



Wyoming State Geological Survey
Geologic Hazards Section

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Preliminary 1:500,000-Scale Digital Surficial Geology Map of Wyoming

by

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Geologic Hazards Section Digital Map 98-1
(HSDM 98-1)

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Background

The Surficial Geology Map of Wyoming shows the surficial features (landforms) and deposits present on the surface in Wyoming. The map was primarily generated for a statewide study of aquifer vulnerability to contamination from pesticides. In that context, it was to be used to assist in the generation of a new State soils map, to analyze the effects of the vadose zone on contaminant migration, to define specific Quaternary-age aquifers, and to refine the analysis of regional hydrogeologic settings.

The Surficial Geology Map of Wyoming can be used, in conjunction with a bedrock geologic map, as a guide in siting new facilities or industries in Wyoming. It can also be used to identify and locate geologic hazards, such as landslides and windblown deposits, or to assist in the search for shallow ground water supplies and for construction aggregate. The map has already been used to assist the Wyoming Gap Analysis Project (Merrill and others, 1997) in southwestern Wyoming, and in the generation of Quaternary Geologic Maps of Wyoming.

Existing Mapping Resources

In late 1994, the Wyoming State Geological Survey started mapping the surficial geology of the entire state. The mapping was accomplished through the use of limited existing surficial geology maps, existing bedrock geology maps, existing soil surveys, existing landslide maps, existing windblown deposits maps, existing clinker maps, and aerial photography. Approximately 85% of Wyoming had to be newly mapped for surficial geology, which was accomplished by interpreting aerial photography and using existing related references.

Aerial Photography

The aerial photography used to generate the surficial geology map was predominantly U.S. Geological Survey (USGS) National High Altitude Photography (NHAP I, 1980 - 1982). The USGS photography was color infrared at a scale of 1:58,200. In addition, Bureau of Land Management (BLM) photography (CPIR, RWIR, WWIR, and RKSP series, 1974-1976) was

used to provide detail in select areas of the State. The BLM photos were color infrared at a scale of 1:31,680. In northeastern Laramie County and southeastern Goshen County, U.S. Department of Agriculture - American Soil Conservation Service (USDA - ASCS) photography (AAM and BBT Series, 1966) was used where NHAP photography was not available. The USDA - ASCS photography was black and white at a scale of 1:20,000. In localized areas, additional photography from multiple sources and dates was used to fill small gaps in the NHAP coverage. The photography was analyzed by using a Fairchild Aviation Corporation Magnifying Mirror Stereoscope and an Abrams Instrument Corporation Pocket Stereoscope.

Surficial Geology Maps

Existing maps of surficial geology were examined, modified, and transferred to a 1:500,000-scale base map. In Yellowstone National Park and northern Teton County, existing surficial geologic maps of the area (Pierce, 1973, 1974a, 1974b, 1974c; Richmond, 1973a, 1973b, 1973c, 1973d, 1974, 1977; Richmond and Pierce, 1971, 1972; Richmond and Waldrop, 1972, 1975; Waldrop, 1975a, 1975b; Waldrop and Pierce, 1975) were modified to provide a classification consistent with the rest of the project. In southwest Wyoming, existing surficial materials maps for the Kemmerer and Evanston 30' x 60' Quadrangles (Gibbons, 1986) were also modified, after examination of aerial photography, to provide a classification consistent with the rest of the project. In the Powder River Basin, existing surficial geologic maps for the Recluse 30' x 60' Quadrangle (Reheis and Williams, 1984), the Reno Junction 30' x 60' Quadrangle (Reheis and Coates, 1987), and the Gillette 30' x 60' Quadrangle (Reheis, 1987) were slightly modified to provide a classification consistent with the rest of the project.

