



Designation: **D4410 – 10** **D4410 – 16**

## Terminology for Fluvial Sediment<sup>1</sup>

This standard is issued under the fixed designation D4410; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 These terms are to be used by persons involved in collecting, reporting, and interpreting information pertaining to sedimentation and hydrologic processes as they apply in the development, use, control, and conservation of water and land resources.

1.2 Some listed terms and definitions are from other ASTM standards and the source document is given in bold type at the end of the definition.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

### 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

[D5614 Test Method for Open Channel Flow Measurement of Water with Broad-Crested Weirs](#)

[D5640 Guide for Selection of Weirs and Flumes for Open-Channel Flow Measurement of Water](#)

[D5674 Guide for Operation of a Gaging Station](#)

[D6855 Test Method for Determination of Turbidity Below 5 NTU in Static Mode](#)

[D6698 Test Method for On-Line Measurement of Turbidity Below 5 NTU in Water](#)

[D7937 Test Method for In-situ Determination of Turbidity Above 1 Turbidity Unit \(TU\) in Surface Water](#)

### 3. Terminology

3.1 *Terms and Definitions:*

**accelerated erosion**—**erosion**, *n*—erosion at a rate greater than geologic or natural erosion.

<sup>1</sup> This terminology is under the jurisdiction of ASTM Committee D19 on Water and is the direct responsibility of Subcommittee D19.07 on Sediments, Geomorphology, and Open-Channel Flow.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

#### DISCUSSION—

Accelerated erosion is usually associated with anthropogenic activities and usually reduces plant cover and increases runoff.

**accretion**—**accretion**, *n*—a process of sediment accumulation.

**agglomeration or flocculation**, *n*—the coalescence of dispersed suspended matter into large flocs or particles which settle rapidly.

**aggradation**—**aggradation**, *n*—the geologic process by which stream beds, flood plains, and the bottoms of other water bodies are raised in elevation by the deposition of material eroded and transported by water from other areas.

**alluvial channel**, *n*—see **alluvial stream**.

**alluvial deposit**—**deposit**, *n*—sediment deposited by the action of moving water.

**alluvial fans**, *n*—sediment deposited in the shape of a segment of a cone formed because of a sudden flattening of a stream gradient especially at debouchures of tributaries on main stream flood plains.

**alluvial stream**, *n*—a stream whose boundary is composed of appreciable quantities of the sediments transported by the flow and which generally changes its bed forms as the rate of flow changes.

**alluviation—alluviation**, *n*—the process of accumulating sediment deposits at places where the flow is retarded.

**alluvium—alluvium**, *n*—a general term for all fluvial deposits resulting directly or indirectly from the sediment transport of (modern) streams, thus including the sediments laid down in riverbeds, flood plains, lakes, fans, and estuaries.

**ambient light**, *n*—light or optical path or both that does not originate from the light source of a turbidimeter. **D7937**

**antidunes**, *n*—bed forms that occur at a velocity higher than that velocity which forms dunes and plane beds.

DISCUSSION—

Antidunes commonly move upstream, and are accompanied by, and in phase with, waves on the water surface.

**armorring—armorring**, *n*—the formation of a resistant layer of relatively large particles by erosion of the finer particles.

**attenuation**, *n*—the amount of incident light that is scattered and absorbed before reaching a detector, which is geometrically centered at 180° relative to the centerline of the incident light beam. **D7937**

DISCUSSION—

Attenuation is inversely proportional to transmitted signal.

$$\text{Attenuated Turbidity} = \text{Absorbed Light} + \text{Scattered Light} \quad (1)$$

DISCUSSION—

The application of attenuation in this test method is as a distinct means of measuring turbidity. When measured in the FAU or AU mode, the turbidity value is a combination of scattered (attenuated) light plus absorbed light. The scattered light is affected by particle size and is a positive response. The absorption due to color is a negative response. The sum of these two responses results in the turbidity value in the appropriate unit.

**automatic power control (APC)**, *n*—the regulation of light power from a source such that illumination of the sample remains constant with time and temperature. **D7937**

**avulsion—avulsion**, *n*—a sudden, natural change of a stream channel, so that the water flows elsewhere than in its previous course.

**bag sampler—sampler**, *n*—a sampler that utilizes a collapsible bag as the sample collection container.

**base flow—flow**, *n*—stream flow that is sustained by ground water and other delayed sources.

**bed-load—bed-load**, *n*—material moving on or near the stream bed by rolling, sliding, and skipping.

**bed-load discharge—discharge**, *n*—the quantity of bed-load passing a cross section of a stream in a unit of time.

**bed-load sampler—sampler**, *n*—a device for sampling the bed-load.

**bed material—material**, *n*—the sediment mixture of which the stream bed is composed.

**bed-material discharge—discharge**, *n*—that part of the total sediment discharge composed of grain sizes occurring in appreciable quantities in the bed material.

