Quaternary Geologic Map Unit Properties Table: Aniakchak National Monument and Preserve (see Plate 2)

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	Map Unit (Symbol)	Description	Features and Processes	Resource Management Issues	History
LANDFORMS AND SURFICIAL DEPOSITS	Holocene Dune deposits (**Qdu**)	Fine to medium sand and pumice.	Includes beach dunes along the heads of bays on the Pacific side, and dunes formed near the end of loose pyroclastic materials on the north side of Aniakchak volcano.	None reported	None reported
	Holocene Lacustrine deposits (**Ql**)	Silt and fine sand deposited in lake basins and locally sandy beach deposits.	**Glaciers and Glaciations**—Includes modern glacier moraine dammed lakes along the Meshik River, and lake deposits around Meshik Lake after the lake shrank.		
	Holocene Swamp deposits (**Qsw**)	Highly organic silt and clay.	Formed in bogs, locally forming quaking bogs, or bogs where floating vegetation forms along the perimeter.		Largely formed between glacial moraines of the Brooks Lake and Mak Hill drift deposits.
	Holocene Estuarine deposits (**Qes**)	Laminated silt and clay, with thin interbeds of fine sand; locally rich in organic material.	Estuaries along the Bristol Bay coast.	**Geohazards**—Tsunamis may inundate these deposits (and other low-lying coastal areas)	None reported
	Holocene Beach deposits (**Qb**)	Well-sorted and stratified sand and gravel.	**Beach Berms**—Beaches on the Bristol Bay side of the Alaska Peninsula are commonly made up of volcanic rocks and pumice; whereas, beaches on the Pacific side are made up of locally eroded bedrock, except where major rivers have carried volcanic material to the coast.		
	Holocene Alluvial deposits (**Qal**)	Poorly to moderately well sorted, non-stratified to well-stratified gravel and sand along streams and rivers.	Point bars, lateral bars, mid-channel bars, junction bars, and braidplains.	**Geohazards**—Flooding.	**Volcanic and Post-Glacial History**—Rivers have carried easily eroded loose volcanic material to the coast. Large alluvial fan deposits along the Aniakchak River and Albert Johnson Creek were formed during the caldera outburst flood.
	Alluvial fan deposits (**Qaf**)	Poorly sorted and poorly stratified gravel and cobbles near the heads of fans, to well-sorted and well-stratified sandy gravel near the toes of fans.	**Caldera Outburst Flood and its Deposits**—Large alluvial fans were formed near Albert Johnson Creek during the caldera outburst flood.		
	Alluvial terrace deposits (**Qt**)	Moderately sorted and stratified sandy gravel, locally containing cobbles and boulders. Terraces along modern and abandoned channels.	**Caldera Outburst Flood and its Deposits**—Downstream of The Gates, the Aniakchak River cuts through terraces that contain very coarse clasts and boulders indicative of large flood deposits	**Petroleum Development** and **Mineral Extraction**—Some of the subsurface rights owned by the Koniag Corporation allow extraction of construction materials. Alluvial terraces are good sources of gravel for roads and platforms.	**Volcanic and Post-Glacial history**—Terraces formed along modern and abandoned channels. Terraces downstream of The Gates contain large boulders and were formed during the caldera outburst flood.
	Abandoned channel deposits (**Qac**)	Moderately well-sorted stratified sand and gravel in channels fronting end moraines.	**Glaciers and Glaciations**—Abandoned channels left dry after glaciers receded. **Caldera Outburst Flood and its Deposits**—Ancient flood channel may have been the result of the outburst flood.	None reported	**Glacial History**—Associated with the end moraines of the Brooks Lake glaciation. **Volcanic and Post-Glacial History**—Caldera outburst flood created a second channel at Aniakchak Bay.
	Colluvium (**Qc**)	Coarse angular rubble.	Talus slopes and cones.	**Geohazards**—Rockfall, landslides, debris flows.	**Post-Glacial History**—Active geomorphic processes and volcanism created a dramatic but potentially dangerous landscape.

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	Map Unit (Symbol)	Description	Features and Processes	Resource Management Issues	History
LANDFORMS AND SURFICIAL DEPOSITS	Landslide deposits (**Qls**)	Large blocks and slides consisting of large angular unsorted, unstratified rubble.	Commonly derived from weakly consolidated Tertiary and Quaternary units.	**Geohazards**—Landslides occur when unconsolidated deposits or weakly consolidated bedrock form steep slopes, undercut by streams, or loosened by weathering or earthquakes.	**Volcanic and Post-Glacial History**—A large landslide at The Gates may have been the cause of the caldera outburst flood approximately1,800 years ago.