Mapping Techniques

The Geologic Hazards Section at the Wyoming State Geological Survey has developed a series of techniques for mapping surficial features and deposits from aerial photography. Over the last sixteen years, Section personnel have mapped landslides, windblown deposits, active faults, and man-made features for the entire State of Wyoming. Much of the previous work has been accomplished by conducting a field examination of the area of interest, and then by applying the field examination to the interpretation of aerial photographs. Most of the interpretative techniques utilized in this project were derived from limited field examination in addition to standard aerial photo interpretation methodologies as defined in Von Bandat (1962), Reeves, Anson, and Landen (1975), Avery (1977), and Lillesand and Kiefer (1979).

Surficial features and deposits were mapped at scales of 1:100,000 and 1:500,000. The smallest feature/deposit shown on the 1:100,000-scale map has a diameter or width of approximately 200 meters. At a scale of 1:500,000, the smallest feature/deposit shown has a diameter or width of approximately 500 meters. Material types are not delineated on the Surficial Geology Map of Wyoming.

Classification Scheme

The classification scheme for surficial geologic units developed by the Wyoming State Geological Survey was a modification of those developed by Gibbons (1986a, 1986b), Pierce

(1973, 1974a, 1974b, 1974c), Reheis (1987), Reheis and Coates (1987), Reheis and Williams (1984), Richmond (1973a, 1973b, 1973c, 1973d, 1974, 1977), Richmond and Pierce (1971, 1972), Richmond and Waldrop (1972, 1975), Waldrop (1975a, 1975b), and Waldrop and Pierce (1975). The classification scheme has two phases, with the first phase being a simple classification of single units, such as alluvium (a), colluvium (c), eolian (e), bedrock (R), and grus (u). The complete single-element classification is as follows:

- A old alluvial plain - a broad, relatively flat deposit formed by the regional erosion of coalescing alluvial and associated alluvial deposits.
- a alluvium - stream and river deposits
- b bench - a strip of relatively level earth or rock, raised and capped with gravel.
- b/m bench and/or mesa (could not be determined from aerial photos)
- c colluvium - loose and incoherent deposits, usually at the foot of a cliff or on the surface of a slope and there chiefly by gravity.
- d dissected
- e eolian deposits - wind blown deposits, includes sand, silt, and clay
- f alluvial fan deposits - a fan shaped deposit made by a stream or a debris flow where they have run out onto a level plain.
- G glaciated bedrock - bedrock that has been scoured and carved out by glacial action.
- g glacial deposits - deposits that have been formed through glacial action, such as till and moraine.
- h hot spring deposit - travertine and siliceous sinter deposits.
- i includes other surficial deposits (25 element classification)
- K Karst - a type of topology formed over limestone, dolomite, gypsum, or other salts by dissolving or solution, and that is characterized by closed depressions or sinkholes.
- k clinker - bedrock that has been baked and fused as a result of a burning coal seam.
- L Tertiary landslide
- l landslide - earth and rock which became loosened from a hillside and slides, flows, or falls down the slope.
- M large open pit mine/quarry
- m mesa - a bedrock-capped plateau or tableland.
- o glacial outwash - alluvium and drift deposited by meltwater streams beyond active glacier ice.
- p playa lake and playa lake deposits - broad, shallow sheets of water which quickly gather and evaporite, leaving mud flats or broad, shallow deposits.
- q periglacial deposits - patterned ground associated with nearby glaciated areas.
- R bedrock
- r residuum - a residual deposit remaining in place after the decomposition of rocks.
- s slopewash - soil and rock material that has been moved down a slope by gravity assisted by running water.
- T structural terrace - a terrace cut in bedrock that is mantled with a thin veneer of alluvium.
- T/t structural terrace and/or terrace deposits (could not be determined from aerial photos)

t	terrace deposits - relict alluvial deposits on relatively flat, horizontal, or gently inclined surfaces which are bounded by a steeper ascending slope on one side and by a steeper descending slope on the opposite side.
t	terrace deposits and/or structural terrace deposits– could not be determined from aerial photos.
u	grus - an accumulation of angular, coarse-grained fragments resulting from the granular disintegration of crystalline rocks.
v	volcanic neck – cylindrical to spire-shaped form that is a remnant of solidified magma that filled the vent of an extinct volcano.
w	lacustrine deposits - deposits associated with lakes.
x	truncated, upturned bedrock

