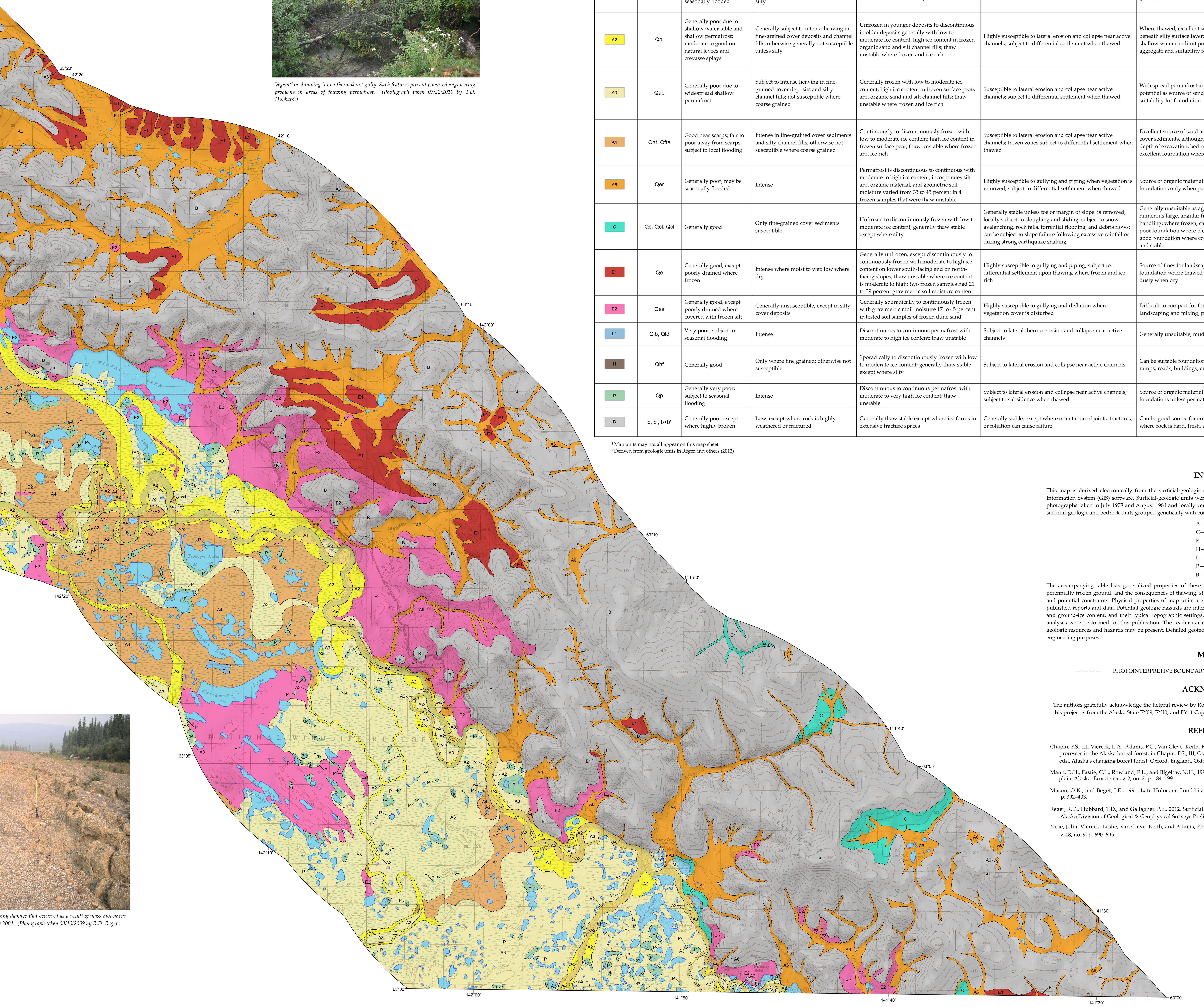
Vegetation slumping into a thermokarst gully. Such features present potential engineering problems in areas of thawing permafrost. (Photograph taken 07/22/2010 by T.D. Hubbard.)