**bed-material load—load**, *n*—that part of the total load which is composed of particle sizes present in appreciable quantities in the shifting portions of the stream bed.

**broadband, white-light source**, *n*—a visible-light source that has a full bandwidth at half of the source's maximum intensity (FWHM) located at wavelengths greater than 200 nm. **D7937**

DISCUSSION—

Tungsten-filament lamps (TFLs) and white LEDs are examples of broadband sources.

**bottomset bed**, *n*—fine-grained material (usually silts and clays) slowly deposited on the bed of a quiescent body of water which may in time be buried by foreset beds and topset beds.

**boulder size (fluvial sediment)—sediment**, *n*—larger than 256 mm in diameter.

**braided river—river**, *n*—a wide- and shallow-river where the flow passes through a number of small interlaced channels separated by bars or shoals.

**calibration turbidity standard**, *n*—a turbidity standard that is traceable and equivalent to the reference turbidity standard to within defined accuracy; commercially prepared 4000 NTU Formazin, stabilized formazin, and styrenedivinylbenzene (SDVB) are calibration turbidity standards. **D7937**

DISCUSSION—

These standards may be used to calibrate the instrument. All meters should read equivalent values for formazin standards. SDVB-standard readings are instrument specific and should not be used on meters that do not have defined values specified for that instrument. Calibration standards that exceed 10 000 turbidity units are commercially available.

**calibration-verification standards**, *n*—defined standards used to verify the instrument performance in the measurement range of interest. **D7937**

DISCUSSION—

Calibration-verification standards may not be used to adjust instrument calibration, but only to check that the instrument measurements are in the expected range. Examples of calibration-verification standards are opto-mechanical light-scatter devices, gel-like standards, or any other type of stable liquid standard. Calibration-verification standards may be instrument-design specific.

**channel—channel**, *n*—a natural or artificial waterway that periodically or continuously contains moving water.

**channel-fill deposits**, *n*—deposits of sediment within a channel, partly or completely filling the channel.

DISCUSSION—

Such materials accumulate where the transporting capacity has been insufficient to remove it as rapidly as it has been delivered.

**classic gully**, *n*—a channel that is formed by gully erosion and is not interrupted by mechanical tillage operations to fill the resulting void.

DISCUSSION—

Gully depth can exceed 30 m. (see **gully erosion**.)

**clay size (fluvial sediment)—sediment**, *n*—0.00024 to 0.004 mm in diameter.

**coagulation**, *n*—the agglomeration of colloidal or finely divided suspended matter caused by the addition to the liquid of an appropriate chemical coagulant, by biological processes, or by other means (see also **agglomeration**).

**cobble size (fluvial sediment)—sediment**, *n*—64 to 256 mm in diameter.

**cohesive sediments—sediments**, *n*—that material whose resistance to initial movement or erosion depends upon the strength of the bond between particles.

**colloids (fluvial sediment)—sediment**, *n*—smaller than 0.00024 mm in diameter.

**colluvial deposits—deposits**, *n*—that material accumulated along valley margins by mass movements from the adjacent hillsides.

**color**, *n*—the hue (red, yellow, blue, etc.) of a water sample produced by the combination of: the selective absorption of visible light, the spectral reflectivity, and the degree of darkness or blackness of suspended matter. **D7937**

DISCUSSION—

The combination above is defined by the Munsell color-classification scheme.<sup>3</sup>

**composite sample—sample**, *n*—a sample formed by combining two or more individual samples or representative portions of the samples.

**concentration (volume)—(volume)**, *n*—the ratio of the volume of dry sediment to the volume of the water-sediment mixture.

**concentration of sediment (by mass)—mass**, *n*—the ratio of the mass of dry sediment in a water-sediment mixture to the mass of the mixture.

<sup>3</sup> Munsell Color Classification System, available from: <http://www.munsell.com>.

**critical flow—flow, *n***—open channel flow in which the energy, expressed in terms of depth plus velocity head, is a minimum for a given flow rate and channel. ~~The Froude number is unity at critical flow.~~ **D5614**

DISCUSSION—

The Froude number is unity at critical flow.

**debris—debris, *n***—as applied to geologic debris flows, a mixture of loose, poorly-sorted rock fragments or soil material, or both, potentially ranging from clay to boulder-size particles that may include fragmental organic matter and other exotic detritus.

**degradation—degradation, *n***—the geologic process by which stream beds, flood plains, the bottoms of other water bodies, and other land surfaces are lowered in elevation by the removal of material by fluids.

