drainage divide. (8)

Drainage basin—A region or area bounded by a drainage divide and occupied by a drainage system; specifically, the tract of country that gathers water originating as precipitation and contributes it to a particular stream channel or system of channels, or to a lake, reservoir, or other body of water. (8)

Drawdown—(a) The lowering of the water level in a well as a result of withdrawal. (b) The difference between the height of the water table and that of the water in a pumped well. (c) the reduction of the pressure head as a result of the withdrawal of water from a well. (8)

Draw slate—In coal mining, shale that occurs above a coal seam and collapses during or shortly after removal of the coal. (8)

Drift (glacial)—A general term applied to all rock material (clay, silt, sand, gravel, boulders) transported by a glacier and deposited directly by, or from the ice, or by running water emanating from a glacier. (8)

Drift (mining)—A horizontal or nearly horizontal underground opening driven along a vein. (8)

Drift mining—The extraction of near-surface coal seams by underground inclined tunneling rather than by open cut mining or vertical-shaft methods. (8)

Effective porosity—The amount of interconnected pore space available for fluid transmission. (1)

Effluent stream—See gaining stream.

Ephemeral stream—A stream which flows only in direct response to precipitation in the immediate watershed or in response to the melting of a cover of snow and ice, and which has a channel bottom that is always above the local water table. (9)

Equipotential line—A contour line on a potentiometric-surface map; a line along which the pressure head of groundwater in an aquifer is the same. (8)

Essential hydrologic functions—The role of the alluvial valley floor in:

—collecting water, storing water, regulating flow, and making the natural flow of surface water or groundwater, or both, usefully available for agricultural activities. . . .

—collecting water includes accumulating runoff and discharge from aquifers in sufficient amounts to make the water available at the alluvial valley floor greater than the amount available from direct precipitation.

—storing water involves limiting the rate of discharge of surface water, holding moisture in soils, and holding groundwater in porous materials.

—regulating the natural flow of surface water results from the characteristic configuration of the channel flood plain and adjacent low terraces.

—regulating the natural flow of groundwater results from the properties of the aquifers which control inflow and outflow.

—making water usefully available for agricultural activities results from the existence of flood plains and terraces where surface and groundwater can be provided in sufficient quantities to support the growth of agriculturally useful plants. (9)

Evapotranspiration—Water withdrawn from a land area by evaporation from water surfaces and from moist soil and by plant transpiration. (2)

Face cleat—The major cleat system or jointing in a coal seam. (8)

Facies—(a) The aspect, appearance, and characteristics of a rock unit, usually reflecting the conditions of its origin.

(b) A mappable, areally restricted part of lithostratigraphic body, differing in lithology or fossil content from other beds deposited at the same time and in lithologic continuity. (c) A distinctive rock type, broadly corresponding to a certain environment or mode of origin. (8)

Facies map—A map showing the gross areal variation or distribution (in total or relative content) of observable attributes or aspects of different rock types occurring within a designated stratigraphic unit, without regard to the position or thickness of individual beds in the vertical succession. (8)

Fault—A fracture or zone of fractures along which there has been displacement of sides relative to one another parallel to the fracture. (8)

Fault breccia—A “tectonic breccia” composed of angular fragments resulting from the crushing, shattering, or shearing of rocks during movement on a fault, from friction between the walls of the fault, or from distributive ruptures associated with a major fault. (8)

Fault gouge—Soft, uncemented pulverized clayey or clay-like material, commonly a mixture of minerals in finely divided form, found along some faults or between the walls of a fault, and filling or partly filling a fault zone; a slippery mud that coats the fault surface or cements the “fault breccia.” (8)

Fault plane—A fault surface that is more or less planar. (8)

Fault surface—In a fault, the surface along which displacement has occurred. (8)

Fence diagram—A drawing in perspective of three or more geologic sections showing their relationships to one another. (8)

Fissility—A general term for the property possessed by some rocks of splitting easily into thin layers along closely spaced, roughly planar, and approximately parallel surfaces, such as bedding planes in shale. . . (8)

Flow-duration curve—A cumulative frequency curve that shows the percentage of time that specified discharges (generally stream flow) are equaled or exceeded. (2)

Flowing well—A well that yields water at the land surface without pumping. (8)

Flow line—The path that a particle of water follows in its movement through saturated, permeable material (soil or rock). (7)

Formation—A body of rock strata, of intermediate rank in the hierarchy of “lithostratigraphic units,” which is unified with respect to adjacent strata by consisting dominantly of a certain lithologic type or combination of types or by possessing other unifying lithologic features. (8)

