DESCRIPTION OF MAP UNITS

	Description of materials	Distribution and thickness	Topography and drainage	Permafrost	Susceptibility to frost action	Suitability for construction	Special problems
Qt Thaw-lake deposits	Lithology dependent upon the materials in which the thaw lake develops. In the area underlain by marine silt and clay (Qm) west of Harrison Bay the lake deposits consist of silt and clay. Lake deposits developed in units Qs, Qem, Qam, Qat, and Qtas are fine to medium sand and silty sand; those in eolian sand (Qe) consist of fine sand; and lake deposits formed in the upland silt unit (Qus) are composed of silt to very fine sand. Qt(mf) are mud flats formed by coastal erosion breaching thaw-lake basins. All of the deposits contain disseminated detrital organic matter and chunks of peat of various sizes. Scattered, discrete, cobble to boulder-sized erratics and lenses of granules to small pebbles occur where the lake deposits are developed in Qm or Qs. Unit includes the deposits of minor streams that cross or connect lake basins.	Occurs throughout the quadrangle but not differentiated in alluvium or deltaic deposits. Generally less than 3 m thick.	Forms flat to moderately dissected areas within isolated, interlocking, or overlapping basins. Maximum surface relief within basins ranges from about 3 m to 10 m and is determined by the degree of dissection and presence of pingos. Pingos occur primarily in lake deposits developed in eolian sand (Galloway and Carter, 1978; Carter and Galloway, 1979) and attain a maximum height of about 10 m. Maximum relief between basin floors and surrounding areas ranges from about 5 m to 15 m. Drainage is poor except in those basins in the eolian sand unit that have been breached and deeply dissected.	Perennially frozen immediately below a thin active layer about 0.5 m thick. Amount of excess ice is largely dependent upon the age of the deposits; early Holocene deposits are ice-rich, whereas the deposits and subjacent strata of recently drained basins may have relatively low ice contents. However, wedge ice in the subjacent strata may have survived the lake episode if the lake was shallower than 2 m.	Highly frost susceptible where developed in marine silt and clay. Susceptibility in remainder of area varies within individual lake deposits depending upon silt content and amount of detrital organic matter; deposits in the central part of lake basins generally very susceptible due to concentration of silt and organic matter.	Generally unsuitable as a source of materials due to silt, organic and ice content and the seasonal flooding of the lake basins by snow melt. The older deposits are less suitable as construction sites due to increasing amount of excess ice with age.	Differential settlement may occur upon thaw of permafrost. Very poor drainage except where deeply incised. Pingos common where thaw-lake deposits developed in eolian sand.
Qal Alluvium	Stratified deposits of fine to medium sand, silty sand, and gravelly sand. Coarse sand and minor gravel occur locally along streams west of the Colville River, except in the Qe map unit. Cobble and boulders occur in the bed of the upper Ublutuoch River, but do not indicate a gravel deposit because they are concentrated from lag that occurs in the basal bed of the Qtas map unit. Gravel and gravelly sand common along the Colville River and streams to the east. Contains detrital wood and peat. Includes deposits of flood-plain lakes and thaw lakes. Organic-rich silt occurs as thin overbank deposits and as thicker lacustrine deposits that fill abandoned channels. Small eolian dunes are common on modern point bars.	Occurs along all the major streams in the quadrangle, but is most extensive along the Colville and Itkillik Rivers, which head in the Brooks Range. Includes flood-plain and alluvial terrace deposits as much as 8 m above modern streams. Probably not more than 5 m thick along modern channels, except along the Colville and Itkillik Rivers where the deposits may be as thick as 20 m.	Forms channels and bars of the modern rivers and terraces of older river courses. Meander scrolls are well preserved on the lower terraces. Terrace drainage generally poor. Subject to flooding to 6 or 8 m above low water some streams.	Permafrost underlies the entire unit except for a 2 to 6 m thick unfrozen layer beneath some of the larger channels and lakes, and a thicker (perhaps perforating) unfrozen zone beneath the Colville River. Elsewhere, active layer about 0.5 m thick. Ice wedges are well developed in the terrace materials, and the silty deposits that form the filling material of abandoned channels contain abundant intergranular ice.	Organic-rich silty materials that fill abandoned channels and form overbank deposits are highly frost susceptible. Point bar and channel deposits with less than 6 percent silt are generally not frost susceptible.	Provides good foundations in channel and bar areas where material consists of medium to coarse sand, gravelly sand, and gravel; and moderately good to poor foundations on terraces and the older parts of flood-plains. Organic-rich lacustrine silt that fills abandoned channels is not suitable for foundations. Deposits with low silt content may be suitable for fill.	Subject to bank erosion, scour, channel shifting, and seasonal flooding. Wind erosion and dune building common on point bars and would occur on other parts of the flood plain and on terraces if surface vegetation is disturbed. Excavation of stream-bed materials may pose environmental problems.
