

Map Unit Properties Table

Age	Map Unit (Symbol)	Unit Description	Erosion Resistance	Suitability for Development	Hazards	Paleontologic Resources	Cultural Resources	Mineral Specimens	Karst Issues	Mineral Resources	Habitat	Recreation	Global Significance
QUATERNARY	Alluvium (Qal); talus and high angle colluvial cones (Qt); landslides (Qls); Bonneville beach gravels (Qbg); Moraines (Qm)	Alluvial cones extend valleyward from the mouths of canyons feeding into American Fork Canyon. Deposits are angular, poorly stratified and often 10's of meters thick. Alluvium is a thin veneer of gravel, sand, silt and clay in gullies and as low cones and fans. Individual gravel are sub- angular and not well- sorted. Landslides of debris derived form Manning Shale are common in American Fork Canyon. Deposits include blocks and slump deposits, unsorted in an assortment of rock sizes in lobe- shaped bulges. Bonneville beach deposits are comprised of gravel, sand, silt and clay with some precipitates locally. Some are crossbedded, sorted sand and finer grained sediments of the deeper water facies. The glacial moraine deposits are composed of a jumbled assortment of rock sizes ranging from clay to boulder-sized particles in ridges and irregular shaped masses. Drapes of fine- grained glacial dust occur at high altitudes.	Low	Unconsolidated deposits could fail if water saturated and should be avoided for waste facilities and large structures, especially if slope is present.	Slump and sliding hazards, flash flood deposits	Packrat middens	May contain Native American artifacts and campsites	None	None	Gravel, sand, silt, clay deposits	Valley fill in area	Good for all uses unless slope is present to create unstable, unconsolidated surface	Bonneville beach deposits record levels of glacial Lake Bonneville in regionally correlative terraces
TERTIARY	Tibble Fork Formation (Tt)	Unit ranges in thickness between 0 and 762 m (0- 2500 ft). Comprised of fluvial pebble to boulder conglomerate. Larger boulders are well rounded and consist of gray to red andesite or latite. Smaller fragments are generally sedimentary rocks including quartz, limestone, brown-weathered rock and red sandstone. Some sandy to shaly greenish- gray to reddish-brown tuffaceous sediments occur locally as interbeds along with white algal limestone. Formation dips 20 to 40 degrees in TICA area.	Moderate to high	Should be suitable for most uses unless severely weathered, weathered volcanic beds may contain shrink- and- swell clays which will cause construction problems with roads and structures	Shaly layers may fail on slopes causing rockfall and landslide hazards, plucking of boulders from conglomeratic beds may cause rockfall hazard	Smooth ostracodes in limestone beds	None	None	Not enough carbonate rocks present to pose a karst problem	None documented	Plucked stones on cliff faces way provide bird nesting habitat	Good for all uses, climbing, and trails	Thick Tertiary deposits recording life after K- T extinction event
	Quartz monzonite of Little Cottonwood Stock (qm)	Part of the Little Cottonwood stock intrusive mass. Unit is quartz monzonite with phenocrysts of potassium feldspar in a medium- grained groundmass of plagioclase, quartz and orthoclase with some biotite and hornblende.	Moderate to high	Unit is exposed northeast of TICA and should be suitable for most development.	Rockfall hazard is high for this unit because of its proximity to the Deer Creek fault, rendering it highly fractured	None	None	Phenocrysts of potassium feldspar 7.6 cm (3 in) long	None	Rich in potassium and other alkali elements	None documented	Attractive for climbers	Rb/Sr date of 30.5 +/- 0.6 Ma (Oligocene in age), unit is component of Wasatch Igneous Belt