- Fracture (structural geology)**—A general term for any break in a rock, whether or not it causes displacement, due to mechanical failure by stress. A fracture includes cracks, joints, and faults. (8)
- Fracture trace**—A natural linear feature less than one mile long and best seen on aerial photographs (scale 1:20,000); a surface manifestation of subsurface fracture zones, or almost vertical zones of fracture concentrations; identified by dark or light tonal lines (on aerial photographs) in the soil, alignments of vegetation, topographic sags, aligned gaps in ridges, and (or) other similar features. (17)
- Fresh water**—Water having less than 1,000 milligrams per liter dissolved material. (4)
- Gaging station**—A particular site on a stream, canal, lake, or reservoir, where systematic streamflow measurements and other hydrologic data are obtained. (10)
- Gaining stream**—A stream, or reach of stream, whose flow is being increased by the inflow of groundwater. (1)
- Geohydrologic system**—A system which includes: aquifer thickness and extent, aquifer boundaries, variations and approximate values of transmissivity and storage coefficient, and magnitude of control to be imposed on the aquifer(s), such as change in discharge or head. (6)
- Geohydrologic unit**—An aquifer, a confining unit (aquiclude or aquitard), or a combination of aquifers and confining units, comprising “a framework for a reasonably distinct hydraulic system.” (8)
- Geologic column**—A composite diagram that shows in a single column the subdivisions of part, or all, of geologic time, or sequence of stratigraphic units of a given locality, or region (the oldest at the bottom and the youngest at the top, with dips adjusted to the horizontal), so arranged as to indicate their relations to the subdivisions of geologic time and their relative positions to each other. (8)
- GoB**—Materials which are separated and wasted from the coal during cleaning, concentrating, or other processing or preparation of coal. (9)
- Graben**—An elongate, relatively depressed crustal unit, or block, that is bounded by faults on its long sides. (8)
- Grid**—(a) A network composed of two sets of uniformly spaced parallel lines, usually intersecting at right angles and forming squares (or rectangles), superimposed on a map, chart, or aerial photograph, to permit identification of ground locations by means of a system of coordinates and to facilitate computation of distance and direction. (b) A systematic array of points or lines. (8)
- Groundwater**—Subsurface water that fills available openings in rock or soil materials to the extent that they are considered water saturated. (9)
- Groundwater barrier**—A natural or artificial obstacle, such as a dike or fault gouge, to the lateral movement of groundwater, not in the sense of a confining bed. It is characterized by a marked difference in the level of the groundwater on opposite sides. (8)
- Groundwater basin**—(a) A subsurface structure having the character of a basin with respect to the collection, retention, and outflow of water. (b) An aquifer or system of aquifers, whether basin-shaped or not, that has reasonably well defined boundaries and more or less definite areas of recharge and discharge. (8)
- Groundwater budget**—See hydrologic budget.
- Groundwater discharge**—Release of water from the zone of saturation. (8)
- Groundwater divide**—See divide (groundwater).
- Groundwater model**—Simulated representation of a groundwater system to aid in the understanding of the behavior of the system when stressed by discharges and recharges and to aid in decision making for groundwater resources management. (7)
- Groundwater reservoir**—All rocks in the zone of saturation; same as aquifer, or aquifer system, or groundwater system. (7)
- Groundwater runoff**—That part of the runoff which has passed into the ground, has become groundwater, and has been discharged into a stream channel as spring or seepage water. (2)
- Groundwater storage**—Water in the zone of saturation.
- Groundwater system**—A groundwater reservoir and its contained water.
- Group**—A formal lithostratigraphic unit next in rank above formation. A group includes two or more contiguous or associated formations with significant lithologic features in common. (8)
- Hardness**—A property of water, that causes formation of an insoluble residue when the water is used with soap and a scale in vessels in which water has been allowed to evaporate. It is primarily due to the presence of ions of calcium and magnesium, but also to ions of other alkali metals, other metals (such as iron), and even hydrogen. Hardness of water is generally expressed as parts per million as CaCO_3 , (40 ppm Ca produces a hardness of 100 ppm as CaCO_3); also as milligrams per liter; and as the combination of carbonate hardness and noncarbonate hardness. (8)
- Head (static)**—The height above a standard datum of the surface of a column of water (or other liquid) that can be supported by the static pressure at a given point. (1)

Headwater—The source (or sources) and upper part of a stream, especially of a large stream or river, including the upper drainage basin. (8)

Heavy metals—Metallic elements with high molecular weights generally toxic in low concentrations to plants and animal life; such metals exhibit biological accumulation. (16)

Highwall—The face of exposed overburden and coal in an open cut of a surface coal-mining activity or for entry to underground mining activities. (9)

Homogeneous aquifer—Hydraulic properties throughout the aquifer are identical everywhere. (1)

Hydraulic conductivity—The volume of fluid, at the existing kinematic viscosity, that will move in unit time under a unit hydraulic gradient through a unit area measured at right angles to the direction of flow. (1)

—Describes the ability of aquifer material to transmit water. Values for horizontal and vertical flow through the same material may differ.