Map unit[1]	Component geologic units[2]	Surface drainage	Seasonal frost susceptibility	Permafrost and thaw stability	Slope stability	Suitability for construction	Potential engineering considerations
A1	Qa, Qaa	Well drained near steep stream banks and where water table is deep; seasonally flooded	Subject to deep, dry freezing where coarse grained and water table is deep; subject to intense frost heaving where silty	Unfrozen to discontinuously frozen with low to moderate ice content where silty; can be thaw unstable where perennially frozen	Highly susceptible to lateral erosion and collapse near active channels	Excellent source of clean sandy gravel aggregate and clean fill material, can be poorly graded; well-drained sand and gravel provide excellent foundation	Subject to inundation during annual high stream stages and by aufeis in braided reaches; shallow water table limits depth and means of excavation; thawed, saturated fine sand and silt subject to liquefaction; responses to seismic shaking can vary considerably, especially near frozen zones
A2	Qai	Generally poor due to shallow water table and shallow permafrost; moderate to good on natural levees and crevasse splays	Generally subject to intense heaving in fine-grained cover deposits and channel fills; otherwise generally not susceptible unless silty	Unfrozen in younger deposits to discontinuous in older deposits generally with low to moderate ice content; high ice content in frozen organic sand and silt channel fills; thaw unstable where frozen and ice rich	Highly susceptible to lateral erosion and collapse near active channels; subject to differential settlement when thawed	Where thawed, excellent source of sandy gravel aggregate beneath silty surface layer; presence of permafrost and shallow water can limit potential as source of sandy gravel aggregate and suitability for foundation	Subject to inundation at least once or twice every 100 years (Chapin and others, 2006; Yarie and others, 1998); shallow water table limits depth and means of excavation; where thawed, fine sand and silt subject to liquefaction; responses to seismic shaking can vary considerably, especially near frozen zones
A3	Qab	Generally poor due to widespread shallow permafrost	Subject to intense heaving in fine-grained cover deposits and silty channel fills; not susceptible where coarse grained	Generally frozen with low to moderate ice content; high ice content in frozen surface peats and organic sand and silt channel fills; thaw unstable where frozen and ice rich	Susceptible to lateral erosion and collapse near active channels; subject to differential settlement when thawed	Widespread permafrost and shallow water table limit potential as source of sandy gravel aggregate and suitability for foundation	Subject to inundation every 500 to 1,000 years (Mann and others, 1995; Mason and Begét, 1991); shallow water table and presence of permafrost limit depth of excavation; subject to liquefaction where thawed and saturated; responses to seismic shaking may vary considerably, sensitive to surface disturbance
A4	Qat, Qfte	Good near scarps; fair to poor away from scarps; subject to local flooding	Intense in fine-grained cover sediments and silty channel fills; otherwise not susceptible where coarse grained	Continuously to discontinuously frozen with low to moderate ice content; high ice content in frozen surface peat; thaw unstable where frozen and ice rich	Susceptible to lateral erosion and collapse near active channels; frozen zones subject to differential settlement when thawed	Excellent source of sand and gravel beneath fine-grained cover sediments, although shallow permafrost can limit depth of excavation; bedrock shallow in strath terraces; excellent foundation where thawed	Bedrock shallow in strath terraces; locally subject to seasonal slope and stream flooding; where saturated, fine-grained cover sediments subject to liquefaction; responses to seismic shaking can vary considerably, especially near frozen zones; locally sensitive to surface disturbance