PERMIAN	Park City Formation (PNpc)	Only lowermost member is exposed and is 137 m (450 ft) thick in TICA area. Unit consists of thin- to medium- bedded fossiliferous limestone and some interbedded sandstone and a phosphatic shale.	Moderate	Unit is exposed northeast of TICA and should be suitable for most development except on phosphatic shale middle beds	Slumping and sliding hazards within shale beds, rockfall is possible for weathered and deformed beds in this unit	Permian age fossils abundant	None	Fossils	Karst potential exists for this unit	Phosphatic shale beds	Vugs on cliff could provide nesting habitat	Good for most uses except on shale beds	Permian in age, records life prior to mass extinction event

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PENNSYLVANIAN	Oquirrh Group (Po); Bridal Veil Falls Limestone (Pob)	Unit is more than 1219 m (4000 ft) thick in TICA area, in Oquirrh Mountains it reaches a maximum thickness of 7900 m (26000 ft). Unit is composed of thin- to thick- bedded, fine- to medium- grained sandstone and quartzite. Unit is slightly calcareous and weathers to tan. Sandstones are interlayered with gray limestone, which lends a banded appearance to the unit. Sandstones are tabular crossbedded. Near the bottom of the unit is the medium- to dark- gray limestone called the Bridal Veil Falls Limestone. This member contains abundant fossils and chert beds and nodules.	Moderate	Unit is only exposed on the uppermost slopes of Mount Timpanogos and Box Elder Peak, however it should be competent for most forms of development unless highly fractured or weathered.	Rockfall hazard if rock is highly jointed or dissolved. Some shale layers may prove incompetent if highly weathered.	Early Pennsylvanian age fossils in conjunction with assorted fusulinids such as <i>Millerella</i> sp.	Chert nodules could have provided tool material	Fossils	Karst potential exists for this unit	None documented	Vugs on cliff could provide nesting habitat	Good for most uses, weathered surfaces could prove hazardous for rock climbing.	Unique, thick banded member prominent in region, Pennsylvanian age fossils
PENNSYLVANIAN - MISSISSIPPIAN	Manning Canyon Shale (PMmc)	Maximum thickness of unit in area is 488 m (1600 ft). Unit is poorly exposed in TICA area, composed of brown to black shale interbedded with fine- grained and gritty, commonly light- brown weathering, quartztic sandstone and gray to black, generally shaly limestone. Some lenses of orange- brown- weathering sugary sandstone and grit occur locally.	Low	Rock weathers easily making it a poor foundation base for structures and most permanent development, especially if a slope is present	Slumping and sliding hazards exist for this unit on slopes and/or if water saturated	Brown shale contains fossil plants. Abundant marine fossils including: <i>Posidonia</i> cf. <i>P. wapanuckensis</i> , <i>Cravenoceras</i> , <i>Eumorphoceras</i> cf. <i>E. bisulcatum</i> , <i>Rayonnoceras</i> cf. <i>R. solidiforme</i> <i>Croneis</i> .	None	Fossils	Not enough carbonate rocks present to pose a karst problem	None documented	Burrowing material if highly weathered, forms gentle slopes in canyons for plant and animal habitat	Not stable	Contains boundary between Upper Mississippian and Pennsylvanian ages near middle of unit
MISSISSIPPIAN	Great Blue Limestone (Mgb)	Unit is 853 m (2800 ft) thick, informally divided into three parts: lower and upper limestone members, separated by carbonaceous shaly beds (Long Trail shale member). Unit is composed of nearly homogenous, calcitic, dark gray to black limestone and shaly limestone. Bedding is very regular and weathers to light- gray to pinkish- tan flaky, slabby rock. Some black chert nodules occur locally as well as some black shale and rusty weathering fine- grained quartzite.	Moderate	Suitable for most development unless significant dissolution or weathering has occurred. Weathered rock sloughs and flakes and is unstable for permanent structures. Dissolution can pose a problem with waste facilities	Rockfall hazard where unit is weathered and on a slope, can be unstable trail base if severely weathered or dissolved.	Late Mississippian age fossils	Chert nodules could have provided tool material	None	Karst potential exists for this unit	None documented	Vugs on cliff could provide nesting habitat	Good for most uses, weathered surfaces could prove hazardous for rock climbing.	Type locality in the Oquirrh Mountains