Hydraulic diffusivity—The hydraulic parameter of transmissivity divided by storage coefficient (storativity); the conductivity of the saturated medium when the unit volume of water moving is that involved in changing the head a unit amount in a unit volume of medium. (1)

Hydraulic discharge—See groundwater discharge.

Hydraulic gradient—In an aquifer, the rate of change of "total head" per unit of distance of flow at a given point and in a given direction. (8)

Hydraulic head—The height of the free surface of a body of water above a given subsurface point. (8)

Hydraulic permeability—The ability of a rock or soil to transmit water under pressure. It may vary according to direction; see hydraulic conductivity. (8)

Hydrograph—A graph of stream stage, discharge, water level, velocity, or other property of water with respect to time. (2)

Hydrologic balance—The relationship between the quality and quantity of water inflow to, water outflow from, and water storage (changes in storage) in a hydrologic unit, such as a drainage basin, aquifer, soil zone, lake, or reservoir.

—A water budget that encompasses the dynamic relationships among precipitation, surface runoff, evaporation, and changes in surface water and groundwater storage. (9)

Hydrologic budget—An accounting of the inflow to, outflow from, and changes in storage in a hydrologic unit such as a drainage basin, aquifer, soil zone, lake, reservoir, or irrigation project. (2)

Hydrologic cycle—The constant circulation of water from the sea, through the atmosphere, to the land, and its eventual return to the atmosphere by way of transpiration and evaporation from the sea and the land surface. (8)

Hydrologic properties—Those properties of a rock that govern the entrance of water and the capacity to hold, transmit, and deliver water, for example, porosity, effective porosity, specific retention, permeability, and direction of maximum and minimum permeability. (8)

Hydrologic regime—The entire state of water movement in a given area.

—A function of the climate and includes the phenomena by which water first occurs as atmospheric water vapor, passes into a liquid or solid form, falls as precipitation, moves along or into the ground surface, and returns to the atmosphere as vapor by means of evaporation and transpiration. (9)

Hydrologic unit—A geographic area representing part or all of a surface drainage basin or distinct hydrologic feature, as delineated by the Office of Water Data Coordination (U. S. Geological Survey) on the State Hydrologic Unit Maps. (10)

Hydrostatic head—The height of a vertical column of water whose weight, if of unit cross section, is equal to the hydrostatic pressure at a given point; "static head" as applied to water. (8)

Hydrostatic level—The level to which the water will rise in a well under its full pressure head. It defines the potentiometric surface. (8)

Hydrostatic pressure—The pressure exerted by the water at any given point in a body of water at rest. The hydrostatic pressure of groundwater is generally due to the weight of water at higher levels in the zone of saturation. (8)

Hydrostratigraphic unit—A body of rock having considerable lateral extent and forming "a geologic framework for a reasonably distinct hydrologic system." (8)

Impermeability—The condition of a rock, sediment, or soil that renders it incapable of transmitting fluids under pressure. (8)

Induced infiltration—Recharge to groundwater by infiltration, either natural or manmade, from a body of surface water as a result of the lowering of the groundwater head below the surface water level. (8)

Induced recharge (aquifer)—Recharge to an aquifer by inflow of stream water, generally caused by the cone of depression intersecting the surface water body.

Indurated—A condition of a rock or soil hardened or consolidated by pressure, cementation, or heat. (8)

Influent flow—Flow of water into the ground from a body of surface water; for example, the seepage of water from an influent stream to the zone of saturation. (8)

Influent stream—A stream or reach of a stream that contributes water to the zone of saturation and develops bank storage; its channel lies above the water table (8); synonymous term is losing stream.

Instantaneous discharge—The discharge at a particular instant in time. (10)

Insulated stream—A stream or reach of a stream that is separated from the zone of saturation by an impermeable bed and neither contributes water to the zone of saturation nor receives water from it. (8)

Integrated drainage—The drainage developed where various higher local base levels of small basins are incorporated into a large basin which has a single lower base level. (8)

Intermittent stream—(a) A stream or reach of stream that drains a watershed of at least one square mile, or (b) a stream or reach of stream that is below the local water table for at least some part of the year, and obtains its flow from both surface runoff and groundwater discharge. (9)

Ion—An atom, group of atoms, or molecule that has acquired a net electrical charge. (10)

Isopach—A line drawn on a map through points of equal true thickness of a designated stratigraphic unit or group of stratigraphic units. (8)

