

Map Unit Properties Table: Kalaupapa National Historical Park

Colored rows indicate units mapped within Kalaupapa National Historical Park

Age	Unit Name (Symbol)	Features and Geologic Description	Erosion Resistance	Suitability for Infrastructure	Hazards	Paleontological Resources	Cultural Resources	Karst	Mineral Occurrence	Habitat	Recreation	Geologic Significance
QUATERNARY (Holocene)	Fill (Qf) Beach deposits (Qbd) Younger dune deposits (Qdy) Lagoon deposits (Qlg)	<i>Qf</i> consists of manmade fill of concrete and rock debris forming piers and breakwaters along the coastline. <i>Qbd</i> contains surf-reworked, cream-colored calcareous sand and gravel forming unconsolidated strand-line deposits parallel to the coastline. Unit includes local stream-derived volcanic detritus as black sand and minor sandstone fragments. <i>Qdy</i> includes unconsolidated coral sand forming eolian dunes and sheets up to 15 m (45 ft) thick. Unit typically occurs adjacent to <i>Qbd</i> . <i>Qlg</i> contains poorly consolidated to unconsolidated mud, silt, and sand present as mudflats in back-beach areas and estuaries. Some marine marl or limey beds present locally.	Very low, except for <i>Qf</i>	High porosity and permeability in addition to proximity to flowing water renders unit unsuitable for waste facilities; building projects on this unit should avoid areas with slopes present.	Heavy erosion, slumps, slides, and mass wasting possible. Shoreline areas are prograding west of Kaunakakai inundating mangrove swamps.	Finely broken coral, shells, and foraminifera	<i>Qlg</i> contains reddish-brown mud as a result of erosion caused by overgrazing in the past 200 years	None	Sand, silt, gravel, black sand, marl	Nearshore, lagoon, estuarine, and mangrove swamp habitat.	Subaerial units are suitable for light recreation, <i>Qlg</i> should be avoided for any impactful recreation due to fragile nature of estuarine habitats.	<i>Qdy</i> contains glassy and lithic sand reworked downwind from 200-500-year-old tephra deposits from the volcano's southwest rift zone.
QUATERNARY (Pleistocene-Holocene)	Alluvium (Qa) Older dune deposits (Qdo)	<i>Qa</i> contains deposits of silt, sand, and gravel along valley bottoms and streams, locally grading upwards into unconsolidated talus and colluvium as well as <i>QTao</i> . <i>Qdo</i> consists of lithified calcareous sand or eolianite in fields inland of the modern coastline. Degree of lithification increases with age and some caliche or red paleosol caps are present locally.	Very low to low for <i>Qdo</i>	Building projects should avoid areas with slopes and close proximity to coastlines.	Erosion, blockfall, slumps, and slides are possible for units with slopes present.	<i>Qdo</i> contains shells and bird bones.	Unit may contain early Hawaiian artifacts and relicts of the Kalaupapa settlement	Karst dissolution is possible for <i>Qdo</i> cemented by calcite	Sand, caliche, paleosol, and gravel	<i>Qa</i> provides permeable substrate for valley floor vegetation	Unit is suitable for most recreation unless in flash flood prone narrow valleys	<i>Qdo</i> contains remains with radiocarbon dates of 4,700 to 6,750 years before present
QUATERNARY (Pleistocene)	Calcareous breccia and conglomerate (Qcbc)	Unit contains poorly to moderately sorted marine-derived sedimentary deposits which extend 2 km (0.7 mi) inland at elevations as high as 72 m (216 ft). Fragments are encased in a sandy lime mud matrix and calcitic cement.	Low	The poorly lithified nature of this unit may render it unstable for heavy development.	If undercut, unit may pose rockfall hazard	Coralline algae, branching coral, shell fragments, gastropod shells, echinoid remains	Unit may contain early Hawaiian artifacts	Karst dissolution is possible for unit cemented by calcite	Sand, basaltic rock clasts, carbonate mud rip-up clasts	Unit provides perched ledges of porous substrate for vegetation	Avoid undercut areas due to risk of landslides	Unit records marine transgression event during the Pleistocene
QUATERNARY (Pleistocene)	Kalaupapa Volcanics (Qppl) Kalaupapa Volcanics; vent deposits (Qppv) Tuff of Mokuho'oniki cone (Qmv)	<i>Qppl</i> contains porphyritic pāhoehoe lava flows ranging in composition from tholeiitic to alkalic basalt and basanite that comprises the broad Kalaupapa Peninsula of East Moloka'i. <i>Qppv</i> consists of a cinder cone, low lava cone, and Kauhākō Crater on top. <i>Qmv</i> contains palagonitic basaltic ash, spatter, sparse lava flows, and a few dikes comprising the islands of Mokuho'oniki and Kanahā off the eastern end of Moloka'i.	Moderate	Units are present at the base of a great windward cliff and should be avoided for development due to the threat of rockfall.	Units can weather to slippery clays, lava tube collapse is possible for flow units	Coralliferous limestone fragments entrained in bedded ash as blocks. Potential paleontological resources of animals that lived in or were transported into lava tubes and caves.	Unit may have contributed to the building of the Kalaupapa settlement and may have spiritual significance for early Hawaiians	None	Basalt, volcanic ash, olivine phenocrysts, coralliferous limestone fragments	Lava tubes may provide cave habitat	Avoid flow areas due to potential for collapse	<i>Qppl</i> has radiometric (potassium-argon) age dates of 0.57 to 0.34 million years. <i>Qmv</i> is younger than 1.3 million years and contains rocks indicative of shallow eruptions.
QUATERNARY (Pleistocene)	East Moloka'i Volcanics Upper member: lava flows (Qemul) vent deposits (Qemuv) domes (Qemud)	<i>Qemul</i> contains 'a'a flows 6-30 m (18-90 ft) thick with rare pāhoehoe flows and ashy soil beds. Unit weathers to a medium to light gray. <i>Qemuv</i> consists of cinder and spatter layers that form bulky cones. <i>Qemud</i> contains lava extrusions covering and obscuring vent sites of <i>Qemuv</i> and flowing within craters of vent deposits.	Moderate	Rough textures and unconsolidated nature of some volcanic deposits make them unsuitable for extensive development.	Units are prone to washing downslope and can weather to slippery clays, lava tube collapse is possible for flow units	Potential paleontological resources of animals that lived in or were transported into lava tubes and caves.	Unit may have spiritual significance for early Hawaiians	None	Cinders, volcanic ash	Units weather to contribute to fertile, iron rich soils	'a'a lavas form unstable, dangerous trailbase	In concert, units record the localized volcanic history of the East Moloka'i area