The second phase of the classification combines the single elements into a multi-element classification for a specific mapping unit. In many cases, a specific mapping unit may be composed of many single elements, such as slope wash (s), colluvium (c), and bedrock (R), that in certain areas can not be shown separately at scales of 1:100,000 or 1:500,000. In such cases, the single elements were combined into a more complex unit (scR), with the single elements ranked from most dominant to least dominant. The mapping unit scR would then represent a complex deposit composed of slopewash, colluvium, and bedrock outcrops, with more slopewash present than either colluvium or bedrock outcrop. Approximately 650 complex units were mapped for the 1:100,000-scale map and 577 units were mapped for the 1:500,000-scale map, with a simple description of each unit presented in Appendix A. These complex units for the 1:500,000-scale map are stored in the attribute SG-UNIT.

In order to achieve the objectives of the Ground-Water Vulnerability to Pesticide Contamination Project (Hamerlinck and Arneson, 1998), it was necessary to devise a classification scheme that was a simplification of the complex 650-unit scheme described above. A 25-element classification scheme that delineated simplified mapping units of most significance to contaminant migration was devised. The 25-element classification was composed of simple combinations of the single elements described above, and also included each of the 650 complex units as subsets. For example, the classification *bi* represents a bench that includes eolian, slopewash, outwash, and bench/mesa deposits. These attributes are stored in the layer item RECLASS. The complete association between the 25-element classification and the 650-unit classification is presented in Appendix B. The 25-element classification is presented below:

Ai	Old alluvial plain with scattered deposits of eolian, residuum, and slopewash
ai	Alluvium with scattered deposits of terrace, slopewash, eolian, residuum, grus and glacial
aR	Shallow Alluvium mixed with scattered bedrock outcrops
bi	Bench including eolian, slopewash, outwash, and bench and/or mesa
bdi	Dissected bench with scattered deposits of residuum, slopewash, landslide, and eolian
tdi	Dissected terrace deposits mixing with alluvium, residuum, eolian, and slopewash
ti	Terrace deposits mixed with scattered deposits of alluvium, residuum, eolian,

	slopewash, and outwash
tre	Shallow terrace deposits mixed with scattered deposits of eolian and residuum
fi	Alluvial fan and gradational fan deposits mixed with scattered deposits of slopewash, residuum, and eolian
fdi	Dissected alluvial fan and gradational fan deposits mixed with scattered deposits of slopewash and residuum
mi	Mesa including scattered deposits of residuum and eolian
ei	Eolian mixed with scattered deposits of residuum, alluvium, and slopewash
oai	Glacial outwash and alluvium mixed with scattered deposits of glacial, terrace, hot spring, bedrock outcrops, residuum, slopewash and grus
gi	Glacial deposits mixed with scattered deposits of slopewash, residuum, grus, alluvium, colluvium, landslide, and/or bedrock outcrops
li	Landslide mixed with scattered deposits of slopewash, residuum, Tertiary landslides, and bedrock outcrops; landslides too small and numerous to show separately
pea	Playa deposits mixed with scattered deposits of alluvium, eolian, and residuum; playa deposits too small to show separately
sci	Slopewash and colluvium mixed with scattered deposits of slopewash, residuum, grus, glacial, periglacial, alluvium, eolian, and/or bedrock outcrops
ri	Residuum mixed with alluvium, eolian, slopewash, grus, and/or bedrock outcrops
ui	Grus mixed with alluvium, eolian, slopewash, and/or bedrock outcrops
Ri	Bedrock and glaciated bedrock including hot spring deposits and volcanic necks; mixed with scattered shallow deposits of eolian, grus, slopewash, colluvium, residuum, glacial, and alluvium.
Mi	Mined areas mixed with scattered deposits of residuum, slopewash, and/or bedrock outcrops
Ki	Karst areas mixed with scattered deposits of residuum, slopewash, alluvium and/or bedrock outcrops
ki	Clinker mixed with scattered deposits of residuum, slopewash, alluvium and/or bedrock outcrops
xi	Truncated bedrock mixed with scattered shallow deposits of eolian, terrace, residuum, alluvium, old alluvial plain, bench, and slopewash
Ti	Structural terrace including and/or mixed with deposits of alluvium, eolian, residuum, slopewash, and terrace.