LANDFORMS AND SURFICIAL DEPOSITS	Marine terrace deposits (**Qmt**)	Well-sorted sand and gravel on raised marine terraces.	**Raised Marine Terraces—**Range from 28 to 30 m (92 to 98 ft) above sea level on the Pacific side and 15 m (49 ft) on the Bristol Bay side. On the Bristol Bay side, wave cut terraces extend as far as 38 km (24 mi) inland.	None reported	**Glacial and Post-Glacial History**—Raised marine terraces were formed primarily by isostatic rebound following the last glacial maximum; however, some of the uplift was probably due to tectonic flexing of the crust caused by subduction of the Pacific Plate.
VOLCANIC DEPOSITS	Volcanic rocks, undivided (**Qv**)	Flows and volcaniclastic rocks.	Forms the caldera walls.	**Geohazards**—Steep cliffs in the caldera and long its flanks are susceptible to landslides and rockfall during extended periods of precipitation or earthquakes.	Formed during eruptions of Aniakchak and Yantarni volcanos.
VOLCANIC DEPOSITS	Holocene Cinder and spatter cones (**Qcs**)	Cones formed from scoriaceous to vitrophyric cinder to bomb-sized volcanic rock.	**Post-Caldera Eruption Features**—Cinder cones in the Aniakchak Crater.	**Geohazards**—Represents past volcanic eruptions.	Formed after the approximately 3,600 cal. yr BP caldera forming Aniakchak II eruption.
VOLCANIC DEPOSITS	Holocene Ash-flow and ash-fall deposits (**Qafd**)	Stratified, welded and non-welded ash, pumice, and scoria. High-silica andesite and dacite.	**Aniakchak II, The Caldera Forming Eruption**—Extensive ash-flow and ash-fall deposits surrounding the Aniakchak and Yantarni volcanoes. **Nearby Holocene Volcanoes**—Yantarni	**Geohazards**—Ash-flow and ash-fall deposits are the most common and most extensive materials erupted from Aleutian volcanos. They can sterilize very large areas.	**Volcanic History**—Primarily Aniakchak II eruption deposits formed approximately 3,600 years ago. The Aniakchak II eruption formed an extensive ignimbrite sheet that extends to the coasts on both sides of the Alaska Peninsula. Also includes Yantarni Volcano deposits that are as young as 2,000 years old.
VOLCANIC DEPOSITS	Holocene Volcanic avalanche deposits (**Qva**)	Unconsolidated volcanic rock debris.	**Nearby Holocene Volcanoes—**Formed on the south rim of Yantarni Volcano and flowed south.	**Geohazards**—During volcanic eruptions, flanks of volcanos can collapse forming large avalanches (**Qva**), ice and snow can melt to form lahars (**Qmf**), and masses of material can flow from steep slopes (**Qdf**).	**Volcanic and Post-Glacial History**—Active geomorphic processes and volcanism created a dramatic but potentially dangerous landscape. **Qva** is coeval with the youngest (2,000 years ago) eruption. Yantarni Volcano dome (**Qd**) formed 2,000 to 3,500 years ago.
VOLCANIC DEPOSITS	Holocene Volcanic mudflow deposits (**Qmf**)	Volcanic mudflows, in part lahars. Unsorted, nonstratified ash and large angular debris. Well-indurated to poorly consolidated.	Mudflows in and on the south flanks of the Aniakchak Crater		
VOLCANIC DEPOSITS	Holocene Volcanic debris flow deposits (**Qdf**)	Coarse angular volcanic rock fragments in a matrix of ash, mud, and lava.	Debris flows on the south flanks of Aniakchak and Yantarni volcanoes.		
VOLCANIC DEPOSITS	Holocene Volcanic explosion debris (**Qed**)	Proximal deposits of angular to rounded volcanic bombs and scoria blown out during volcanic eruptions.	Volcanic debris on the flanks of Aniakchak and Yantarni volcanoes.		
VOLCANIC DEPOSITS	Volcanic domes (**Qd**)	High-silica andesite, dacite, and rhyolite domes.	Yantarni Volcano dome and a small dome on the northeast flank of Aniakchak volcano.	**Geohazards**—Volcanic eruptions.	
VOLCANIC DEPOSITS	Andesite plug domes (**Qanp**)	Dark-gray, fine- to coarse-grained hypabyssal andesite plugs and shallow intrusions.	Small dome on the south flank of Aniakchak volcano.		

