DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

OPEN-FILE REPORT
78-890
BUFFALO QUAD., WYO.

PRELIMINARY GEOLOGIC MAP OF THE BUFFALO QUADRANGLE, JOHNSON COUNTY, WYOMING

By
Ernest Dobrovolny
1978

CORRELATION OF MAP UNITS

af, m			
UNCONFORMITY	Qs	Qt1	Qc1 — Holocene
Qh			
UNCONFORMITY	Qc		Pleistocene(?) — QUATERNARY
Qk			
UNCONFORMITY			
Qu			Pleistocene
UNCONFORMITY	QTu		
Qt2			
UNCONFORMITY			
Qt3			
UNCONFORMITY			TERTIARY(?)
Qt4			
UNCONFORMITY			
Twk, Tw			Eocene — TERTIARY

DESCRIPTION OF MAP UNITS

af ARTIFICIAL FILL--Mainly engineered embankments along major highways and abandoned railroad grades. In and near Buffalo, consists of poorly compacted reworked soil and bedrock waste from excavation sites, discarded brick and concrete fragments, tree trunks, and other solid refuse; also includes an abandoned sanitary landfill northwest of Buffalo

m MODIFIED LAND--Mainly abandoned gravel pits where the surface has been extensively regraded and seeded; in many places the lower part of the original gravel deposit has not been removed because the desired select material could be more economically extracted by skimming the upper part

Qs LANDSLIDE DEPOSITS (HOLOCENE)--Debris slides and earthflows consisting of shale, sandy silt, or sandy clay that have moved downslope and outward toward valley bottoms. Located in the upper tributaries of Negro Creek, in the northeast corner of the quadrangle, and southwest of Willow Grove Cemetery where movement is caused by infiltration of water from unlined irrigation ditches

Qh ALLUVIUM (HOLOCENE)--Light-brown, tan, and gray gravel, sand, silt, and minor amounts of clay deposited as highly irregular beds in the flood plains of existing streams. Maximum thickness about 6 m

Q1 LAKE DEPOSITS(HOLOCENE AND PLEISTOCENE?)--Two small lake deposits were mapped. One is along the north quadrangle boundary east of Rock Creek where light-brown, tan, and gray, interbedded silt, sand, and gravel with minor amounts of clay was deposited in a depression resulting from the collapse of materials above burned coal beds. The other is near the west quadrangle boundary along Sand Creek and consists of brown, tan, and light-gray silt, sand, marl, clay, and fine gravel in beds ranging from about 1 to 10 cm thick; some beds are highly fossiliferous; a radiocarbon age of gastropod shells was 11,200± 300 years B.P. (Meyer Rubin, written commun., W-3676, 1977). Maximum thickness about 5 m

Qk KAYCEE FORMATION (HOLOCENE)--Gray to light-brown sand, silt, and minor amounts of gravel; includes alluvium in valley bottoms and in places interfingers with colluvium on adjacent slopes. Thickness ranges from less than 0.5 to about 2.0 m

Qu UCROSS FORMATION (PLEISTOCENE)--Gravel, sand, silt, and sandy to silty clay. The formation consists of three distinct units. The upper unit, a paleosol, 5-40 cm thick, is a sandy to silty, calcareous, dark-gray clay, and locally contains organic material. Along Clear Creek a fatty, highly plastic silty clay with a potential for shrinkage and swelling in the critical range occurs locally. In most other locations the unit is a sandy clay with a potential for shrinkage and swelling in the noncritical to marginal range. The middle unit is a silty to sandy clay; locally, it is silty sand with thin beds of fine gravel, but in most places it is highly calcareous, light-gray to light-brown clay; it contains vertebrate fossils in several places. Thickness ranges from about 0.2 to 1.5 m. The lower unit is gravel 0.5-8.0 m thick, derived from igneous, metamorphic, and sedimentary rocks cropping out in the Bighorn Mountains. The stones are stained yellow, brown, and red; in most places they are 2-5 cm in dimension, but west of Buffalo they are as much as 30 cm in longest dimension. In the tributaries entering Clear Creek from the south, the unit is commonly a coarse silty sand; along Rock Creek it contains reworked clinker and coal fragments

Qc COLLUVIUM (HOLOCENE AND TERTIARY?)--Generally gray silt, sand, and fine gravel that locally contains boulders and coarse gravel deposited on slopes by gravity and sheet wash; grades downslope into Kaycee Formation (Qk). Thickness ranges from less than 0.5 to about 2.5 m

TERRACE ALLUVIUM (PLEISTOCENE AND TERTIARY?)--Light-brown, tan, and gray, very coarse gravel with stones as large as 1.0 m in longest dimension, sand, and silt. Deposits derived from igneous, metamorphic, and sedimentary rocks cropping out in the Bighorn Mountains. Ranges in thickness from 0.5 to 20 m