Isopach map—A map that shows the thickness of a bed, formation, sill, or other tabular body throughout a geographic area by means of isopachs at regular intervals. (8)

Isotropy—A condition of having properties that are uniform in all directions. (8)

Joints—System of fractures in rocks along which no movement parallel to the fracture surface has occurred (as opposed to faults). In coal, joints and fractures may be termed "cleats". Joints and fractures are some of the most important water-bearing and transmitting openings in rock formations, and provide secondary hydraulic conductivity, (secondary permeability). (1)

Key bed—(a) A well-defined, easily identifiable stratum or body of strata that has sufficiently distinctive characteristics (such as lithology or fossil content) to facilitate correlation in field mapping or subsurface work. (b) A bed, the top or bottom of which is used as a datum in making structure-contour maps. (8)

Land Surface Datum (LSD) Correction—The vertical distance from the measuring point (MP), usually from the top of the well (or casing) to the ground surface. (6)

Leachate—A solution obtained by leaching; such as water that has percolated through soil containing soluble substances and that contains certain amounts of these substances in solution. (8)

Leaching—(a) Separation, selective removal, or dissolving-out of soluble constituents from a rock, or orebody, by the natural action of percolating water. (b) The removal in solution of nutritive or harmful constituents (such as mineral salts and organic matter) from an upper to a lower soil horizon by the action of percolating water, either naturally (by rainwater) or artificially (by irrigation). (8)

Lignite—A brownish-black coal that is intermediate in coalification between peat and subbituminous coal; consolidated coal with a calorific value less than 8,300 BTU per pound on a moist, mineral-matter-free basis. (8)

Limestone—A sedimentary rock consisting chiefly (more than 50 percent by weight or by areal percentages under the microscope) of calcium carbonate, primarily in the form of the mineral calcite, and with or without magnesium carbonate; specifically, a carbonate sedimentary rock containing more than 95 percent calcite and less than 5 percent dolomite. (8)

Lineaments—Linear features on aerial photographs or imagery formed by the alignment of stream channels or tonal features in soil, vegetation, or topography. (15)

Linear (adj.)—Arranged in a line or lines; pertaining to the line-like character of some object or objects. (8)

Lithification—The conversion of a newly deposited, unconsolidated sediment into a coherent, solid rock, involving processes such as cementation, compaction, desiccation, crystallization. It may occur concurrent with, soon after, or long after deposition. (8)

Lithify—To change to stone, or to petrify; especially to consolidate from a loose sediment to a solid rock. (8)

Lithofacies map—A "facies map" based on lithologic attributes, showing areal variation in the overall lithologic character of a given stratigraphic unit. (8)

Lithologic map—A type of geologic map showing the rock types of a particular area. (8)

Lithology—The description of rocks, especially in the hand specimen and in outcrop, based on such characteristics as color, mineralogic composition, and grain size. (8)

Lithostratigraphic unit—A body of rock that is unified by consisting dominantly of a certain lithologic type or combination of types, or by possessing other unifying lithologic features. (8)

Losing stream—A stream, or reach of a stream, that is losing water into the streambed and recharging the underlying aquifer. (1)

Low flow—The flow of a stream when less than an average minimum flow occurs for an indicated period of days; see base flow.

Low-flow frequency curve—A graph showing the magnitude and frequency of minimum flows for a time period of a given length. The frequency is generally expressed as the average interval, in years, between recurrences of an annual minimum flow equal to or less than shown by the magnitude scale. (2)

Marker bed—(a) A geologic formation serving as a marker. (b) "Key bed". (8)

Materially damage the quantity or quality of water—With respect to alluvial valley floors, to degrade or reduce by surface coal mining and reclamation operations the water quantity or quality supplied to the alluvial valley floor to the extent that resulting changes would significantly decrease the capability of the alluvial valley floor to support agricultural activities. (9)

Mean discharge—The arithmetic mean of individual discharges during a specific period of time. (10)

Member—A lithostratigraphic unit of subordinate rank, comprising some specially developed part of a formation. It may be formally defined and named, informally named, or unnamed. (8)

Micromho—The unit used in reporting specific conductance of water per centimeter at 25°C. (15)

Micron (μm)—A unit of length that is equal to one-millionth of a meter; it is also known as a micrometer. (5)

Mine drainage—Surface water and groundwater drainage from mines.

Mine plan area—The area of land and water within the boundaries of all permit areas during the entire life of the surface coal mining and reclamation operations. (9)

Monocline—A local steepening in an otherwise uniform gentle dip. (8)

Node—A point within a digital groundwater model at which hydraulic properties, boundary conditions, and hydraulic head can be fixed, or referenced, in space.