**delivery rate—rate, *n***—use **sediment delivery ratio** or sediment yield, whichever is meant.

**delta—delta, *n***—a sediment deposit formed where moving water is slowed by a slower moving body of water.

**density, *n***—the mass of a substance per unit volume,  $\rho$  in kg/L or kg/m<sup>3</sup>.

DISCUSSION—

Use  $\rho_s$  for density of solid particles,  $\rho_w$  for water,  $\rho_d$  for dry sediment with voids,  $\rho_{sat}$  for saturated sediment,  $\rho_{wet}$  for wet sediment, and  $\rho_b$  for submerged sediment (buoyant weight).

**density current—current, *n***—the movement of one fluid under, through, or over another fluid of differing density.

**deposition—deposition, *n***—the chemical, mechanical, or biological processes through which sediments accumulate in a resting place.

**depth-integrated sample, *n***—a discharge-weighted (velocity-weighted) sample of water-sediment mixture collected at one or more verticals in accordance with the technique of depth integration; the discharge of any property of the sample expressible as a concentration can be obtained as the product of the concentration and the water discharge represented by the sample.

**depth-integrating sediment sampler, *n***—a device that collects a representative water-sediment mixture at all points along the sampling vertical.

**depth integration, *n***—a method of sampling at every point throughout a given depth (the sampled depth) whereby the water-sediment mixture is collected isokinetically so that the contribution from each point is proportional to the stream velocity at the point.

DISCUSSION—

This process yields a sample with properties that are discharge weighted over the sampled depth. Ordinarily, depth integration is performed by traversing either a depth- or point-integrating sampler vertically at an acceptably slow and constant rate; however, depth integration can also be accomplished with vertical slot samplers.

**detector, *n***—a solid-state device that converts light into electrical current or voltage. **D7937**

**detector angle, *n***—the angle between the axis of the detector acceptance cone and the axis of the source light or NIR beam. **D7937**

DISCUSSION—

The detector angle equals  $180^\circ - \theta$ . ( $\theta$  is the scattering angle.)

**diameter, sedimentation—sedimentation, *n***—the diameter of a hypothetical sphere of the same specific gravity and the same settling velocity as the given particle in the same fluid.

**direct-measuring bed-load sampler—sampler, *n***—a device which physically collects and holds bed load.

**discharge (water), *n***—the volume of water flowing through a cross-section in a unit of time, including sediment or other solids that may be dissolved in or mixed with the water; usually cubic feet per second (ft<sup>3</sup>/s), or cubic metres per second (m<sup>3</sup>/s). **D5674**

**dispersed system—system, *n***—in laboratory analysis of grain sizes, an initial condition whereby the particles begin to settle from a stirred mixture; when stirring stops, each particle settles independently of other particles.

**dissolved load—load, *n***—the part of the stream load that is carried as dissolved solids.

**dissolved solids—solids, *n***—the mass of constituents in a filtered water sample. For operational purposes, the filter pore is usually 0.00045 mm.

DISCUSSION—

For operational purposes, the filter pore is usually 0.00045 mm.

**drainage basin—basin, *n***—See **watershed**.

**dunes (stream), *n***—bed forms of coarse sediment, generally transverse to the direction of flow, with a triangular profile having a gentle upstream slope.

DISCUSSION—

Dunes advance downstream by the movement of sediment along the upstream slope and by the deposition of sediment on the steep downstream slope. Dunes move downstream at low velocities compared to the stream flow velocity.

**ephemeral gully—gully, *n***—a channel that is formed by gully erosion on cropland and that is routinely but temporarily obscured by mechanical operations such as tilling.

**equal-discharge-increment (EDI) method, *n***—a procedure for obtaining the discharge weighted suspended-sediment concentration of flow at a cross section whereby depth integration is performed at the centers of three or more equal flow segments of the cross section.

DISCUSSION—

If approximately equal volumes of water-sediment mixture are collected from each flow segment, the samples may be composited for analysis. If unequal volumes are collected, samples from each flow segment must be analyzed separately and the results combined mathematically.

**equal-width-increment (EWI) method, *n***—a procedure of obtaining the discharge weighted suspended-sediment concentration of flow at a cross section by performing depth integration at a series of verticals equally spaced across the cross section and using the same vertical transit rate at all sampling verticals.

**fall velocity—velocity, *n***—the settling rate of a particle in a given medium.

**filtrate—filtrate, *n***—the fluid that has passed through a filter.

**filtration—filtration, *n***—the process of passing a liquid through a porous medium for the removal of suspended matter.

**fine-material load—load, *n***—that part of the total sediment load that is composed of particles of a finer size than the particles present in appreciable quantities in the bed material; normally, the fine-material load consists of material finer than 0.062 mm.