QTu Undivided unit (late Pleistocene to late Tertiary?)--Isolated remnants of terrace deposits occurring at different heights; not correlated with major terrace map units

Qt2 Unit 2 (Pleistocene)--Approximately 40-65 m above present stream level (Mapel, 1959)

Qt3 Unit 3 (Pleistocene)--Approximately 70-80 m above present stream level (Mapel, 1959)

Qt3_ Unit 3 (Pleistocene)--Approximately 90-105 m above present stream level (Mapel, 1959)

QTt4 Unit 4 (early Pleistocene to late Tertiary)--Approximately 140-180 m above present stream level (Mapel, 1959)

Qc1 CLINKER (HOLOCENE AND PLEISTOCENE)--Fused slag and brick-like baked material formed where shale, siltstone, or sandstone beds above coal in the Wasatch Formation were altered by the heat of burning lignite and subbituminous coal deposits. The resulting pink, red, and blue-black clinker deposits are widespread in the northeast part of the quadrangle where coal beds in the Wasatch Formation are thicker than elsewhere in the map area. Observed thicknesses of clinker along roadcuts range from less than 1.0 to more than 35 m

Tw WASATCH FORMATION (EOCENE)--Sandstone, siltstone, shale, lignite, and subbituminous coal. The sandstone is light gray to yellowish tan gray, medium to fine grained, generally poorly consolidated, friable, lenticular, and crossbedded in most outcrops; channel sandstones from less than 1 to 10 m thick are present throughout the stratigraphic section and locally they are cemented with calcium carbonate. The siltstone and shale are light gray to reddish brown, highly carbonaceous in places, and grade laterally into coal beds. The coal is black to dark brown, lignitic to subbituminous, and occurs in beds from about a centimeter to about 6 m thick. Named coal beds in the northeastern part of the quadrangle in descending order are the Walters, Healy, and Cameron (Mapel, 1959); the Walters and Healy beds are burned on all outcrops; many uncorrelated coal beds generally thicker than 1 m underlie the northeastern part of the quadrangle to a depth of at least 150 m (Farrow, 1976). Thickness about 300 m

Twk Kingsbury Conglomerate Member--Light-brown, greenish-gray, and gray shale, sandstone, and conglomerate. The member is distinguished by lenticular conglomerate beds as much as 4 m thick consisting of subrounded pebbles and cobbles of limestone and dolomite, and igneous and metamorphic rocks. Because the conglomeratic beds grade northeast into finer sediments, the contact is highly indefinite

References

Algermissen, S. T., and Perkins, D. M., 1976, A probabilistic estimate of maximum acceleration in rocks in the contiguous United States: U.S. Geological Survey Open-File Report 76-416, 45 p.

Farrow, R. A., 1976, Preliminary report on the geotechnical properties of the Wasatch Formation at Buffalo, Wyoming: U.S. Geological Survey Open-File Report 76-877, 78 p.

Mapel, W. J., 1959, Geology and coal resources of the Buffalo-Lake De Smet area, Johnson and Sheridan Counties, Wyoming: U.S. Geological Survey Bulletin 1078, 148 p. [1961].

——— CONTACT

—·—·— INDEFINITE CONTACT AT BASE OF KINGSBURY CONGLOMERATE MEMBER OF THE WASATCH FORMATION (Twk)

——— CONTACT OF COAL BED-- Drawn at inferred base of burned bed; H, Healy; W, Walters

3c LOCATION AND THICKNESS OF COAL BED--Thickness shown in meters; C, Cameron; U, uncorrelated

ABANDONED ADIT OR SHAFT

+ LOCATION OF TEST HOLE--Used for measurement of geotechnical properties of the Wasatch Formation

