

Aquasol Classification to the Great Group

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Aquasols include mineral subaqueous soils, peraquic soils, and those soils where water is removed so slowly that the soil is wet at shallow depths (<30 cm from the soil surface) for sufficient duration to become strongly biochemically reducing and to express this morphologically. Free water is at or near the surface long enough during the growing season that hydrophytic vegetation are predominant and most mesophytic crops cannot be grown, unless the soil is artificially drained. These soils would correspond to those that are poorly-drained or wetter as defined in the Soil Survey Manual and in general have morphologies similar to those used to identify hydric soils.

Aquasols would key out after the proposed order Artesols, and after Gelisols and Histosols.

An Aquasol meets one or more of the following criteria:

- 1) A Histic epipedon, or
- 2) Aquic conditions within 30 cm of the mineral soil surface for some time in normal years (unless artificially drained), and one or more of the following:
 - a. A mollic or umbric epipedon that has within 30 cm of the mineral soil surface, or bottom of the epipedon if it is shallower, a chroma ≤ 2 , and one or more of the following:
 1. Contains distinct or prominent redox concentrations, or
 2. Contains mucky modified textures, or
 3. Is immediately underlain by a horizon where >50% of the soil (on ped faces or within the matrix) has one of these combinations of Munsell hue, value, chroma and redox concentrations if noted and extends to a depth of 75 cm or a lithic, paralithic, or densic contact.

| Hue | Value | Chroma | Redox Concentrations Required |
|--|----------|--------|-------------------------------|
| 10YR or redder* | ≥ 4 | 1 or 2 | Yes |
| 2.5Y or yellower** | ≥ 4 | 1 | No |
| 2.5Y or yellower | ≥ 4 | 2 | Yes |
| 5Y or yellower | ≥ 4 | 3 | Yes |
| Neutral (N) | ≥ 4 | 0 | No |
| Any color if it results from uncoated mineral grains due to saturation; (e.g. g subscripts, representing strong gleying) | | | |

*10YR or redder includes 10YR, 7.5YR, 5YR, 2.5YR, and 10R

**2.5Y or yellower includes hues of 2.5Y, 5Y, or those on the Gley page.

b. Starting within 30 cm of the mineral soil surface, and extending to a depth of 75 cm or lithic, paralithic, or densic contact, soil horizons with textures finer than loamy fine sand and >50% of each horizon as one of these combinations of Munsell hue, value, chroma and redox concentrations (on ped faces or within peds):

| Hue | Value | Chroma | Redox Concentrations Required |
|---|----------|--------|-------------------------------|
| 10YR or redder | ≥ 4 | 1 or 2 | Yes |
| 2.5Y or yellower | ≥ 4 | 1 | No |
| 2.5Y or yellower | ≥ 4 | 2 | Yes |
| 5Y or yellower | ≥ 4 | 3 | Yes |
| Neutral (N) | ≥ 4 | 0 | No |
| Any color if results from uncoated mineral grains due to saturation; (e.g. g subscripts, representing strong gleying) | | | |

c. Starting within 30 cm of the mineral soil surface, and extending to a depth of 75 cm or lithic, paralithic or densic contact, soil horizons with textures of loamy fine sand or coarser and >50% of the soil has one of these combinations of Munsell hue, value, chroma and redox concentrations (on ped faces or within peds):

| Hue | Value | Chroma | Redox Concentrations Required |
|---|----------|--------|-------------------------------|
| 10YR or redder | ≥ 4 | 1 | No |
| 10YR or redder | Any | 2 | Yes |
| 2.5Y or yellower | Any | 1 | No |
| 2.5Y or yellower | Any | 3 | Yes, distinct or prominent |
| Neutral | Any | 0 | No |
| Any color if results from uncoated mineral grains due to saturation; (e.g. g subscripts, representing strong gleying) | | | |

d. In a layer with andic soil properties at a depth 30 cm or less, either from the mineral soil surface or from the top of an organic layer, whichever is shallowest, aquic conditions for some time in normal years (or artificial drainage) and *one or more* of the following:

1) 2 percent or more redox concentrations; *or*

2) A color value, moist, of 4 or more and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds or in the matrix if peds are absent; *or*

e. Sulfidic (hyper or hypo) materials within 30 cm of the soil surface; or

f. In soils that have an oxic horizon, or a kandic horizon with similar weatherable mineral properties as an oxic horizon, and where the upper 18 cm of the mineral soil has 40% or more clay, either:

i. An epipedon with a color value, moist, of 3 or less and, directly below it, a horizon with chroma of 2 or less; or

ii. An epipedon of any color, underlain directly below by a horizon with 50% or more hue of 2.5Y or yellower; or a chroma of 3 or less, or both, and containing distinct or prominent redox concentrations within 30 cm of the mineral soil surface; or

g. A spodic horizon with a moist color value 3 or less and chroma 3 or less that is at least 10 cm thick, and within 30 cm of the mineral soil surface aquic conditions within the spodic horizon or an overlying albic horizon; or

3) Inundation with 2 cm or more of water for at least 21 hours per day, for every day of the year; or

4) Peraquic conditions (within 30 cm of the mineral soil surface).

Aquasols: Key to Suborders

DA. Aquasols that have a field observable water table 2 cm or more thick above the soil surface for more than 21 hours of every day in all years, and in all horizons within 100 cm of the mineral soil surface, have an electrical conductivity of less than 0.6 dS/m in a 1:5 (soil:water), by volume.

Frasaqs

DB. Other Aquasols that have a field observable water table 2 cm or more thick above the soil surface for more than 21 hours of every day in all years.

Wassaqs

DC. Aquasols that have a water table within 30 cm of the soil surface for every day in all years.

Peraqs

DD. Other Aquasols that have: 1. A layer 25 cm or more thick, within 100 cm of the mineral soil surface, that has either slickensides or wedge-shaped peds that have their long axes tilted 10 to 60 degrees from the horizontal; and 2. A weighted average of 30 percent or more clay in the fine-earth fraction either between the mineral soil surface and a depth of 18 cm or in an Ap horizon, whichever is thicker, and 30 percent or more clay in the fine-earth fraction of all horizons between a depth of 18 and 50 cm.

Vertaqs

DE. Other Aquasols that have a mollic epipedon.

Mollaqs

DF. Other Aquasols that have a spodic horizon at least 10 cm thick.

Spodaqs

DG. Other Aquasols that have an umbric, melanic, or histic epipedon, or have buried O and/or dark-colored A horizons (moist value of 3 or less), within 200 cm of the soil surface and with combined thickness of 20 cm or more, that have 1.0 percent or more Holocene-age organic carbon, or has at least 20 kg/m² organic carbon in the upper meter.

Humaqs

DH. Other Aquasols that have an argillic, natric or kandic horizon starting within 150 cm of the mineral soil surface.

Argaqs

DI. Other Aquasols that have less than 35 percent (by volume) rock fragments and a texture of loamy fine sand or coarser in all layers (sandy loam lamellae are permitted) within the particle-size control section, and don't have an argillic horizon (unless buried).

Psammaqs

DJ. Other Aquasols that have have andic soil properties in 60 percent or more of the thickness either:

1. Within 60 cm either of the mineral soil surface or of the top of an organic layer with andic soil properties, whichever is shallower; or
2. If there is a root restrictive horizon or contact within that depth, between either the mineral soil surface or the top of an organic layer with andic soil properties, whichever is shallower, and the restrictive layer.

Andaqs

DK. Other Aquasols that have either:

1. An oxic horizon within 150 cm of the mineral soil surface and no kandic horizon within that depth; or

2. 40 percent or more (by weight) clay in the fine-earth fraction between the mineral soil surface and a depth of 18 cm (after mixing) and a kandic horizon that has the weatherable-mineral properties of an oxic horizon and has its upper boundary within 100 cm of the mineral soil surface.