Qat Alluvial terrace	Fluvial deposits of interbedded silty sand, gravelly sand, and minor pebble to cobble gravel. Clast rock types include chert, sandstone, and chert-pebble conglomerate. Detrital wood and chunks of peat locally common. Overlain by thin eolian sand and peat. Penetrated and deformed by sand wedges.	Occurs on both sides of the Colville and Itkillik Rivers, and along the Kachemach and Miluveach Rivers. Thickness undetermined but in excess of 10 m. Overlying eolian sand and peat from 0.5 to 2 m thick.	Forms residual surfaces between thaw lake basins. Surfaces are fluvial terrace remnants that occur from 6 to 10 m above modern flood plains. Drainage generally good.	Permafrost present beneath an active layer that is generally less than 0.5 m thick. Ice wedges occur in the upper few m.	Silty sand marginally frost susceptible depending on silt content.	Not suitable for foundations because of excessive differential settlement on thaw of ice-rich permafrost. Sand, and locally gravel, may be suitable for fill, base course, or surfacing.	Easily eroded by running water if flow is concentrated by construction activities or if surface vegetation is removed. Susceptible to wind erosion if surface vegetation is removed. Sand-wedge materials may be liquefiable when thawed and saturated.
Qd Deltaic deposits	Silty sand grading to silt at the coast. Contains some very fine-grained organic matter. Cobble gravel occurs locally along Nechelik Channel where the channel is eroding the gravelly materials of map unit Qat.	Occurs at the mouths of the Colville and Kalikpik Rivers and at the mouth of Fish Creek in the southeastern part of the quadrangle. The thickness undetermined, but probably about 15 to 20 m.	Forms channels, banks, islands, sandbars, and mudflats of the modern deltas. Very poorly drained. Lakes and ponds common on islands. Low dunes common on and adjacent to sandbars.	Islands are underlain by permafrost and contain active ice wedges. Active layer generally less than 0.5 m thick beneath tundra covered areas; somewhat thicker beneath bare ground. Open taliks occur beneath the deepest channels and lakes.	Highly frost susceptible.	Deposits with proper silt content may be suitable for borrow, but excavation may pose environmental problems and would be subject to flooding. Not suitable for foundations due to frost susceptibility, poor drainage, and frequent channel shifts.	Subject to seasonal flooding, formation of river-ice dams, bank erosion, scour, and channel shifting.
Qb Beach deposits	Marine deposits of gravelly sand and sand, locally with considerable amounts of detrital organic material including peat and wood. Gravel composed of chert, granite, quartzite, dolomite, diabase, and rock types and, is derived from erosion of older deposits.	Present locally along the northern part of Kogru River and the Beaufort Sea coast, and as offshore islands. Deposits are thin and narrow, generally from 1 to 3 m thick and from 10 to 50 m wide.	Forms low ridges along and slightly inland from the modern shorelines. Drainage good on ridges but where more than one ridge is present the inter-ridge areas are poorly drained.	The active layer on presently forming beaches and spits may be as much as 2 m thick. Inactive beach ridges may have actively growing ice wedges. Probably contains less total ice than sandy and silty deposits of other map units.	Granular materials not susceptible to frost action.	Poor for concrete due to chert and organic content and unsuitable size grading. Otherwise, generally good except may require addition of binder for surfacing or base course. Materials of limited volume.	Subject to ice shove along shore and subject to storm surge flooding below 3 m in altitude. Excavation of actively forming beaches need impact evaluation to determine effect of borrowing activities on coastal erosion and deposition.