MISSISSIPPIAN	Humbug Formation (Mh)	Unit is more than 244 m (800 ft) thick in TICA area. Composed of interbanded dark to light- gray, fine- to coarse- grained dolomite with fine- to medium- grained limey sandstone. Unit appears banded with brown beds layered with gray beds.	Moderate	Good for all development unless highly fractured, which could pose a problem with waste facilities	Rockfall hazard on cliff faces	sparingly fossiliferous in limestone beds	None	None	Karst potential exists for this unit	Attractive building stone	Vugs and ledges on cliffs could provide nesting habitat	Rock climbing and Mountain biking. Good for all uses	Distinct banded unit

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MISSISSIPPIAN	Deseret Limestone (Md)	The unit is more than 152 m (500 ft) thick. Unit is a massive to medium- bedded, cliff and cave- forming unit with dark- to light- blue- gray, fine- to coarse- grained dolomite with abundant lenticular, or lens- like, black chert deposits and some interbedded limestone. Timpanogos Cave is contained in this unit.	Moderate to high	Dissolution can create conduits which pose a problem for waste facilities and severe dissolution can make construction on this unit risky	Rockfall on cliff faces, and assorted cave-related hazards such as slippery trails, holes, and sharp speleothems	Late Mississippian age brachiopods and corals, crinoid stems, cup corals and colonial corals.	Native Americans may have used the caves for ceremonial and other purposes, chert masses may have been tool material	Speleothems, fossils	Karst exists in this unit, caves present	None documented	Caves provide animal lion and other mammal habitat	Caving, climbing	Cave and cave formations (speleothems)
MISSISSIPPIAN	Gardison Limestone (Mg)	Unit is more than 183 m (600 ft) thick in monument area. Lower beds are dark-gray, thin- bedded, coarse- grained limestone and dolomite. Middle beds contain thin- bedded, blue- gray limestone with silty partings. Upper beds are dark-gray, massive limestone and dolomite. Light- brown to black, and white chert abundant locally. Carbonaceous shale marks top of unit.	Moderate to high	Shaly partings can render the unit unstable for foundations and other permanent facilities	Shaly partings can pose rockfall hazards	Fossils of <i>Triplophyllites</i> , <i>Syringopora</i> , <i>Spirifer centronatus</i> , <i>Triplophyllites excavatum</i> , <i>Cliothyridina</i> and <i>Aviculipecten</i> of Mississippian age.	Many chert nodules useful for ancient tools	Fossils	Some karst potential in carbonate beds	Locally uraniferous and phosphatic layers	Vugs on cliff could provide nesting habitat	Good for all uses	Mississippian fossils of Kinderhookian age
MISSISSIPPIAN	Fitchville Dolomite (Mf)	In the TICA area the unit is more than 152 m (500 ft) thick, composed of coarse, light- gray to tan dolomite and dolomitic sandstone with some pebbly layers. Upper beds are very fine- grained dolomite.	Low to moderate	Dissolution can create water conduit problems and dangerous trail base, but otherwise okay for all uses	Jointed sandstone beds can pose rockfall hazards on cliffs, crystal lined vugs are hazardous hand and foot holds	Mississippian age fossils	None	Crystal lined vugs	Karst potential exists for this unit	Flaggy lower beds are attractive flagstone material	Many vugs present for bird and small creature habitat	Rock climbing and caving potential	Mississippian fossils, records profound unconformity