Oxaqs

DL. Other Aquasols.

Orthaqs

Frasaqs: Key to the Great Groups

Frasaqs that have, in all horizons at a depth between 20 and 50 cm below the mineral soil surface, a fluidity class of slightly fluid or greater.

Fluifrasaqs

Other Frasaqs that have both a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed sample) in the upper 18 cm of the mineral soil surface and at least 0.6% soil organic carbon.

Humifrasaqs

Other Frasaqs that have less than 35 percent (by volume) rock fragments and a texture class of loamy fine sand or coarser in all layers within the particle-size control section.

Psammifrasaqs

Other Frasaqs that have: 1. at a depth of 125 cm below the mineral soil surface, an organic carbon content (Holocene age) of 0.6 percent or more; *or* 2. An irregular decrease in organic carbon content (Holocene age) between a depth of 25 cm and either a depth of 125 cm below the mineral soil surface or a root restrictive layer, whichever is shallower.

Fluvifrasaqs

Other Frasaqs.

Haplofrasaqs

Wassaqs: Key to the Great Groups

Wassaqs that have a horizon or horizons with a combined thickness of at least 15 cm within 50 cm of the mineral soil surface that contain hypersulfidic materials.

Sulfiwassaqs

Other Wassaqs that have less than 35 percent (by volume) rock fragments and a texture class of loamy fine sand or coarser in all layers within the particle-size control section.

Psammowassaqs

Other Wassaqs that have, in all horizons at a depth between 20 and 50 cm below the mineral soil surface, a fluidity class of slightly fluid or greater.

Fluiwassaqs

Other Wassaqs that have that have a histic epipedon or at least 20 kg m² soil organic carbon in the upper 100 cm, or both.

Humiwassaqs

Other Wassaqs that have: 1. at a depth of 125 cm below the mineral soil surface, an organic carbon content (Holocene age) of 0.6 percent; or 2. An irregular decrease in organic carbon content (Holocene age) between a depth of 25 cm and either a depth of 125 cm below the mineral soil surface or root restrictive contact, whichever is shallower.

Fluviwassaqs

Other Wassaqs.

Haplowassaqs.

Peraqs: Key to the Great Groups

Peraqs that have a sulfuric horizon within 50 cm of the mineral soil surface (identified by pH below 4.0).
Sulfoperaqs

Other Peraqs that have hypersulfidic material within 50 cm of the mineral soil surface (unoxidized, with pyrite, pH initially above 4.0, but drops below 4.0 after incubation).
Sulfiperaqs

Other Peraqs that have, in all horizons at a depth between 20 and 50 cm below the mineral soil surface, a fluidity class of slighty fluid or greater.
Fluiperaqs,

Other Peraqs that have a histic epipedon or at least 20 kg m² soil organic carbon in the upper 100 cm, or both.
Humiperaqs

Other Peraqs that have less than 35 percent (by volume) rock fragments and a texture class of loamy fine sand or coarser in all layers (sandy loam lamellae are permitted) within the particle-size control section.
Psammoperaqs

Other Peraqs that have at a depth of 125 cm below the mineral soil surface, an organic-carbon content (Holocene age) of 0.8 percent or more; or an irregular decrease in organic-carbon content (Holocene age) between 25-125 cm depths below the mineral soil surface or to a root restrictive contact, whichever is shallower.
Fluviperaqs

Other Peraqs.

Haploperaqs

Vertaqs: Key to the Great Groups

Vertaqs that have within 100 cm of the mineral soil surface *either*: 1. A sulfuric horizon; *or* 2. Sulfidic materials.
Sulfivertaq

Other Vertaqs that have a salic horizon within 100 cm of the mineral soil surface.
Salivertaq

Other Vertaqs that have a duripan within 100 cm of the mineral soil surface.
Duravertaq

Other Vertaqs that have a natric horizon within 100 cm of the mineral soil surface.
Natravertaq

Other Vertaqs that have a calcic horizon within 100 cm of the mineral soil surface.
Calcivertaq

Other Vertaqs that have, throughout one or more horizons with a total thickness of 25 cm or more within 50 cm of the mineral soil surface, *both*: 1. An electrical conductivity in the saturation extract of less than 4.0 dS/m at 25 °C; and 2. A pH value of 4.5 or less in 0.01 M CaCl₂ (5.0 or less in 1:1 water).