Project Mapping

In parts of western Wyoming, the surficial geology was directly mapped at a scale of 1:500,000 by utilizing aerial photography, existing landslide maps, and existing geologic maps. The reasons for this approach in western Wyoming are that many of the surficial features were previously mapped landslides or glacial deposits, and that the terrain was distinct enough to allow for mapping at a scale of 1:500,000. In Teton County and northern Lincoln County, the geologic map of Grand Teton National Park (Love, Reed, and Christiansen, 1992), the geologic map of the Wyoming portion of the Driggs 1 x 2 (Love 1982), and the Geologic Map of

Wyoming (Love and Christiansen, 1985) served as the basis for the surficial geology mapped from aerial photography. In the central parts of Lincoln County, the geologic maps of the Preston 1 x 2 Quadrangle (Oriol and Platt, 1980), the Geologic Map of Wyoming (Love and Christiansen, 1985), the Cokeville 30-Minute Quadrangle (Rubey, Oriol, and Tracey, 1980), and the Afton and part of the Big Piney 30-Minute Quadrangles (Rubey, 1973) served as the basis for the surficial geology mapped from aerial photography. In the Wind River Basin and surrounding mountains, the Structural Geology of the Wind River Basin, Wyoming (Keefer, 1970), the Geologic Map of Wyoming (Love and Christiansen, 1985), the Mineral Resources of the Teton Wilderness and Adjacent Areas (Antweiler and others, 1989), the Ground-Water Resources of the Wind River Indian Reservation, Wyoming (McGreevy, Hodson, and Rucker, 1969), and the Ground-Water Reconnaissance of the Green River Basin, Southwestern Wyoming (Welder, 1968) served as the basis for the surficial geology mapped from aerial photography. Landslides were derived from Case and others (1991) and Larsen and others (1991).

Most of Wyoming was newly mapped at a scale of 1:100,000 by utilizing the previously mentioned photography. The reason for mapping most of the State at a scale of 1:100,000 instead of at a scale of 1:500,000 was that there was insufficient detail on existing 1:500,000-scale base layers to properly locate small features in the basins and in areas of low relief. All available geologic maps listed in Wyoming State Geological Survey Map Series 9A-9R (De Bruin, 1983, 1984, 1985; De Bruin and Greer, 1986; Glass, 1981; Greer and Ver Ploeg, 1989; King and Ver Ploeg, 1990) provided guidance for the mapping.

Many of the 1:100,000-scale surficial geology maps contained too much detail to be transferred to the 1:500,000-scale base. In such areas, mapped units were combined before they were transferred to the 1:500,000-scale base, with every effort made to combine similar or related units. The same mapped units were not consistently combined, as the combinations were dependent only on the density of the mapped units in any area.

GIS Methodology

The 1:500,000-scale inked green-line copy of the surficial geology linework drafted at the Wyoming State Geological Survey was scanned into ARC/INFO Version 6.2⁴ at a 400 dpi (dots per inch) resolution by the Wyoming Water Resources Center GIS Lab. Because of the physical size of a 1:500,000-scale map of Wyoming, the map had to be scanned in three portions. Each of these portions was individually registered using latitude-longitude tic locations, and eventually rejoined. The RMS (Root Mean Squared) error in the registration procedure was limited to 0.006 inches as a standard. The scanned raster image was converted to a vector GIS format using ARC/INFO's GRIDLINE utility and then manually edited within ARCEDIT to remove any linework anomalies. In addition to removing slivers and other vectorization artifacts, a new state boundary was added that had been previously digitized at a scale of 1:100,000 as a part of the Wyoming Gap Analysis Project (Merrill and others, 1997). This boundary was added to ease the comparison with other 1:100,000-scale datasets previously created within the state. Quality control procedures, which consisted of plotting the new dataset at a scale of 1:500,000 and comparing it on a light-table to the original to detect linework errors and omissions, were then