Observation well—A special well installed in a selected location for the purpose of observing hydrologic variables, such as water levels, pressure changes, groundwater quality. (8)

Open hole well—A well which is drilled and does not contain any casing, grouting, or other well construction features.

Overburden—Material of any nature, consolidated or unconsolidated, that overlies a coal deposit, excluding topsoil. (9)

Paludal (adj.)—Pertaining to a marsh. (8)

Particulate material—Material that is retained by a filter having a pore size of 0.45 micron. (4)

Perched groundwater—Unconfined groundwater that is separated from an underlying body of groundwater by an unsaturated zone and by a confining bed (also called the perching bed).

—The perched zone of saturation may be either permanent, where recharge is frequent enough to maintain a saturated zone above the perching bed, or temporary, where recharge is insufficient to prevent the perched water from disappearing as a result of drainage over the edge of or through the confining or perching bed. (1)

Perched water table—The water table of a body of perched groundwater. (8)

Perching bed—A body of rock or poorly permeable material, generally having the form of a layer, bed, or stratum, that supports a body of perched groundwater. Its permeability is sufficiently low that water percolating downward through it is not able to bring water in the underlying unsaturated zone above atmospheric pressure. (8)

Percolation—The movement, under hydrostatic pressure, of water through the interstices of a rock or soil. (Does not include movement through large openings, such as caves.) (2)

Perennial stream—A stream, or part of stream, that flows continuously during the year as a result of groundwater discharge or surface runoff. (9)

Permeability (intrinsic)—A measure of the relative ease with which a porous medium can transmit a liquid under a potential gradient. (1)

Permit area—The area of land indicated on the approved map submitted by the operator with his or her application, required to be covered by the operator's performance bond . . . which shall include the area of land upon which the operator proposes to conduct surface coal mining and reclamation operations under the permit, including all disturbed areas, . . . (9)

Permittee—A person holding or required by the Act . . . to hold a permit to conduct surface coal mining (and underground mining) and reclamation operations issued by a State regulatory authority pursuant to a State program, by the Director pursuant to a Federal program, by the Director pursuant to a Federal lands program, . . . (9)

pH—A standard unit for expressing the hydrogen-ion concentration. It is defined as the negative logarithm to the base 10 of the hydrogen-ion concentration in gram-moles

per liter. A pH of 7 is neutral, whereas values below 7 are acidic and values above 7 to the theoretical maximum of 14 are alkaline. More precisely, pH meters measure chemical activity rather than concentration of the hydrogen-ions; however, activity is equal to or nearly equal to concentration in dilute solutions. (5)

Phreatic water—A term that originally was applied only to water that occurs in the upper part of the zone of saturation under water-table conditions, but has come to be applied to all water in the zone of saturation. (8)

Phreatophyte—A plant that obtains its water from the zone of saturation or through the capillary fringe and is characterized by a deep root system. (8)

Porosity—The percentage of the bulk volume of a rock or soil that is occupied by interstices, whether isolated or connected. (8)

Potentiometric map—A map showing the altitude of a potentiometric surface of an aquifer by means of contour lines or other symbols. (8)

Potentiometric surface—An imaginary surface representing the total head of groundwater and defined by the level to which water will rise in a tightly cased well. (8)

—The water table of an unconfined aquifer is a particular potentiometric surface. (1)

Precipitation—All forms of water particles, liquid or solid, that fall from the atmosphere and reach the ground. (8)

Precipitation event—A quantity of water resulting from drizzle, rain, snow, sleet, or hail, in a limited period of time; . . . also includes that quantity of water emanating from snow cover as snow melt in a limited period of time. (9)

Primary porosity—The “porosity” that developed during the final stages of sedimentation or that was present within sedimentary particles at the time of deposition. (8)

Probable hydrologic consequences (PHC) determination—A premining predictive estimate (by the operator) of the hydrologic impacts of the proposed mining operation.

—An analysis of the potential impacts of the proposed mining operation on the quantity and quality of groundwater and surface water under seasonal flow in the permit and adjacent areas.

—A predictive estimate of the potential impacts on the hydrologic balance. (9)

Public-water system—A system for the provision to the public of piped water for human consumption, if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year. (9)

Pumpage—The quantity or discharge of water, or other liquid, pumped, such as groundwater. (8)

Pumping level—The water level in a discharging well.

Pumping test—See aquifer test.

Radius of influence—The radial distance from the center of a well bore to the edge of its area of influence. (8)

Rank (coal)—A generalized classification of coals according to degree of metamorphism, or progressive alteration, in the natural series from lignite to anthracite. (11)

Rating curve—See stage-discharge curve.