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VOLCANIC DEPOSITS	Basalt and basaltic andesite flows (**Qba**)	Medium- to dark-gray basalt and basaltic andesite flows.	Flows on the west side of Yantarni Volcano.	**Geohazards**—Volcanic eruptions.	**Volcanic and Post-Glacial History**—Active geomorphic processes and volcanism created a dramatic but potentially dangerous landscape. **Qva** is coeval with the youngest (2,000 years ago) eruption. Yantarni Volcano dome (**Qd**) formed 2,000 to 3,500 years ago.
	Dacite flows (**Qda**)	Light- to medium-gray dacite flows.	Flows in and on the flanks of Aniakchak volcano.		
	Dacite plugs (**Qdap**)	Light- to dark-gray, medium- to coarse-grained hypabyssal dacite. Includes dikes and sills.	Dikes are harder to erode than softer marine sedimentary rocks, so they form prominent spires along the Pacific coast.		
GLACIAL DEPOSITS	Glacial lake deposits (**Qgl**)	Highly organic silt and clay, locally with stratified sand and pebbles near moraine fronts. Not mapped in Aniakchak National Monument and Preserve.	Left behind when lakes drained after moraines (acting as dams) eroded. Lake terraces extend 58 km (36 mi) along Dog Salmon River valley where the area is poorly drained and contains numerous small lakes, ponds, and quaking bogs.	**Geohazards**—Unconsolidated units are easily eroded and susceptible to landsliding when exposed on slopes or undercut by streams.	**Glacial History**—Brooks Lake glaciation deposits are Late Pleistocene in age. **Qbln** is approximately 11,000 years old. **Qblil** has a minimum age of between 20,000 and 16,500 years old. **Qblk** has a maximum age of approximately 30,400 years old.
	Pleistocene Brooks Lake glaciation undivided drift (**Qblu**)	Unsorted, unstratified, coarse to fine till.	Freshly to moderately weathered irregular knob and kettle topography.		
	Pleistocene Brooks Lake glaciation Newhalen Stade drift (**Qbln**)	Unsorted, unstratified, coarse to fine till; locally contains sorted and stratified ice-contact deposits. Not mapped in Aniakchak National Monument and Preserve.	Lightly eroded, well-developed arcuate end and lateral moraines with prominent knob and kettle topography.		
	Pleistocene Brooks Lake glaciation Iliamna Stade drift (**Qblil**)	Unsorted, unstratified, coarse to fine till; locally contains sorted and stratified ice-contact deposits.	Eroded and rounded large arcuate, lobate, end and lateral moraines. Knob and kettle topography considerably modified by mass wasting with many kettles partly filled.		
	Pleistocene Brooks Lake glaciation Kvichak Stade drift (**Qblk**)	Unsorted, unstratified, coarse to fine till; locally contains sorted and stratified ice-contact deposits.	Considerably weathered knob and kettle topography; many kettles are filled with sediment. Large arcuate, lobate, and rounded end moraines.		
	Pleistocene Brooks Lake glaciation outwash deposits (**Qblo**)	Moderately well-sorted sand and gravel.	Slightly eroded, flat and gently sloping plains in front of Brooks Lake glaciation end moraines. Outwash deposits accumulated where meltwater streams or rivers deposited moderately-sorted gravel and sand		
	Pleistocene Mak Hill glaciation drift (**Qmhd**)	Unsorted, unstratified, coarse to fine till. Sorted and stratified ice-contact deposits present in some beach-cliff exposures along Bristol Bay. Not mapped in Aniakchak National Monument and Preserve.	Highly weathered, rounded and flattened knobs. Kettle ponds mostly filled with sediment. Covered by marine terrace deposits and outwash from the Brooks Lake glaciation. End moraine is highly segmented.	**Geohazards**—Unconsolidated units are easily eroded and susceptible to landsliding when exposed on slopes or undercut by streams.	**Glacial History**—oldest glacial deposits are from the Mak Hill glaciation. Minimum age 43,000 to >47,000 years old.
	Pleistocene Mak Hill glaciation outwash deposits (**Qmho**)	Moderately well-sorted, stratified, consolidated sandy gravel.	Eroded and segmented deposits of flat and sloping plains in front of the Mak Hill end moraine. Outwash deposits accumulated where meltwater streams or rivers deposited moderately-sorted gravel and sand		

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TERTIARY to JURASSIC Bedrock, undivided (**TJbu**)	Undifferentiated bedrock. See Geologic Map Units Properties Table and Plate 1 for individual units.	See Geologic Map Units Properties Table and Plate 1.	See Geologic Map Units Properties Table and Plate 1.	See Geologic Map Units Properties Table and Plate 1.