CAMBRIAN	Maxfield Limestone (Cm)	Unit ranges in thickness between 0 and 91 m (0- 300 ft). Unit contains thin- to thick- bedded, blue- gray, mottled or speckled magnesian limestone and dolomite. Some oolitic and pisolithic lower beds and white dolomite upper beds	Moderate	Dissolution can create hazardous trail base and conduits not suitable for waste facilities.	Rockfall hazard potential	Fossils of trilobites <i>Kootenia</i> sp., <i>Doliochometopsis</i> sp., <i>Spencia</i> sp.	None	Fossils, pisolite layers	Karst potential exists for this unit	None documented	Vugs on cliff could provide nesting habitat	Rock climbing potential	Cambrian fossils
CAMBRIAN	Ophir Formation (Co)	Near TICA unit is 91 m (300 ft) thick. Lower beds are olive- green micaceous shale. Middle beds are massive gray limestone and upper beds are brown, calcareous sandstone mixed with shale.	Low	Micaceous shale can be unstable for structure foundations	Unit can be a crumbly trail base	worm tracks, fucoid markings, brachiopods and trilobites. Fossils of <i>Olenellus</i> , <i>Micromitra</i> , <i>Obolus</i>	None	Fossils	Middle beds may have dissolution	None documented	Vugs on cliff could provide nesting habitat	Good for trails	Cambrian fossils
CAMBRIAN	Tintic Quartzite (Ct)	Unit is 396 m (1300 ft) thick in TICA region in prevalent exposures. Unit is nearly pure quartz. Weathers to brown, white and tan with thin to thick beds (irregular). It is medium- to coarse- grained, white to pinkish on fresh surfaces with conglomeratic lower beds. Some pebbles are up to 5 cm (2 in) in diameter. Random crossbedding and shale stringers locally.	High	Good for all development unless highly fractured, which could pose a problem with waste facilities	Rockfall hazard along cliffs is prevalent where unit is undercut along trails	None	Chert pebbles may have been used for tools	Glassy quartzite	No carbonate rocks present	Attractive building stone	None documented	Good for all uses unless undercut on steep slopes. Mountain biking	Pure quartzite

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PRECAMBRIAN	Mutual Formation (pCm)	The unit ranges in thickness from 0 to 396 m (0- 1300 ft) in TICA area. Composed of quartzite grit and conglomerate with minor amounts of shale. Quartzite is rusty to red- purple with tan to gray sandstones. Fragments consist of schist, gneiss, limestone and tillite. Fragments can be up to 1.5 m (5 ft) in diameter.	Moderate to high	Shaly layers should be avoided, but otherwise all is suitable.	Plucking of pebbles on cliff faces may pose rockfall hazard	None	Chert pebbles may have been used for tools	None	No carbonate rocks present	Attractive building stone	None documented	Good for all uses, rock climbing potential	None documented
PRECAMBRIAN	Mineral Fork Tillite (pCmf)	Unit is 0- 61 m (0- 200 ft) thick in TICA area and is composed of rounded pebbles, cobbles, and boulders in a silty and sandy matrix with glacial flour acting as cement. Fragments consist of quartzite, algal limestone, dolomite, schist, greenstone, gneiss, granite, and amphibolite. Unit appears as a dark gray to black massive conglomerate to sandstone.	Moderate	Glacial flour cement may degrade and cause the unit to be friable locally. Okay for all development.	Plucking of pebbles and boulders along steep slopes may pose a rockfall hazard	Some fossil algae boulders	Chert pebbles may have been used for tools	Unusual ancient glacial till	No carbonate rocks present	None documented	Plucked stones on cliff faces way provide bird nesting habitat	Good for all uses	Unique ancient glacial deposit formation
PRECAMBRIAN	Big Cottonwood Formation (pCbc)	Unit has maximum thickness in TICA area of 396 m (1300 ft). Composed of massive quartzite and gray to dull- purple shale. Weathers to rusty- buff color.	Moderate to high	Especially shaly layers may pose a problem to construction and highly fractured areas should be avoided for development, otherwise all is suitable.	Rockfall hazard if present on cliff face	None	None	None	No carbonate rocks present	Attractive building stone	None documented	Good for all uses, rock climbing potential on cliffs	23165 m (76000 ft) thick type section at Big Cottonwood Canyon