Dystravertaqs

Other Vertaqs that have episaturation.

Epivertaqs

Other Vertaqs.

Endovertaqs

Mollaqs: Key to the Great Groups

Mollaqs that have a histic epipedon or at least 20 kg m² soil organic carbon in the upper 100 cm, or both.

Humimollaqs

Other Mollaqs that have a duripan within 100 cm of the mineral soil surface.

Durimollaqs

Other Mollaqs that have a natric horizon.

Natramollaqs

Other Mollaqs that have an argillic horizon.

Argimollaqs

Other Mollaqs that have a calcic horizon within 100 cm of the mineral soil surface.

Calcimollaqs

Other Mollaqs that have less than 35 percent (by volume) rock fragments and a texture class of loamy fine sand or coarser in all layers within the particle-size control section.

Psammimollaqs

Other Mollaqs that have at a depth of 125 cm below the mineral soil surface, and an organic-carbon content (Holocene age) of 0.6 percent or more; or an irregular decrease in organic-carbon content (Holocene age) between 25-125 cm depths below the mineral soil surface.

Fluvimollaqs

Mollaqs that have episaturation.

Epimollaqs

Other Mollaqs.

Endomollaqs

Spodaqs: Key to the Great Groups

Spodaqs that have a histic or umbric epipedon or have at least 20 kg/m² organic carbon in the upper meter.

Humispodaqs

Other Spodaqs that have less than 0.10 percent iron (by ammonium oxalate) or at least 3 times as much ammonium oxalate extractable aluminum as iron in 75 percent or more of the spodic horizon.

Alaspodaqs

Other Spodaqs that have a fragipan within 100 cm of the mineral soil surface.

Fragispodaqs

Other Spodaqs that have a placic horizon within 100 cm of the mineral soil surface.

Placispodaqs

Other Spodaqs that have an ortstein within 100 cm of the mineral soil surface.

Petraspodaqs

Other Spodaqs that have episaturation.

Epispodaqs

Other Spodaqs.

Endospodaqs

Humaqs: Key to the Great Groups

Humaqs that have a melanic epipedon.

Melanihumaqs

Other Humaqs that have an umbric epipedon.

Umbrihumaqs

Other Humaqs that have a histic epipedon.

Histohumaqs

Other Humaqs that have an argillic horizon.

Argihumaqs

Other Humaqs that have less than 35 percent (by volume) rock fragments and a texture class of loamy fine sand or coarser in all layers within the particle-size control section and don't have a spodic horizon.

Psammihumaqs

Other Humaqs that have at a depth of 125 cm below the mineral soil surface, and an organic-carbon content (Holocene age) of 0.6 percent or more; or an irregular decrease in organic-carbon content (Holocene age) between 25-125 cm depths below the mineral soil surface.

Fluvihumaqs

Other Humaqs that have episaturation.

Epihumaqs

Other Humaqs.

Endohumaqs

Argaqs: Key to the Great Groups

Argaqs that have an abrupt textural change between the ochric epipedon or albic horizon and the argillic or kandic horizon *and* have a saturated hydraulic conductivity of 0.4 cm/hr (1.0 $\mu\text{m}/\text{sec}$) or slower (moderately low or lower Ksat class) in the argillic or kandic horizon..

Albargaqs

Other Argaqs that have a fragipan within 100 cm of the mineral soil surface.

Fragiargaqs

Other Argaqs that have a natric horizon within 150 cm of the mineral soil surface.