Qm Marine silt and clay	Clayey silt, silty clay, and minor sandy silt. Includes thin, superposed marine deposits of two or more marine transgressions. The uppermost of these contains scattered ice-rafted pebbles, cobbles, and boulders of red granite, pink quartzite, dolomite, and other rock types not found in streams draining the north flank of the Brooks Range. Also present are the remains of marine mammals, mollusks, foraminifers, and ostracodes. The upper two m of these deposits have been extensively reworked by thaw-lake activity and are overlain by 1 to 2 m of peat.	Occurs in the northwestern part of the quadrangle east of Harrison Bay. Thickness not determined, but extends at least to the base of coastal bluffs that are as much as 6 m in height	Forms poorly to moderately well drained surfaces isolated by thaw-lake basins.	Perennially frozen beneath an active layer that is generally less than 0.5 m thick. Active ice wedges well developed and fossil ice wedges locally occur at depths of a few m. Interstitial ice content in excess of natural voids down to 6 or 8 m below surface and may produce more settlement upon thawing than the 3.3 m noted in marine sand near Barrow (Hussey and Michelson, 1966).	Highly frost susceptible.	Not suitable for foundations because of excessive differential settlement on thaw of ice-rich permafrost. Construction materials not readily available.	Easily eroded. Silt has high liquefaction potential when thawed.
Qs Marine sand over silt and clay	Predominantly silty sand with scattered granules and pebbles, but along the north edge of the unit includes pods of pebbly sand that may be barrier island deposits. These are best exposed along the north shore of Kogru River. The pebbles consist of chert of probable Brooks Range derivation and of the exotic rock types described for Qm. The pebbly deposits contain abundant marine mollusks, foraminifers, and ostracodes, sparse sea mammal remains, and locally common driftwood. Elsewhere, the sand contains sparse remains of marine mollusks, ostracodes, and foraminifers. Underlying the marine sand at altitudes that range from sea level to about 2 m is marine silt and clay that, south of Kogru River, locally contains pebble, cobble, and boulder-sized dropstones of the rock types described for Qm. The silt and clay contains marine ostracodes and foraminifers, but no mollusks have been collected within this quadrangle. Overlying the marine sand are thin lacustrine and eolian deposits and peat, and wedges of fine to very fine eolian sand that penetrate and deform the marine sand and the upper part of the marine silt and clay.	Occurs adjacent to and west of Kogru River in the west-central part of the quadrangle. The sand ranges from 2 to 4 m thick, and the underlying marine silt and clay is of undetermined thickness. The overlying deposits are generally 1 to 2 m thick.	Forms residual surface between thaw-lake basins. Drainage generally good. Not subject to snowmelt flooding.	Permafrost present beneath an active layer that is generally less than 0.5 m thick. Ice wedges well developed and interstitial ice content high. Similar deposits near Barrow are supersaturated with ice down to about 6 or 8 m (Sellmann and others, 1975), with ice content of 75% by volume at a depth of 1 m, exclusive of wedge ice.	Sand marginally frost susceptible, depending on silt content. Marine and lacustrine silt and clay highly frost susceptible.	Not suitable for foundations because of excessive differential settlement on thaw of ice-rich permafrost. Sand may be suitable for fill, base source, or surfacing if silt content is appropriate and if stabilized to prevent deflation.	Easily eroded by running water if surface vegetation is removed or if flow is concentrated by construction activities. Material forming the sand wedges may be liquefiable when thawed and saturated.
