DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

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(Table 2 of 3B)

TABLE 2. Physical Properties and Engineering Characteristics of Weathered Materials on Sedimentary Bedrock, Fairfax County, Virginia

Surface Materials Map Unit	Surface Materials Map Symbol	Bedrock Map Symbol	Parent Bedrock and Structure	Weathering Profile	Unified Soil Classification of Residuum [1]	Total Unit Weight (kilograms force per cubic meter)	Drainage and Natural Moisture Characteristics		Suitability as Compacted Material	Excavation Properties	Erodibility	Shear Strength and Compressibility Characteristics	Allowable Bearing Pressure (kilograms force per square centimeter)	Slope Stability	Road Performance Characteristics
							Surface Drainage	Internal Drainage and Natural Moisture							
Conglomerate	7a	S3	Consists of gray to reddish-brown thin- to thick-bedded (1.3 cm-5m) conglomerate, sandstone, siltstone, and shale. Bedding generally obscure and joints widely spread. Conglomerate (rock type) occasionally has boulders of quartz, quartzite, and schist with diameters up to 25 cm, rounded to angular. Boulders and large gravels can locally make up to 30 percent of total rock volume, and still be completely encased in matrix. Matrix is typically a friable silty sand, cemented with silica, iron oxides, and minor amounts of clay. Can have some calcite cement.	Residuum typically is massive with no or few joints and parting planes, and is normally gravelly, sandy, and silty. Hard quartz and quartzite boulders and cobbles are occasionally encased in a weaker, friable matrix of medium to stiff consistency to depths of at least 7 m. Schist boulders are commonly weaker than the matrix. The contact between zones weathered to different degrees can be rather irregular. Depth of weathered material above unweathered rock varies from 0-10 m, averaging about 3 m. Commonly disaggregated, loose, and friable at the surface, gradually becoming more rock-like at depth; locally indurated ledges at surface.	SP,SM,CM, CP,ML	1900 and higher, generally increasing with depth to unweathered rock.	Usually well drained, locally poorly drained.	Permeability generally low, and natural moisture content usually near plastic limit in residuum.	Good source of fill at localized sites; however, some facies have boulders or highly micaceous silty residuum. Compaction of highly micaceous soil very sensitive to moisture content.	Residuum easy with light power equipment; weathered rock can be difficult to excavate with power equipment.	Silty and micaceous facies are highly susceptible, especially when remolded. Weathered and unweathered rock may be susceptible to ravveling.	Medium to stronger consistency. Effective friction angle generally greater than 25 degrees. Micaceous silts can be highly compressible, and behave much as saprolite in Piedmont rocks. Erratic boulders along eastern margin can make conventional sampling impossible.	1 or greater for shallow footings above unweathered rock.	Temporary vertical excavations generally stable to depths at least 2.7-3 m. Residuum and weathered rock stable on slopes less than about 35 degrees. Unweathered rock stable at much steeper angles.	Micaceous silts can have very low support values and are susceptible to frost heaving and weakening, but surface and internal drainage usually sufficient to prevent serious problems. Residuum generally amenable to cement stabilization.
Sandstone	7b	S2	Consists of interbedded gray, pink, and reddish-brown arkosic sandstone, conglomerate, siltstone, and shale, thin- to thick-bedded (0.6 cm-5 m), generally in well defined beds. The beds of siltstone and shale are 2.5 cm to 0.3 m thick. Occasionally intensely fractured and jointed. Most joints steep to vertical, with partings parallel to bedding at contrasting rock types. Arkose is fine- to coarse-grained, locally conglomeratic; commonly has 1 to 5 percent mica, with interlocking grains of quartz and feldspar cemented with iron oxides and silica, locally with calcite cement.	Typically forms dominantly sandy and silty residuum, with some clay-rich beds. Residuum may have only a few more fractures and parting planes than the parent rock, or be much more intensely fractured. Weathered rock has larger, stronger pieces of hard rock, yet retains original structures (joints, fractures, and bedding) of parent bedrock; typically has thin open voids between pieces of broken rock. Depth of residuum ranges between 0-5 m, and depth to unweathered rock is 0-7 m. Average depth of weathering about 1.7 m, and usually not highly variable at a given site. Slightly weathered strata can overlie highly weathered layers.	