DESCRIPTION OF SOME ENGINEERING GEOLOGIC ASPECTS OF THE MAP UNITS

MAP UNITS	GENERALIZED LITHOLOGIC DESCRIPTION	PERMEABILITY	EXCAVATION (by power equipment)	COMPACTION	FOUNDATION STABILITY	SLOPE STABILITY	EARTHQUAKE STABILITY[1]	RESISTANCE TO EROSION	COMMENTS
ARTIFICIAL FILL af	Sand, silt, gravel, and clay in engineered highway embankments; abandoned sanitary landfills; uncompacted refuse mixed with silt, sand, and gravel	Generally low in engineered highway fills; probably high to very high in other fills	Easy	Easy	Generally good on highway fills; very poor on uncompacted fill and subject to severe differential settlement	Slopes of 2:1 are generally stable on highway fills; uncompacted fills with slopes of 2:1 are stable for short periods of time and then fail by sloughing and raveling associated with differential compaction	Generally good on engineered highway fills; very poor on uncompacted fills	Generally good on highway fills where protected by vegetation; very poor on uncompacted fills	
MODIFIED LAND m	Sand, silt, gravel, and clay; mainly regraded and seeded abandoned gravel pits	Moderately high	Easy	Moderately difficult	Good to fair	Generally stand for long periods of time on slopes of 2:1	Good to fair; locally poor	Generally good, but locally subject to slope wash and severe gullying where slopes range between 5 and 15 percent	
LANDSLIDE DEPOSITS Qs	Silt, sand, clay, and some gravel	Low in material where sliding is caused by normal mass-wasting processes; moderate to high in material where sliding is induced by leakage from irrigation ditches	Easy	Moderately easy	Poor	Slopes generally low and unstable	Very poor	Poor	Landsliding can be minimized or even eliminated by control of water through selective use of underdrains and sealing irrigation ditches
ALLUVIUM Qh	Gravel, sand, silt, and minor amounts of clay	High to very high	Easy	Moderately easy	Fair to good	Stands in steep to near-vertical slopes for months when dry; subject to severe gullying	Poor to fair	Poor; subject to periodic flooding, scour, and gully wash	Limited use as fill and surfacing material for highways
LAKE DEPOSITS Q1	Silt, sand, gravel, clay, and marl	Moderate in deposits along Rock Creek; low to moderate in deposits along Sand Creek	Easy	Easy	Fair to poor	Stands in near-vertical slopes for long periods of time	Poor to fair	Poor	Small volume limits use and poses no significant hazard in construction
KAYCEE FORMATION Qk	Sand, silt, gravel, and minor amounts of clay	Variable; moderate to high	Easy	Easy	Fair	Slopes generally very steep; vertical cuts stand for long periods of time; most failures take place by undercutting and slippage of vertical blocks	Poor to fair	Poor; subject to sheet flooding and gully wash	
UCROSS FORMATION Qu	Gravel, sand, silt, and silty clay	Moderate to high in the lower gravel; moderate to low in finer grained sediments of upper part of unit	Easy to moderately difficult in lower gravel; easy for upper part of unit	Moderately difficult in lower gravel; easy in upper part of unit	Fair to good	Upper part generally stands in near-vertical slopes for long periods of time; lower part stands in steep to moderately gentle slopes	Fair to poor	Poor to moderate; subject to scour during floods	Limited use as fill and surfacing material for highways; the upper plastic silty clay is usually considered as overburden waste
COLLUVIUM Qc	Silt, sand, fine gravel, and minor amounts of coarse gravel and boulders	Moderate to high	Easy	Moderately easy	Fair	Vertical cut slopes stand for short periods of time	Fair to poor	Poor; subject to sheet flooding and gully wash	
TERRACE ALLUVIUM QTu, Qt2, Qt3_, Qt3, QTt4	Coarse gravel and boulders with some sand and silt	Generally high	Easy to moderately easy; locally large boulders must be moved aside	Moderate to difficult	Fair to good	Near-vertical cuts stand for short periods of time; longer periods of exposure lead to raveling and development of moderately gentle slopes of about 1:1	Fair to poor	Poor to moderate	Extensive use as surfacing material for highways and as aggregate in asphalt and concrete
CLINKER Qc1	Fused slag and baked shale, siltstone, and sandstone	Generally high due to large number of fractures and vesicles caused by gas bubbles	Generally easy; locally larger masses of slag must be moved aside	Moderate to difficult	Poor to good; highly variable over short distances	Characteristically stands in steep slopes; vertical or near-vertical cuts usually stand for long periods of time	Generally good; locally poor	Generally resistant	Extensive use as surfacing material for secondary roads and driveways; was used as railroad ballast; used as ornamental and decorative stone
WASATCH FORMATION Tw, Twk	Sandstone, siltstone, shale, conglomerate, coal, and lignite	Variable: high to moderate in most sandstones and coals; low in shales and siltstones	Generally easy; difficult to moderately difficult for some of the cemented channel sandstones	Easy for most shales, sandstones, and siltstones; difficult for some sandstones	Generally fair to good; locally excellent on some of the cemented channel sandstones; fair to poor on some of the shales and siltstones	Variable; near-vertical cuts in shales, siltstones, and some sandstones generally stand for short to longer periods of time; near-vertical cuts in cemented sandstone stand for indefinitely long periods of time	Variable; fair to good; locally along some stream valleys may be subject to liquefaction	Variable; generally good to fair; cemented sandstones highly resistant; shales and siltstones poorly resistant; locally subject to sheet flooding, gully wash, and scour	Coal has been mined locally by underground methods; subsidence features over abandoned coal mines east of I-90 in sec. 25 along Rock Creek; used as fill for highways

[1]According to data compiled by Algermissen and Perkins (1976), the area is seismically quiet and classed as one of probably no to minor structural damage from natural earthquakes.