Qe Eolian sand	Fine to very fine sand containing abundant quartz with minor dark minerals. Well sorted. Stratified, with large-scale cross bedding in places. Contains peat beds and wood in upper few m. Marine silt and clay and fluvial silt and pebbly sand exposed beneath the eolian sand in cut-banks on the north side of Fish Creek.	Occupies most of the southwestern part of the quadrangle. Thickness ranges from a few m to more than 30 m. This unit forms the eastern edge of a large sand sea (Carter, 1981).	Forms generally well drained linear dune ridges as much as 30 m high upon which are superimposed parabolic dunes that are generally less than 1 m high. Contains poorly drained depressions that are not part of an intergrated drainage system.	Permafrost underlies entire unit. Active layer less than 1.5 m thick on well drained slopes and summits and less than 0.5 m thick in poorly drained depressions. Ice wedges occur in the upper few m but the remainder of the deposits is generally free of excess ice in excess of natural voids. However, the presence of deep lakes (Sloan and Snyder, 1978) may indicate that the eolian sand overlies sediments that contain large amounts of massive ice.	Generally not frost susceptible, except where silt content exceeds 6 percent.	Adequate for natural foundations but requires stabilization for use as a surfacing material or fill. Relatively easy to excavate with a ripper on well drained dune ridges.	Extremely susceptible to wind erosion when protective vegetation is removed. Very sensitive to surface disturbances. Active blowouts present in places. Locally, sand may be liquefiable when thawed and saturated.
Qem Thin eolian sand over marine silt and clay	Fine sand containing abundant quartz with minor dark minerals. Well sorted, poorly stratified. Contains peat beds and willow shrubs in growth position in upper part. In lower part includes sand wedges which also penetrate and deform underlying materials. Beneath the eolian sand at altitudes that range from sea level to about 8 m is marine silt and clay similar to that described for the lower part of Qs except that erratics have been observed only in the northern and northwestern part of the map unit, and marine mollusks have been collected from exposures along the Kalipkik River in the south-central part of the map unit.	Occurs west of Harrison Bay and south of Kogru River in the west-central part of the quadrangle. The eolian sand is from 2 to 6 m thick and the marine silt and clay is of undertermined thickness.	Forms residual surfaces between thaw-lake basins. Common parabolic dunes which are less than 1 m high. Drainage generally good. Not subject to snowmelt flooding.	Permafrost present beneath an active layer that is generally less than 0.5 m thick. Ice wedges occur in the upper few m, and interstitial ice in excess of natural voids probably is present in the marine silt and clay.	Eolian sand generally not frost susceptible, except where silt content exceeds 6 percent. Silt and clay highly frost susceptible.	Not suitable for foundations because of excess differential settlement on thaw of ice-rich permafrost. Sand may be suitable for fill, base course, or surfacing if silt content is appropriate and if stabilized to prevent deflation.	Extremely susceptible to wind erosion if surface vegetation is removed. Easily eroded by running water if flow is concentrated by construction activities or if surface vegetation is removed. Locally, sand may be liquefiable when thawed and saturated.
Qam Alluvial sand over marine silt and clay	Predominantly fluvial silty sand with scattered granules and pebbles, but includes minor sandy pebble gravel. Pebbles composed primarily of chert and quartz. Overlies marine silt and clay which is exposed at altitudes that range from 8 to 20 m. Overlying the fluvial sand is thin eolian sand and peat; and wedges of fine to very fine eolian sand penetrate and deform the alluvial sand.	Occurs on both sides of Judy Creek and east of the Kachemach River in the southern part of the quadrangle. Fluvial sand 3 to 6 m thick, marine silt and clay of unknown thickness. Eolian sand and peat 1 to 2 m thick.	Forms residual surfaces between thaw lake basins. Drainage generally good. Not subject to snowmelt flooding.	Permafrost present beneath an active layer that is generally less than 0.5 m thick. Ice wedges occur in the upper few m, and interstitial ice in excess of natural voids probably is present in the marine silt and clay.	Silty sand generally frost susceptible. Silt and clay highly frost susceptible.	Not suitable for foundations because of excessive differential settlement on thaw of ice-rich permafrost. Sand may be suitable for fill, base course, or surfacing if silt content is appropriate and if stabilized to prevent deflation.	Easily eroded by running water if flow is concentrated by construction activities or if surface vegetation is removed. Materials forming the sand wedges may be liquefiable when thawed and saturated.