A6	Qer	Generally poor; may be seasonally flooded	Intense	Permafrost is discontinuous to continuous with moderate to high ice content; incorporates silt and organic material, and geometric soil moisture varied from 33 to 45 percent in 4 frozen samples that were thaw unstable	Highly susceptible to gullying and piping when vegetation is removed; subject to differential settlement when thawed	Source of organic material for landscaping; suitable for foundations only when permafrost is preserved	Thawing produces mudflows and hyperconcentrated flows; subject to seasonal stream and slope icings; sensitive to surface disturbance
C	Qc, Qcf, Qcl	Generally good	Only fine-grained cover sediments susceptible	Unfrozen to discontinuously frozen with low to moderate ice content; generally thaw stable except where silty	Generally stable unless toe or margin of slope is removed; locally subject to sloughing and sliding; subject to snow avalanching, rock falls, torrential flooding, and debris flows; can be subject to slope failure following excessive rainfall or during strong earthquake shaking	Generally unsuitable as aggregate source because numerous large, angular fragments require special handling; where frozen, can require ripping or blasting; poor foundation where blocks are loose and unstable to good foundation where coarse and fine fractions are mixed and stable	Can become unstable if saturated margins or toe removed, or subject to seismic shaking; active slope processes may have deleterious impacts
E1	Qe	Generally good, except poorly drained where frozen	Intense where moist to wet; low where dry	Generally unfrozen, except discontinuously to continuously frozen with moderate to high ice content on lower south-facing and on north-facing slopes; thaw unstable where ice content is moderate to high; two frozen samples had 21 to 39 percent gravimetric soil moisture content	Highly susceptible to gullying and piping; subject to differential settlement upon thawing where frozen and ice rich	Source of fines for landscaping and mixing; makes good foundation where thawed and dry; muddy when wet; dusty when dry	Vertical cuts can be stable if drainage is provided; ice-rich areas sensitive to surface disturbance
E2	Qes	Generally good, except poorly drained where covered with frozen silt	Generally unsusceptible, except in silty cover deposits	Generally sporadically to continuously frozen with gravimetric moil moisture 17 to 45 percent in tested soil samples of frozen dune sand	Highly susceptible to gullying and deflation where vegetation cover is disturbed	Difficult to compact for foundations; source of sand for landscaping and mixing; poorly graded	Subject to deflation where unprotected
L1	Qlb, Qld	Very poor; subject to seasonal flooding	Intense	Discontinuous to continuous permafrost with moderate to high ice content; thaw unstable	Subject to lateral thermo-erosion and collapse near active channels	Generally unsuitable; muddy during wet weather	Subject to seasonal flooding during high stream stages
H	Qhf	Generally good	Only where fine grained; otherwise not susceptible	Sporadically to discontinuously frozen with low to moderate ice content; generally thaw stable except where silty	Subject to lateral erosion and collapse near active channels	Can be suitable foundation material for runways, taxiways, ramps, roads, buildings, embankments, and artificial levees	Subject to inundation every 500 to 1,000 years (Chapin and others, 2006; Yarie and others, 1998); shallow water table; can be subject to liquefaction where fine grained, saturated, and thawed; can become locally unstable if margins undercut
P	Qp	Generally very poor; subject to seasonal flooding	Intense	Discontinuous to continuous permafrost with moderate to very high ice content; thaw unstable	Subject to lateral erosion and collapse near active channels; subject to subsidence when thawed	Source of organic material for landscaping; unsuitable for foundations unless permafrost is preserved	Difficult to excavate and compact; subject to seasonal slope and stream icings
B	b, b', b+b'	Generally poor except where highly broken	Low, except where rock is highly weathered or fractured	Generally thaw stable except where ice forms in extensive fracture spaces	Generally stable, except where orientation of joints, fractures, or foliation can cause failure	Can be good source for crushed aggregate and riprap where rock is hard, fresh, and not intensely fractured	Quality of rock varies, depending on lithology, degree of weathering, and fracturing; local zones of weathering or shearing can be clay rich