SP,SM,SC, (ML,CL)	2000 and higher, generally increasing with depth to unweathered rock.	Well to poorly drained, depending primarily on topographic setting.	Weathered rock commonly more permeable than residuum and unweathered rock, forming zone of water accumulation in weathered rock; commonly saturated in weathered rock zone after wet period, causing perched water table near surface. Permeability of weathered rock normally low to medium. Unweathered rock occasionally highly fractured, with high permeability.	Locally good source of fill, where very sandy facies predominate.	Same as above.	Fine-grained facies very susceptible where unweathered and weathered rock exposed. Weathered and unweathered rock may be susceptible to rapid breakdown into many small chips; can occasionally erode soil along joints and parting planes, making tubes with diameters up to 10cm.	Medium to stronger consistency. Effective friction angle generally greater than 25 degrees, except for very fine-grained facies. Residuum not highly compressible.	1 or greater for shallow footings above unweathered rock; commonly much higher. Should investigate for erosion tubes, which can undermine structures.	Temporary vertical excavations generally stable to depths of at least 2.7-3 m. Permanent long slopes in residuum and weathered rock stable at slopes less than about 35 degrees. Permanent long slopes on unweathered rock stable on slopes of 35 degrees or less, unless in massive sandstone with no siltstone or shale layers; siltstone and shale layers can weaken and erode, undermining sandstone. Massive unweathered sandstone stable at 60 degrees or steeper.	Perched water near ground surface and silty soils make subgrade susceptible to adverse frost weakening and pumping. Very silty soils sometimes amenable to cement stabilization.
Siltstone and Shale	7c	S1	Consists dominantly of reddish-brown laminated mudstone, with lesser amounts slightly fissile shale, interbedded with siltsone and fine-grained sandstone. Well bedded in thin to medium layers, 0.6 cm-1m thick. Commonly intensely jointed, with joints as close as a fraction of a cm to 8 cm apart. One parting set usually parallel to bedding, joints steeply dipping. High angle joints commonly at several orientations at a given site. Usually has calcite as cementing agent, as vug and vein fillings, and locally in layers; may locally cement joints.	Residuum can range gradationally from massive plastic clay to a mass almost entirely of weak, small rectangular clayey chips, 0.1-0.15cm thick, with irregular, subangular, blocky structures. Residuum can also have flaggy fragments, little altered from the parent bedrock. The residuum can be as much as 1.7m thick, with a consistency ranging from soft to medium and stronger. Beneath the residuum the rock fragments are larger and stronger, and irregularly fractured, but also with the same structures (joints, fractures, and bedding) as underlying fresh rock. Thin, open voids are commonly between the rock fragments. The weathering profile rarely exceeds 7m in depth, commonly ranging from 1-2.3m. Depth of weathering usually not highly variable at a given site, but slightly weathered strata can overlie highly weathered layers.	ML,MH,CL, CH,SM,SC, (SP)	1150 and higher, generally increasing with depth to unweathered rock.	Commonly poorly drained.	Permeability low; tends to pond water near surface.	Commonly good, except where highly plastic clay. Possibility that weathered and unweathered material will slake and continue to weaken after compacted in fill. Materials that slake should not be used as backfill for utility excavations, because of tendency to settle upon softening.	Same as above.	High clay content usually prevents extreme erosion problems. Both weathered and unweathered rock may soften and weaken where exposed, during life span of normal structures.	Clays soft to stiff, silts generally stronger than clays. Effective friction angle probably greater than 20 degrees, even for clays. Plastic soils can be highly compressible.	1 or greater for shallow footings above unweathered rock; swelling soils may require footings be buried deeper than 1.3-1.7m.	Temporary vertical excavations generally stable to depths of at least 2m. Permanent slopes in residuum and weathered rock stable on slopes of 25 degrees or less. Unweathered rock stable on slopes of 35 degrees or less, depending on jointing intensity; steeper slopes may fail as siltstone and shale deteriorate.	Same as above, except generally not as susceptible to adverse frost weakening and pumping. CBR values of clays can be very low.

[1] Soils in parentheses are present in secondary amounts.