QTas Alluvial and eolian sand and marine sand and silt	Highly variable composition, but generally consists of stratified deposits of marine silty sand, gravelly sand, silt, and minor clay, overlain by fluvial silty sand, gravelly sand, and minor organic-rich silt, which in turn locally is overlain by eolian sand. In places, marine deposits do not occur, and only fluvial and eolian deposits are present. The base of the marine deposits is exposed only in bluffs along the right bank of the Colville River, where it is marked by a sparse lag of pebbles, cobbles, and boulders. Rock types in the lag include those characteristic of map units Tsg and Tg. The marine deposits commonly are fossiliferous, containing mollusks, foraminifers, ostracodes, and rare marine mammal remains. The deposits of two marine transgressions occur and locally may be superposed. Fluvial deposits locally contain buried peat beds, and logs of spruce, larch, and poplar. The lower part of the eolian sand contains ventifacted pebbles of chert and quartz derived from the fluvial deposits. Wedges of pebble-free eolian sand penetrate and deform the underlying deposits. Peat and/or peaty, silty sand occurs at the top of the unit.	Occurs on both sides of the Colville River in the southeastern part of the quadrangle. Thickness of marine deposits 1 to 6 m; fluvial deposits 10 to 20 m; eolian deposits 1 to 5 m; peat and peaty sand 1 to 2 m. Aggregate thickness 12 to 20 m.	Forms flat to gently rolling terrain broken by thaw-lake basins and ravines. Drainage good on slopes, fair to poor on flatter surfaces.	Perennially frozen beneath an active layer that is generally less than 0.5 m thick. Ice wedges occur in the upper few m. Silt, organic-rich silt, and clay may have interstitial ice in excess of natural voids.	Silty sand generally frost susceptible. Silt and clay highly frost susceptible.	Not suitable for foundations because of excessive differential settlement on thaw of ice-rich permafrost. Sand may be suitable for fill, base course, or surfacing if silt content is appropriate and if stabilized to prevent deflation.	Easily eroded by running water if flow is concentrated by construction activities or if surface vegetation is removed. Sand-wedge filling subject to liquefaction if thawed and saturated. Susceptible to wind erosion if surface vegetation is removed.
Qc Colluvial deposits	Silt and very fine sand with dispersed pebbles and cobbles. Contains disseminated, fine-grained organic matter and, in places, chunks of peat of various sizes, and pieces of detrital wood. Bones of extinct Pleistocene mammals locally present.	Occurs in the southeast corner of the map and along the east side of the Colville River - Itkillik River valley. Thickness from 1 to 10 m.	Forms valley and gully slopes and bottoms. Drainage good on upper slopes, poor on lower slopes and in valley and gully bottoms.	Perennially frozen beneath an active layer that is generally less than 0.5 m thick. Contains ice wedges and moderate to high volumes of interstitial ice beneath lower slopes and valley bottoms.	Highly frost susceptible.	Generally unsuitable as a source for materials because of organic content. Not suitable for foundations on lower slopes and valley bottoms because of excessive differential settlement on thaw of ice-rich permafrost.	Easily gullied by running water. Disruption of surface vegetation on lower slopes and valley bottoms may cause melting of ground ice and lead to subsidence.
Qus Upland sand and silt	Predominantly wind blown very fine sand and silt. Includes some clay and layers and lenses of chert granules and pebbles. Stratification indistinct. Gravelly sand to sandy gravel. Clasts predominantly pebble-sized, well rounded, and composed of chert and quartz. Very poorly exposed.	Occurs only in the southeast corner of the quadrangle. Ranges from a few m to as much as 10 thick.	Forms flat to gently rolling terrain broken by deep thaw-lake basins, major stream valleys, and ravines. Drainage good on slopes, fair to poor on flatter surfaces.	Active layer generally less than 0.5 m thick. Ice wedges well developed and sediment may contain a high volume of interstitial ice.	Silt and silty sand are frost susceptible.	Not suitable for borrow except as binder material. Not suitable for foundations because of excessive differential settlement on thaw of ice-rich permafrost.	Easily gullied by running water when water is channeled by construction activities or when surface vegetation is removed. Disruption of surface vegetation may cause melting of ice wedges and lead to subsidence. Locally deposits may be liquefiable when thawed and saturated.