[1] Map units may not all appear on this map sheet
[2] Derived from geologic units in Reger and others (2012)



INTRODUCTION

This map is derived electronically from the surficial-geologic map of the eastern corridor segment (Reger and others, 2012) using Geographic Information System (GIS) software. Surficial-geologic units were initially identified by interpretation of ~1:65,000-scale false-color infrared aerial photographs taken in July 1978 and August 1981 and locally verified by field checking in 2008, 2009, and 2010. The map shows the distribution of surficial-geologic and bedrock units grouped genetically with common properties that are typically significant for engineering applications:

A—Alluvial deposits
C—Colluvial deposits
E—Eolian deposits
H—Manmade deposits
L—Lake deposits
P—Paludal peat deposits
B—Bedrock and residual

The accompanying table lists generalized properties of these groups, including surface drainage, effects of seasonal freezing, the presence of perennially frozen ground, and the consequences of thawing, stability of slopes, suitabilities and limitations of material for construction purposes, and potential constraints. Physical properties of map units are interpretive, based on extrapolation from verified localities and from previously published reports and data. Potential geologic hazards are inferred from the typical physical properties of map units, including sediment texture and ground-ice content, and their typical topographic settings. Except for a few test pits, no subsurface investigations or significant laboratory analyses were performed for this publication. The reader is cautioned that this map is intended only as a general guide, and that unevaluated geologic resources and hazards may be present. Detailed geotechnical investigations should be conducted prior to utilization of any map units for engineering purposes.

MAP SYMBOLS

———— PHOTOINTERPRETIVE BOUNDARY—All boundaries are inferred or approximately located

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The authors gratefully acknowledge the helpful review by Rod Combellick and able cartographic assistance by James Weakland. Funding for this project is from the Alaska State FY09, FY10, and FY11 Capital Improvement Projects.

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View nothwest along the old Alaska Highway route, showing damage that occurred as a result of mass movement associated with thawing permafrost. Road was rerouted in 2004. (Photograph taken 08/10/2009 by R.D. Reger.)

ENGINEERING-GEOLOGIC MAP, ALASKA HIGHWAY CORRIDOR, PARTS OF TANACROSS A-1, A-2, A-3, AND B-3 QUADRANGLES, ALASKA

by

T.D. Hubbard[1], R.D. Reger[2], and P.E. Gallagher[1]

2013

SCALE 1 63360

1 1/2 0 1 2 3 4 5 MILES
3000 0 3000 6000 9000 12000 15000 18000 21000 24000 27000 FEET
1 .5 0 1 2 3 4 5 6 7 KILOMETERS

CONTOUR INTERVAL 100 FEET
TANACROSS A-1, A-3, AND B-3 — SUPPLEMENTARY CONTOUR INTERVAL 50 FEET
TANACROSS A-1, A-2, AND B-3 — DATUM IS MEAN SEA LEVEL
TANACROSS A-3 — NATIONAL GEODETIC VERTICAL DATUM OF 1929

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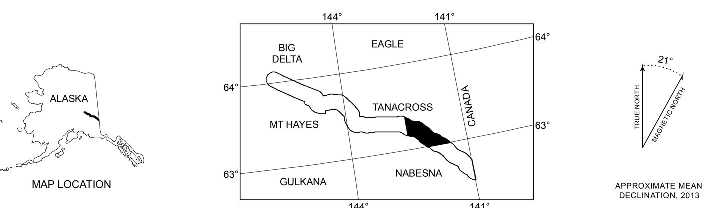

Location of Map Area in Proposed Corridor

Topographic base map from:
U.S. Geological Survey topographic maps
Tanacross A-1 (1952 – minor revisions 1971)
Tanacross A-2 (1955 – minor revisions 1972)
Tanacross A-3 (1948 – minor revisions 2000)
Tanacross B-3 (1949 – minor revisions 1964)
Projection:
Universal Transverse Mercator Zone 7 North
Datum:
North American Datum of 1927
Geologic fieldwork by:
R.D. Reger and T.D. Hubbard (2008, 2009, 2010)
Digital cartography by:
J.R. Weakland (2011, 2012), L.E. Southerland (2012), and P.E. Gallagher (2011, 2012, 2013)
Reviewed by:
R.A. Combellick (2010)

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