Recharge—The process involved in the absorption and addition of water to the zone of saturation; also, the amount of water added. (8)

Recharge area—An area in which water is absorbed that eventually reaches the zone of saturation in one or more aquifers. (8)

Recharge capacity—The ability of the soils and underlying materials to allow precipitation and runoff to infiltrate and reach the zone of saturation. (9)

Regolith—A general term for the layer or mantle of fragmental and unconsolidated rock material, whether residual or transported and of highly varied character, that nearly everywhere forms the surface of the land and overlies or covers the bedrock. (8)

Rib—The side wall of an outside entry in a coal mine. (11)

Rider coal—A thin, unmineable coal found closely above a thicker, mineable coal bed. Normally only a few inches thick. (11)

Rose diagram—A circular or semicircular star-shaped graph indicating values or quantities in several bearing directions, consisting of radiating rays drawn proportional in length to the value or quantity; some examples include a structural diagram for plotting strikes of planar features, or a “histogram” of orientation data. (8)

Runoff—That part of the precipitation that appears in surface streams. It is the same as streamflow unaffected by artificial diversions, storage, or other works of man in or on the stream channels. (2)

Salinity—A term describing water solutions containing dissolved mineral solids. The U. S. Geological Survey has assigned terms for degrees of salinity for waters with the following dissolved-solids concentration ranges: (5)

slightly saline = 1,000 to 3,000 mg/L (milligrams per liter)

moderately saline = 3,000 to 10,000 mg/L

very saline = 10,000 to 35,000 mg/L

briny = over 35,000 mg/L

Sandstone—A medium-grained clastic sedimentary rock composed of abundant rounded or angular fragments of

sand size (1/16 to 2 mm) set in a fine-grained matrix (silt or clay) and more or less firmly united by a cementing material (commonly silica, iron oxide, or calcium carbonate); the consolidated equivalent of sand, intermediate in texture between conglomerate and shale. (8)

Sandstone channel—A sandstone body that ranges in thickness from several inches to many feet and in length up to several miles and that cuts across structure and bedding of the enclosing rocks. Also called a clastic dike. (11)

Saturated thickness—See zone of saturation.

Secondary porosity—The porosity developed in a rock after its deposition or emplacement through such processes as solution or fracturing. (8)

Seepage measurements—Flow measurements made at various locations along a stream to determine whether or not a stream is losing or gaining water. (15)

Semiperched groundwater—Unconfined groundwater separated by a low-permeability, but saturated, bed from a body of confined water whose hydrostatic level is below the water table. (8)

Shale—A fine-grained detrital sedimentary rock, formed by the consolidation (especially by compression) of clay, silt, or mud. It is characterized by finely laminated structure that imparts a fissility approximately parallel to the bedding, along which the rock breaks readily into thin layers and that is commonly most conspicuous on weathered surfaces, and by an appreciable content of clay minerals and detrital quartz; a thinly laminated or fissile claystone, siltstone, or mudstone. (8)

“Shut-in” well—A tightly cased well is “shut-in” when a valve, or other flow restricting device, is closed preventing discharge of fluids. A well is “shut-in” to measure fluid pressures, which can be related to hydraulic properties of the aquifers tapped by the well.

Slug test—An aquifer testing method where a known solid volume—a slug of water or a sand filled pipe—is instantaneously injected into (or removed from) a well, and the decline of (or recovery of) the water level is measured at closely spaced intervals to determine hydraulic characteristics of the aquifer materials penetrated by the well.

Sole-source aquifer—An aquifer that supplies 50 percent or more of the drinking water of an area, as defined by the U. S. Environmental Protection Agency. (14)

Solute—Any substance derived from the atmosphere, vegetation, soil, or rocks and is dissolved in water.

Specific capacity—The rate of discharge of a well divided by the drawdown of the well; expressed as gallons per minute per foot of drawdown. Specific capacity is roughly proportional to transmissivity. (1)

Specific conductance—A measure of the ability of a water to conduct an electrical current. It is the reciprocal of the electrical resistance in ohms measured between opposite faces of a centimeter cube of an aqueous solution at a specific temperature. The standard measurement is expressed in microseisms per centimeter at 25 degrees Celsius ($^{\circ}\text{C}$), abbreviated $\mu\text{S}/\text{cm}$. The old units were micromhos per centimeter at 25 degrees Celsius, abbreviated $\mu\text{mhos}/\text{cm}$ at 25°C . Specific conductance is related to the type and concentration of ions in solution and can be used to approximate the dissolved-solids concentration in water. Estimates of the dissolved-solids concentration, in milligrams per liter (mg/L), range from 60 to 85 percent of the specific-conductance value in $\mu\text{S}/\text{cm}$ at 25°C . (5)

—For sulfate-type waters, the estimated range of dissolved solids concentration in milligrams per liter is from 90 to 100 percent of the specific-conductance value.