⁴ Product of Environmental Systems Research Institute, Redlands, CA

performed on the data. Once attributed, the dataset was once again checked for accuracy. Dissolve routines as well as extensive manual inspections were performed to identify unclosed polygons as well as mis-labeled polygons. After a thorough review by the WSGS, several small changes were made to the linework to add necessary additional detail. These changes were made using a digitizer and were limited to small areas in the western edge of the state. Once again the RMS error was limited to 0.006 inches. When the linework was finalized, 47,062 line segments were included as well as 16,608 individual polygons.

Each polygon was attributed with the ten-digit character item SG-UNIT which contains the original surficial geology unit attribute. The domain of this field included the 577 original descriptions. Another field was later added to depict the simplified attributing scheme developed by the WSGS. This character field was called RECLASS and includes only the 25 simplified values.

The data layer currently exists as a Lambert Conformal Conic projection with standard parallels of 33 and 45 degrees north latitude. The central meridian is defined as 107.5 degrees west and the projection's origin is 41 degrees north latitude. No false northings or eastings were used.

Currently the product can be referred to as Version 1.0 but additional errors may exist which will be fixed in future releases. It should be noted that if the product is viewed at a scale much larger than 1:500,000 the linework will appear jagged. This is an artifact remaining from the vectorization process that exists within the ARC/INFO software. No smoothing routines were performed on the linework in order to ensure that no error propagation exists.

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APPENDIX A

650 ELEMENT CLASSIFICATION DESCRIPTIONS

Base Classification

A	old alluvial plain
a	alluvial deposits
b	bench deposits
b/m	bench deposits and/or mesa caprock
c	colluvium
d	dissected
e	eolian deposits
f	alluvial fan deposits
G	glaciated bedrock
g	glacial deposits
h	hot spring deposit
i	includes other surficial deposits (used with 25 element classification)
K	Karst
k	clinker
L	Tertiary landslide
l	landslide
M	large open pit mine/quarry
m	mesa caprock
o	glacial outwash
p	playa lake and playa lake deposits
q	periglacial deposits
R	bedrock
r	residuum
s	slopewash
T	structural terrace
T/t	structural terrace and/or terrace deposits
t	terrace deposits
t/T	terrace deposits and/or a structural terrace
u	grus
v	volcanic neck/flow
w	lacustrine deposits
x	truncated, upturned bedrock

No letter for pediment.

Detailed Classification

The first letter represents the main surficial unit seen on aerial photographs. Following letters represent other deposits that were seen in smaller amounts.

Italics indicate classification codes present on 1:100,000 scale maps, but not present on the 1:500,000 scale map.

