Map Unit Properties Table

Age	Unit Name (Symbol)	Features and Description	Erosion Resistance	Suitability for Development	Hazards	Paleontological Resources	Cultural Resources	Mineral Occurrence	Habitat	Recreation	Geologic Significance
QUATERNARY (Pleistocene–Holocene)	Alluvium & Terrace (Qat)	Silt, sand & gravel. Thickness: 0- 15 m (0- 50 ft).	Low, especially during floods	Floodplain deposit	Flooding	None	Ancient campsites; potential Native American & pioneer sites; sites buried in floodplain?	Sand & gravel	Riparian habitat & wetlands vegetation (cottonwoods, sedges, reeds, iris)	Hiking trails (Fossil Hills Tr & Devil's Corkscrew Tr); bird watching; Niobrara River	Niobrara River continues to carve its Holocene terrace
TERTIARY (Miocene)	Unconformity										
	Ogallala Group Runningwater Formation (Trw)	Non- marine light buff to orange sand, massive, often with local zones of carbonate cementation, & occasional lenses of crystalline gravel, sand & silt of fluvial origin. Thickness: 107 m (350 ft).	Moderate; mapped in the uplands N. of the Monument	Limited exposures in the monument	None documented	CARNIVORA: Procyonidae: *Edaphocyon*, *Bassariscus*. Canidae: *Pblaocyon, Cynarctoides*, *Tomarctus*, *Leptocyon*. Amphicyonidae: *Daphoenodon*, *Cynelos, Amphicyon*. Ursidae: *Cephalogale*. Mustelidae: *Potamotherium, Brachypsalis*, *Leptarctus, Oligobunis*. PERISSODACTYLA: Rhinocerotidae: *Menoceras*. *Chalicotheriidae*. *Tapiridae*. Equidae: *Parahippus pawniensis, Parahippus cognatus, Archaeohippus*, *anchitheres*. ARTIODACTYLA: Tayassuidae: *Desmathyus*. Anthracotheriidae: *Arretotherium*. Entelodontidae: *Dinohyus*. Moschidae: *Blastomeryx sp*. Dromonerycidae: *Aletomeryx, Barbouromeryx*. Oreodonts: *Merycochoerus*.	None documented; potential Native American & pioneer sites	None documented	Mixed grass prairie (western, slender, & crested wheat grasses; Blue grama grass; threadleaf sedge; needle & thread grass); cacti; cheat grass	Mapped N of Monument	World renown vertebrate fossils; much less pyroclastic debris than in formations of the Arikaree Group
	Unconformity										
	Arikaree Group Upper Harrison beds (now recognized as the informal "Anderson Ranch Fm.") (Thu)	Non- marine light gray to light brown fine sand & silt of pyroclastic origin, massive in its upper part within the monument area, & in its lower part often reworked by fluvial & aeolian processes into horizontally laminated & cross- stratified deposits, with buff to white lenses rich in mammalian fossils filling the base of local channels. Includes local dense freshwater limestones (Agate Limestone), volcanic ash & lithic pebble conglomerate. Locally, contains a prominent silica-cemented land surface (Agate paleosurface) at or near its top that is extensively burrowed & rich in root casts. Thickness: 90 m (300 ft).	Relatively high; forms resistant cliffs and flat-topped ridges	Hills of Thu contain fossil quarries; also exposed as narrow ridges	Potential rockfall	CARNIVORA: Canidae: *Pblaocyon, Cynarctoides*, *Tomarctus*. Amphicyonidae: *Daphoenodon, Ysengrinia, Cynelos,* temnocyonines. Ursidae: *Cephalogale*. Mustelidae: *Oligobunis, Promartes, Megalictis*. PERISSODACTYLA: Rhinocerotidae: *Menoceras, Diceratherium*. Chalicotheriidae. Tapiridae. Equidae: *Parahippus nebrascensis, Parahippus wyomingensis*, anchitheres. ARTIODACTYLA: Tayassuidae: *Cynorca, Desmathyus*. Hypertragulidae: *Nanotragulus*. Entelodontidae: *Daeondon* (*Dinohyus*). Protoceratidae: *Syndyoceras*. Camelidae: *Stenomylus*. Moschidae: *Blastomerys advena, Blastomerys alcotti*. Oreodonts: *Promerycochoerus, Merycochoerus*. FALCONIFORMES: *Buteo ales* GALIFORMES: *Boreortalis tantala, Palaealectoris incertus*, CHARADRIIFORMES: *Paractiornis perpusillus* Accipitridae indeterminate: *Palaeastur atavus*	Unknown	Agates	Plants that tolerate dry, rocky conditions (little blue stem grass, threadleaf sedge, sandhills muley & tufted milk vetch); also 3 species of cacti along rocky bluffs & trails (brittle, prickly pear, & ball cactus); 64 lichen species	Hiking trails lead to fossil quarries	World renown vertebrate fossils; University Hill & Carnegie Hill quarries
	Unconformity										