Tgs Gravelly sand	Gravelly sand to sandy gravel. Clasts predominantly pebble-sized, well rounded, and composed of chert and quartz. Very poorly exposed.	Occurs on the east side of the Colville River - Itkillik River valley in the southeastern part of the quadrangle, where it underlies QTas. Thickness about 1 to 3 m.	Forms an indistinct bench on the valley side. Well drained.	Perennially frozen beneath an active layer that is probably less than 1 m thick. Ice content unknown but probably not in excess of natural voids.	Probably not frost susceptible.	Not suitable for borrow due to thickness of overburden (QTas).	———
Tg Gravel	Pebble, cobble, and boulder gravel. Clasts predominantly of hard, resistant rock types common in nearby parts of the Brooks Range, including chert, quartz, sandstone, and chert-pebble conglomerate. Erratics to 1.5 m in diameter locally common; largest erratic observed 10 m in diameter. Poorly exposed; parts of deposit may have silty matrix and may be till.	Occurs in the southeast corner of the quadrangle. Up to 20 m thick. Probably underlies most of map unit Qus.	Forms bluffs on the upper slopes of valleys. Well drained.	Entire unit is perennially frozen. Thickness of active layer is unknown but may be as much as 2 m on unvegetated, south-facing slopes. Ice content not known but probably not in excess of natural voids.	Susceptible to frost action where matrix is silty.	Suitable for fill, base course, and surface course (with proper grading), but unsatisfactory for aggregate because of chert content. Provides good foundations near bluff tops where silt cover is not excessive.	———
Tsg Sand, gravelly sand, conglomerate, and pebbly mud	Nonmarine, moderately to poorly consolidated deposits of variable composition, ranging from conglomerate opposite the mouth of the Itkillik River, to sandy gravel, gravelly sand, sand, and pebbly mud at other localities, Contains clasts up to 1.2 m in diameter composed of metamorphic, intrusive, and volcanic rock types which do not occur in nearby parts of the Brooks Range and which are distinct from the rock types found in younger glaciomarine deposits. Locally contains lignitized logs of large coniferous trees. Contains disseminated sulfur in places. Some granitic clasts weathered to grus.	Exposed in river cut-banks at widely separated localities in the southeastern part of the quadrangle; on the Ublutuoch River west of Nuiqsut, on the west side of the Colville River opposite the mouth of the Itkillik River, at three places on the west side of the Kachemach River, and at one locality on the west side of the Miluveach River. Exposed thickness (incomplete) ranges from 2 to 8 m; total thickness considerably greater but unknown. Overlain by 3 to 10 m of younger deposits.	Forms the lower parts of river cut-banks. Drainage generally good.	Perennially frozen. Generally low ice content but fine-grained units may contain ice in excess of natural voids.	Fine-grained beds susceptible to frost action.	Not suitable for borrow due to thickness of overburden and extensive weathering of some clasts.	———
Tm Marine siltstone, shale, and sandstone	Marine siltstone, shale, and sandstone. Thin to medium bedded; poorly indurated. Contains fossil mollusks, ostracodes, and foraminifers.	Occurs near Ocean Point along the north side of the Colville River. Exposed thickness about 20 m.	Forms the lower 20 m of 35 m-high bluffs. Well drained.	Perennially frozen but ice content insignificant.	Fine-grained and/or thin bedded units susceptible to frost action.	Not suitable for borrow due to thickness of overburden.	Subject to debris flows and rock falls.
Kp Nonmarine sandstone, siltstone, and shale	Nonmarine sandstone, siltstone, and shale with minor coaly beds and thin tephra layers. Thinly to thickly bedded; moderately to poorly indurated. Fine-grained beds are commonly bentonitic. Forms part of the type section for the upper part of the Kogasukruk Tongue of the Prince Creek Formation (Brosge and Whittington, 1966).	Occurs near the southern border of the map on the west side of the Colville River. The measured thickness (incomplete) of the upper part of the Kogasukruk Tongue is 353 m (Brosge and Whittington, 1966).	Forms the lower 20 m of 35 m-high bluffs. Well drained.	Perennially frozen but ice content insignificant.	Thin bedded and/or fine-grained units susceptible to frost action.	Not suitable for borrow due to thickness of overburden.	Subject to debris flows and rocks falls.

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