Specific discharge—The rate of discharge of groundwater per unit area of porous media measured at right angles to the direction of flow. (1)

Specific storage—The volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head. (1)

Specific yield—The yield, or storage coefficient, of an unconfined aquifer defined as the ratio of the volume of water which saturated rock or soil will yield by gravity to the total volume of the saturated rock or soil. (1)

Spoil—The overburden or noncoal material removed in gaining access to the coal or mineral material in surface mining. (9)

Spring—A place where groundwater flows from a rock or soil upon the land or into a body of surface water. (3)

Stage-discharge curve (rating curve)—A graph showing the relation between the gage height, usually plotted as ordinate, and the amount of water flowing in a channel, expressed as volume per unit of time, plotted as abscissa. (2)

Static water level—The water level in a well which is in equilibrium with the groundwater flow conditions of the aquifer at the well; that is, when no water is being, or recently has been, taken from the aquifer either by pumping or by free flow. It is generally expressed as the distance from the ground surface (or from measuring a point near the ground surface) to the water level in the well; also, static head. (12)

Steady flow—Occurs when, at any point, the magnitude and direction of the specific discharge are constant in time. (1)

Storage—In groundwater hydrology, storage refers to water naturally detained in a groundwater reservoir, to artificial impoundment of water in groundwater reservoirs, and to the water so impounded. (7)

Storage coefficient—See storativity.

Storativity—The hydraulic property of an aquifer that measures the volume of water an aquifer releases from or takes into storage per unit of surface area of the aquifer per unit change in head. (1)

—The storage capacity of an aquifer as described by the terms specific yield, effective porosity, coefficient of storage, and storage coefficient. (15)

Strata—Plural of stratum. (8)

Stratigraphic classification—The arbitrary but systematic arrangement, zonation, or partitioning of the sequence of rock strata of the earth's crust into units with reference to any or all of the many different characters, properties, or attributes that the strata may possess. (8)

Stratigraphic column—See geologic column.

Stratigraphic map—A map that shows the areal distribution, configuration, or aspect of a stratigraphic unit or surface. (8)

Stratigraphic section—See geologic column.

Stratigraphic sequence—A chronological succession of sedimentary rocks from older below to younger above, essentially without interruption. (8)

Stratigraphy—The science of rock strata. It is concerned not only with the original succession and age relations of rock strata but also with their form, distribution, lithologic composition, fossil content, geophysical and geochemical properties and other characteristics and attributes of rocks as strata; also their interpretation in terms of environment or mode of origin, and geologic history. (8)

Stratum—A tabular or sheetlike body or layer of sedimentary rock, visually separate from other layers above and below; a bed. (8)

Stream—A general term for a body of flowing water. (2)

Stream basin—See drainage basin.

Stream gaging—The process and art of measuring the depths, areas, velocities, and rates of flow in natural or artificial channels. (2)

Stream-gaging station—A location on a stream at which a record of stream discharge is obtained. Within the U.S. Geological Survey, this term is used only for those stream sites where a continuous record of discharge is obtained. (2)

Stream regimen—The system or order characteristics of a stream; . . . its habits with respect to velocity and volume, form of and changes in channel, capacity to transport sediment, and amount of material supplied for transportation.

—Term also applied to a stream which has reached equilibrium between erosion and deposition. (2)

Strike (structural geology)—The direction (bearing) or trend taken by a structural surface, such as a bedding plane or fault plane as it intersects the horizontal. (8)

Structure (geologic)—The general disposition, attitude, arrangement, or relative positions of rock units within an area; the sum total of the structural features within an area, reflecting past deformational processes such as faulting, folding, and igneous intrusion. (8)

Structure contour—A contour line on a map that indicates the altitude of a structural surface, such as on the base or top of a formation, a formation boundary or a fault. (8)

Structure-contour map—A map that indicates the subsurface configuration by means of structure contour lines. (8)

Structure section—A vertical section that shows the observed geologic structure on a vertical or near-vertical surface, or, more commonly, one that shows the inferred geologic structure as it would appear on a vertical plane cutting through part of the earth's crust. (8)

Subsidence—The sudden sinking or gradual downward settling of the earth's surface with little or no horizontal motion. (8)

—A sinking of part of the earth's surface, such as may result from soil compaction, collapse of underground mines, or removal of groundwater, oil or gas. (15)

Subsidence crack—A crack or joint in the rock formed or widened as a result of subsidence. (15)