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TERTIARY (Miocene)	Arikaree Group Harrison Fm. (Th)	Non- marine gray to dark gray fine sand of pyroclastic origin, massive, but locally reworked by fluvial & aeolian processes into horizontally laminated & cross- stratified deposits, & including throughout the monument the Agate Ash (KS 48). Combined thickness of Harrison, Monroe Creek, & Gering Formations: 30- 120 m (100- 400 ft) (Thaa = Agate Ash).	Relatively high due to stabilization by plant roots; low if disturbed	Forms gentle, grassy slopes probably suitable for development	None documented	CARNIVORA: Procyonidae: *Zodiolestes*. Canidae: *Pblaocyon*, *Tomarctus*, *Leptocyon*. Amphicyonidae: *Daphoenodon*, temnocyonines. Mustelidae: *Oligobunis*, *Promartes*. PERISSODACTYLA: Rhinocerotidae: *Menoceras?*, *Diceratherium*. Chalicotheriidae. Tapiridae. Equidae: *Parahippus wyomingensis*, anchitheres. ARTIODACTYLA: Tayassuidae: *Desmathyus*. Hypertragulidae: *Nanotragulus*. Entelodontidae: *Dinohyus*. Protoceratidae: Syndyoceras, Protoceras. Camelidae: *Stenomylus*. Oreodonts: *Promerycochoerus*. *Paleocastor* & *Daemonelix* burrows.	Potential Native American & pioneer sites; possible artifacts from Cook Ranch	None documented	Mixed grass prairie (western, slender, & crested wheat grasses; Blue grama grass; threadleaf sedge; needle & thread grass); cacti; cheat grass	Hiking trails; bird watching	World renown verbetrate fossils; *Stenomylus* Quarry; *Paleocastor* fossils & *Daemonelix* burrows
	Arikaree Group Monroe Creek Fm.	Gray, brownish- gray, & grayish brown volcaniclastic silty very fine- grained sandstones; carbonate- cemented horizons common; often mapped with Harrison Fm.	Low	Not exposed in Monument	Not exposed in Monument	Not exposed in Monument	Not exposed in Monument	Not exposed in Monument	Not exposed in Monument	Not exposed in Monument	Air- fall & wind blown detritus; originally deposited on low relief topography
TERTIARY (Oligocene)	Arikaree Group Gering Fm.	Gray, brownish- gray, & grayish brown volcaniclastic fine- to medium- grained sandstones, silty sandstones, brown sandy silts, & local beds of ash, coarse sand, & fine gravel.	Low	Not exposed in Monument	Not exposed in Monument	Not exposed in Monument	Not exposed in Monument	Not exposed in Monument	Not exposed in Monument	Not exposed in Monument	Fills paleovalleys
	Unconformity										
	Arikaree Group Unnamed Lithic Unit (now known as the Sharps Fm) (Tl)	Non- marine light orange to light brown sand & silt of pyroclastic origin, massive, with frequent small vertically oriented carbonate concretions scattered throughout the unit. Thickness: unknown.	Moderate; exposed on upthrown block of normal fault	Limited exposures in monument – SE part of map	None documented	None documented in monument; vertebrate fossils have been discovered in the Sharps Fm. outside Agate Fossil Beds NM	None documented	None documented	Limited exposures	Limited exposures	Pyroclastic eolian deposits; ash- fall from volcanic eruptions as far away as the Great Basin
	White River Group Brule Formation	Brown Siltstone beds: brown volcaniclastic sandy siltstones & silty very fine- grained sandstones; local mudstones; correlative zone of ash beds in lower part. Whitney Mbr: brown volcaniclastic siltstones; local mudstones & fine- to medium- grained sandstones; two regionally correlative ash beds Orella Mbr: brown to greenish- gray volcaniclastic mudstones & siltstones; upper part has fine- to medium- grained sandstones & thinly bedded mudstones; regionally correlative ash bed in lower part.	Low; mudst. & siltstones less resistant than sandstones	Not exposed in Monument	Not exposed in Monument	Not exposed in Monument	Not exposed in Monument	Not exposed in Monument	Not exposed in Monument	Not exposed in Monument	West- east trending paleovalley fill deposit
	White River Group Chadron Formation	Gray & greenish- gray bentonitic claystones & mudstones; fine- to coarse- grained sandstones & local conglomerates underlie the claystones- mudstones. Combined thickness of Brule Fm. & Chadron Fm.: 170- 180 m (550- 600 ft)	Low; mudst less resistant than sandstones	Not exposed in Monument	Not exposed in Monument	Not exposed in Monument	Not exposed in Monument	Not exposed in Monument	Not exposed in Monument	Not exposed in Monument	Fills complex pattern of paleovalleys
	Unconformity										
CRETACEOUS	Pierre Shale Fm.	Black & gray clay shale with thin sandstone beds in upper part. Thickness: 760+ m (2500+ ft).	Low	Not exposed in Monument	Not exposed in Monument	Not exposed in the monument; marine invertebrate (clam) fossils & fish scales are known in the Pierre Shale outside Agate Fossil Beds NM	Not exposed in Monument	Not exposed in Monument	Not exposed in Monument	Not exposed in Monument	Remnants of marine environments within the Cretaceous Western Interior Seaway