**flocculant—flocculant, *n***—an agent that produces flocs or aggregates from small suspended particles.

**flocculating agent—agent, *n***—a coagulating substance such as alum, ferrous sulfate, or lime which, when added to water, forms a precipitate that expedites the settling of suspended matter.

**flocs or floccules, *n***—masses of solids formed in a liquid by addition of coagulants (flocculants), or through biochemical processes, or by agglomeration of individual particles.

**fluvial sediment—sediment, *n***—particles derived from rocks, biological materials, or chemical precipitants, that are transported by, suspended in, or deposited by flowing water.

**foreset bed, *n***—the advancing and relatively steep frontal slope of a delta, that progressively covers the bottomset bed and in turn is covered by the topset bed.

DISCUSSION—

Foreset beds represent the greater part of the volume of a delta.

**Froude number, *n***—dimensionless number expressing the ratio of inertial to gravity forces in free-surface flow. It is equal to the average velocity divided by the square root of the product of the average depth and the acceleration due to gravity. **D5640**

**gauge height—height, *n***—the height of a water surface above an established or arbitrary datum at a particular gauging station; also termed stage. **D5674**

**gauging station—station, *n***—a particular site on a stream, canal, lake, or reservoir at which systematic observations of hydrologic data are obtained. **D5674**

**geologic erosion—~~or natural erosion, *n*~~**—the erosion process on or in a given land form ~~that is not associated with the activities of man~~ undisturbed by activities of man and his agents.

**graded sediment, *n***—in geology, a sediment consisting chiefly of grains of the same size range.

DISCUSSION—

In engineering, a sediment having a uniform or equable distribution of particles from coarse to fine.

**graded stream—stream, *n***—a stream in which a steady state has been reached such that over a period of time the discharge and sediment load entering the system are balanced by the discharge and sediment load leaving the system.

**grading—grading, *n***—the degree of mixing of size classes in sedimentary material.

**gravel size (fluvial sediment)—sediment, *n***—~~between 2.0 and to~~ 64 mm in diameter.

**gross erosion—erosion, *n***—the total of all sheet, gully, and channel erosion in a watershed.

**hydraulic jump—jump, *n***—an abrupt transition from supercritical flow to subcritical or tranquil flow, accompanied by considerable turbulence or gravity waves, or both. **D5614**

**instantaneous sampler, *n***—a suspended-sediment sampler that takes a representative specimen of the water-sediment mixture in a stream at a desired depth and moment of time.

**isokinetic sampling—sampling, *n***—~~to sample done~~ in such a way that the water-sediment mixture moves with no change in velocity as it leaves the ambient flow and enters the sampler intake.

**lag deposits, *n***—the larger and heavier particles that are sorted out and left behind in stream channels.

**lateral accretion deposits—deposits, *n***—See point bar.

**maximum transit rate—rate, *n***—the maximum speed at which the sampler can be lowered and raised in the sampling vertical and still have the sample collected isokinetically.

**measured sediment load, *n***—that part of the total sediment discharge that can be measured with available suspended-sediment samplers; does not include bed-load discharge and suspended sediment discharge very near the bed.

**mechanical analysis, *n***—a determination of the particle-size distribution of a sample by mechanical separation.

**median diameter—diameter, *n***—the grain diameter such that half of the sediment by mass is composed of particles of larger size and half by mass is composed of particles of smaller size; commonly denoted by the symbol “ $D_{50}$ ”.

**movable bed, *n***—a stream bed made up of materials readily transportable by the stream flow.

**mudflow, *n***—a mass of water-sediment mixture which, because of its high viscosity, moves more slowly than water.

**narrow-band source, *n***—a light source with a full bandwidth (at half of the source’s maximum intensity) (FWHM) located at wavelengths less than 5 nm. **D7937**

**native water, *n***—water from a sampled medium; this water has been unaffected by sampling, handling, and preservation.

**natural levee, *n***—raised berms or crests above the flood-plain surface adjacent to the channel usually containing coarser materials deposited by flood flows.

**naturally dispersed sample—sample, *n***—a sample having sediment that will not settle in about 4 h due to the character of fineness of particles or due to the nature of the dissolved constituents, or both.

**nephelometer—nephelometer, *n***—an instrument that measures the amount of light scattered in a suspension.

**nominal diameter, *n***—the diameter of a sphere that has the same volume as the sediment particle.

DISCUSSION—

Sometimes called *equivalent spherical diameter*.

**noncohesive sediments—discrete particles, the movement of which for given erosive forces depends only upon the properties of shape, size, and density and upon the relative position of the particle with respect to surrounding particles.**