Natrargaqs

Other Argaqs that have a kandic horizon with less than a 20% decrease in clay from clay maximum within 150 cm of the mineral soil surface.

Kandiargaqs

Other Argaqs that have a kandic horizon.

Kanhaplargaqs

Other Argaqs that have an argillic horizon

Paleargaqs

Other Argaqs that have episaturation.

Epiargaqs

Other Argaqs.

Endoargaqs

Psammaqs Key to the Great Groups

Psammaqs that have: One or both of the following: 1. At a depth of 125 cm below the mineral soil surface, an organic-carbon content (Holocene age) of 0.6 percent or more and no root restrictive contact within that depth; or 2. An irregular decrease in organic-carbon content (Holocene age) between a depth of 25 cm and either a depth of 125 cm below the mineral soil surface or a root restrictive contact, whichever is shallower.

Fluvipsammaqs

Other Psammaqs have, in the 0.02 to 2.0 mm fraction within the particle-size control section, a total of more than 90 percent (by weighted average) resistant minerals.

Quartzipsammaqs

Other Psammaqs that have episaturation.

Epipsammaqs

Other Psammaqs

Endopsammaqs

Andaqs: Key to Great Groups

Andaqs that have in half or more of each pedon, a placic horizon within 100 cm of the mineral soil surface or of the top of an organic layer with andic soil properties, whichever is shallower.

Placandaqs

Other Andaqs that have, in 75 percent or more of each pedon, a coherent, pedogenically cemented horizon within 100 cm of the mineral soil surface or of the top of an organic layer with andic soil properties, whichever is shallower.

Petrandaqs

Other Andaqs that have a 1500 kPa water retention of less than 15 percent on air-dried samples and less than 30 percent on undried samples throughout 60 percent or more of the thickness either: 1. Within 60 cm of the mineral soil surface or of the top of an organic layer with andic soil properties, whichever is shallower, if there is no root restrictive contact within that depth; or 2. Between the mineral soil surface or the top of an organic layer with andic soil properties, whichever is shallower, and a root restrictive contact.

Vitrandaqs

Other Andaqs that have episaturation.

Epiandaqs

Other Andaqs.

Endoandaqs

Oxaqs: Key to the Great Groups

Oxaqs that have, in one or more subhorizons of an oxic or kandic horizon within 150 cm of the mineral soil surface, an apparent ECEC of less than 1.50 cmol(+) per kg clay and a pH value (1N KCl) of 5.0 or more.

Acroxaqs

Other Oxaqs that have plinthite forming a continuous phase* within 125 cm of the mineral soil surface.

Plinthoxaqs

Other Oxaqs that have a base saturation (by NH₄OAc) of 35 percent or more in all horizons within 125 cm of the mineral soil surface.

Eutroxaqs

Other Oxaqs that have episaturation

Epioxaqs

Other Oxaqs.

Endoxaqs

Orthaqs: Key to the Great Groups

Orthaqs that have: 1. A salic horizon; or 2. In one or more horizons with a total thickness of 25 cm or more within 50 cm of the mineral soil surface, an exchangeable sodium percentage (ESP) of 15 or more (or a sodium adsorption ratio [SAR] of 13 or more) and a decrease in ESP (or SAR) values with increasing depth below 50 cm.

Halorthaqs

Other Orthaqs that have combined surface horizons that are at least 15 cm thick and that meet all the criteria for histic, melanic, mollic, or umbric epipedon.

Humorthaqs

Other Orthaqs that have one or both of the following: 1. At a depth of 125 cm below the mineral soil surface, an organic-carbon content (Holocene age) of 0.6 percent or more and no root restrictive contact within that depth; or 2. An irregular decrease in organic-carbon content (Holocene age) between a depth of 25 cm and either a depth of 125 cm below the mineral soil surface or a root restrictive contact, whichever is shallower.

Fluviorthaqs

Other Orthaqs that have episaturation.

Epiorthaqs

Other Orthaqs.

Endorthaqs