Substantially disturbed—For the purposes of coal exploration, to impact significantly upon land, air, or water resources by such activities as blasting, mechanical excavation, drilling or altering coal or water exploratory holes or wells, construction of roads and other access routes, and the placement of structures, excavated earth, or other debris on the surface of the land. (9)

Surface mining activities—Those surface coal mining and reclamation operations incident to the extraction of coal from the earth by removing the materials over a coal seam, before recovering the coal, by auger coal mining, or by recovery of coal from a deposit that is not in its original geologic location. (9)

Surface water—Water on land surface, such as stream and lakes (as opposed to groundwater). (2)

Syncline—A fold in which the core contains the stratigraphically younger rocks; it is generally concave upward. (8)

Suspended material—See particulate material. (4)

Suspended residue—The material retained by a filter. (4)

Total material—The quantity of a given material present in an unfiltered water sample, regardless of the form or occurrence of the material. (4)

Total recoverable material—The total quantity of all dissolved forms of a given material plus that which is brought into solution and into an analytically determinable form, usually by means of an acid-digestion pretreatment or an acid-oxidation-digestion pretreatment of the sample. The exact conditions of the digestion pretreatment must be specified. (4)

Toxic forming materials—Earth materials or bedrock mine waste which are acted upon by air, water, weathering, or microbiological processes and are likely to produce chemical or physical conditions in soils or water that are detrimental to biota or users of water. (9)

Toxic mine drainage—Water that is discharged from active or abandoned mines or other areas affected by coal exploration or surface coal mining and reclamation operations, which contains a substance that through chemical action or physical effects is likely to kill, injure, or impair biota commonly present in the area that might be exposed to it. (9)

Trace element—Any constituent, other than organic, of water that generally occurs in concentrations of less than one milligram per liter. (10)

Transgressive sediments—Sediments deposited during the advance or encroachment of water over a land area or during the subsidence of the land. (8)

Transmissivity—The rate at which water of the prevailing kinematic viscosity is transmitted through a unit width of the aquifer under a unit hydraulic gradient. (1)

Transpiration—The process by which water absorbed by plants, usually through the roots, is evaporated into the atmosphere from the plant surface. (8)

Unconfined aquifer—See water-table aquifer.

Unconfined groundwater—Groundwater that has a free water table and is not overlain by a confining bed . . . (8)

Unconformity—(a) A substantial break or gap in the geologic record where a rock is overlain by another that is not next in stratigraphic succession. . . . (b) The structural relationship between rock strata in contact, characterized by a lack of continuity in deposition and corresponding to a period of non-deposition, weathering, or especially erosion . . . prior to the deposition of the younger beds, and often (but not always) marked by absence of parallelism between the strata; . . . (8)

Unconsolidated materials—(a) Sediment that is loosely arranged or unstratified, or whose particles are not cemented together, occurring either at the surface or at depth. (b) Soil material that is in a loosely aggregated form. (8)

Underburden—The barren rock material underlying a mineral deposit; opposite of overburden; underclay is a special type of underburden.

Underclay—A layer of fine-grained detrital material, usually clay, lying immediately beneath a coal bed or forming the floor of a coal seam. (8)

Underground mining activities—A combination of (a) surface operations incident to underground extraction of coal or in situ processing. . . . (b) underground operations such as underground construction, operation, and reclamation of shafts, adits, underground support facilities, in situ processing, and underground mining, hauling, storage, and blasting. (9)

Undifferentiated—Not separated into different formations of rock types.

Uniform flow—Specific discharge, at every point in the aquifer, that has the same magnitude and direction at any given instant in time. (1)

Unsaturated zone—The thickness of material between the land surface and the water table. (1)

Unsteady flow—Flow that results if the magnitude or direction of the specific discharge changes with time. (1)

Washout (mining)—A mass of shale, siltstone, or sandstone filling a channel in a coal seam that was cut into the coal swamp during the time of deposition. (8)

—A channel cut into or through a coal seam at some time during or after the formation of the seam, and generally filled in later by sand that later lithified into sandstone. (11)

Water-budget—See Hydrologic Budget.

Water table—The upper surface of a zone of saturation, where the body of groundwater is not confined by an overlying impermeable zone. (9)

Water-table aquifer—An aquifer having a water surface at which the water pressure is atmospheric. (1) (see unconfined groundwater)

Well yield—The quantity of water pumped, or withdrawn, from a well per unit of time; for example, the number of gallons per minute. (7)

Zone of saturation—A thickness of rock or soil material in which all the interstices are filled with water under pressure greater than atmospheric. The upper surface of the zone of saturation is the water table. (7)

References for Glossary of Geohydrologic Terms

- (1) Lohman, S. W., and others, 1972, Definitions of selected ground-water terms—revisions and conceptual