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QUATERNARY (Pleistocene–Pliocene)	Older alluvium (QTao)	Unit consists of poorly consolidated to lithified sand and gravel. In places, texture is coarse enough to be considered conglomeratic with well rounded and moderately sorted clasts. Some colluvial lenses present locally. Unit is present as terraces, thick valley fill, and locally mantling ridges.	Low	Heterogeneous layering may result in structural weakness making units unsuitable for heavy development.	Rockfall hazard due to some ledge-forming layers exposed along slopes incised by modern drainages	Pleistocene and Pliocene fossil fragments are possible.	Unit may have provided tool material for early Hawaiians	None documented.	Sand, gravel, volcanic clasts	Units form terraced benches	Good for most uses unless incised and undercut by local streams.	Unit records early weathering and deposition patterns on Moloka'i
QUATERNARY (Pleistocene–Pliocene)	East Moloka'i Volcanics Lower member: lava flows (QTemll) vent deposits (QTemlv) caldera complex (QTemlcc) Intrusive rocks (QTemli)	<i>QTemll</i> contains pāhoehoe and 'a'ā flows of aphyric to porphyritic olivine basalt. Unit weathers darker gray, distinguishable from the overlying <i>Qemu</i> . <i>QTemlv</i> consists of cinder and localized spatter cones. <i>QTemlcc</i> contains thick lava flows with many intrusive plugs, talus, and fault breccia. Unit is permeated by dike swarms. Ponded areas are thickest and secondary mineralization is a field characteristic of the caldera complex. <i>QTemli</i> consists of steep, near-vertical dikes, stocks and plugs within <i>QTemlcc</i> .	Moderately low	Heterogeneous layering of lava types may result in structural weakness making the terrane unsuitable for heavy development.	<i>QTemlc</i> weathers to clay and may weaken stacks of lava flows rendering them susceptible to slides. Lava tubes may collapse.	Potential paleontological resources of animals that lived in or were transported into lava tubes and caves.	Filled amygdules may have provided trade and tool material for early Hawaiians	None	Olivine, augite phenocrysts, volcanic rocks, ash, vesicle linings and amygdules filled with calcite, quartz, chalcedony, smectite-group clay minerals	Lava tubes may provide cave habitat	'a'ā lavas form unstable, dangerous trailbase	Units record volcanic evolution of the eastern side of Moloka'i
QUATERNARY (Pleistocene–Pliocene)	West Moloka'i Volcanics: Wai'ele and other late lava (QTwmw) Wai'ele and other late lava; vent deposits (QTwmwv) lava flows (QTwmll) vent deposits (QTwmv), Intrusive rocks (QTwmi)	<i>QTwmw</i> is an informal unit underlain by red ashy soils from 0.2 to 1.2 m (0.6-3.6 ft) thick. Flows range in composition from alkalic basalt to hawaiite with some tholeiitic layers at Ka'eo. <i>QTwmwv</i> consists of cinder and spatter cones. <i>QTwmll</i> lack the red ashy soil interbeds of <i>QTwmw</i> and contains pāhoehoe and 'a'ā flows with thin beds less than 0.6 m (1.5 ft) thick at several localities. <i>QTwmv</i> contains localized vent deposits of cinder and spatter cones. <i>QTwmi</i> contains coarser-grained intrusive dikes.	Moderate	Heterogeneous nature of units could pose stability issues on slopes, avoid flow areas that may contain lava tubes for wastewater treatment facility development.	Flows separated by ashy layers may be prone to rockfall and sliding on slopes	Potential paleontological resources of animals that lived in or were transported into lava tubes and caves.	Early Hawaiians quarried late lava flows of <i>QTwmw</i> lending the name Kalau ko'i (the adze pit) to the features	None	Volcanic rocks, ash	Unit weathers to reddish, iron rich soils	'a'ā lavas form unstable, dangerous trailbase, avoid flow areas due to potential for collapse	<i>QTwmw</i> ranges in age from 1.80 to 1.73 million years old and represent postshield-stage volcanism.