Ad	dissected old alluvial plain deposits
Ade	dissected old alluvial plain deposits mixed with eolian deposits
Adr	dissected old alluvial plain deposits mixed with residuum
Adre	dissected old alluvial plain deposits mixed with residuum and eolian deposits
Adrs	dissected old alluvial plain deposits mixed with residuum and slopewash
Ads	dissected old alluvial plain deposits mixed with slopewash
<i>Ae</i>	old alluvial plain deposits mixed with eolian deposits
<i>Aer</i>	old alluvial plain deposits mixed with eolian deposits and residuum
Aerx	old alluvial plain deposits mixed with eolian deposits and residuum on truncated, upturned bedrock
Are	old alluvial plain deposits mixed with residuum and eolian deposits
a	alluvial deposits
acg	alluvial deposits mixed with glacial deposits
ae	alluvial deposits mixed with eolian deposits
aep	alluvial deposits mixed with eolian and playa lake deposits
aer	alluvial deposits mixed with eolian and residuum
af	alluvial deposits mixed with alluvial fan deposits
afe	alluvial deposits mixed with alluvial fan and eolian deposits
afr	alluvial deposits mixed with alluvial fan deposits and residuum
afs	alluvial deposits mixed with alluvial fan and slopewash deposits
aft	alluvial deposits mixed with alluvial fan that grade into terrace deposits
ag	alluvial deposits mixed with glacial deposits
agh	alluvial deposits mixed with glacial and hot spring deposits
ah	alluvial deposits mixed with hot spring deposits
ao	alluvial deposits mixed with glacial outwash
ap	alluvial deposits mixed with playa lake deposits
aR	alluvial deposits with bedrock outcrops
aRe	alluvial deposits mixed with bedrock outcrops and eolian deposits
ar	alluvial deposits mixed with residuum
are	alluvial deposits mixed with residuum and eolian deposits
arK	alluvial deposits mixed with residuum and Karst features
<i>arR</i>	alluvial deposits mixed with residuum and bedrock outcrops
ars	alluvial deposits mixed with residuum and slopewash deposits
arse	alluvial deposits mixed with residuum, slopewash, and eolian deposits
arsg	alluvial deposits mixed with residuum, slopewash, and glacial deposits
arT/t	alluvial deposits mixed with residuum on a structural terrace or terrace deposits
arw	alluvial deposits mixed with residuum and lacustrine deposits
as	alluvial deposits mixed with slopewash
ase	alluvial deposits mixed with slopewash and eolian deposits
aseR	alluvial deposits mixed with slopewash, eolian deposits and bedrock outcrops
asf	alluvial deposits mixed with slopewash and alluvial fan deposits
asR	alluvial deposits mixed with slopewash and bedrock outcrops
asRe	alluvial deposits mixed with slopewash, bedrock outcrops and eolian deposits
asr	alluvial deposits mixed with slopewash and residuum
asre	alluvial deposits mixed with slopewash, residuum and eolian deposits
at	alluvial deposits mixed with terrace deposits
ate	alluvial deposits mixed with terrace and eolian deposits
ater	alluvial deposits mixed with terrace deposits, eolian deposits, and residuum

atr	alluvial deposits mixed with terrace deposits and residuum
ats	alluvial deposits mixed with terrace deposits and slopewash
au	alluvial deposits mixed with grus
aw	alluvial deposits mixed with lacustrine deposits
b	bench deposits
bd	dissected bench deposits
bde	dissected bench deposits mixed with scattered eolian deposits
bdl	dissected bench deposits mixed with scattered landslide debris
bdr	dissected shallow bench deposits mixed with residuum
bdre	dissected shallow bench deposits mixed with residuum and eolian deposits
bds	dissected bench deposits mixed with slopewash
be	bench deposits mixed with scattered eolian deposits
b/m	bench deposits and/or mesa caprock with shallow residuum
b/md	dissected bench deposits and/or dissected mesa caprock with shallow residuum
b/mde	dissected bench deposits and/or dissected mesa caprock with shallow residuum, mixed with scattered eolian deposits
b/me	bench deposits and/or mesa caprock with shallow residuum, mixed with scattered eolian deposits
bo	bench deposits and/or glacial outwash
bod	dissected bench deposits and/or dissected glacial outwash
br	shallow bench deposits mixed with residuum
bre	shallow bench deposits mixed with residuum and scattered eolian deposits
brx	shallow bench deposits mixed with residuum on truncated, upturned bedrock
bs	shallow bench deposits mixed with slopewash
bx	shallow bench deposits on truncated, upturned bedrock
bxe	shallow bench deposits on truncated, upturned bedrock mixed with scattered eolian deposits
c	colluvium
cf	colluvium mixed with alluvial fan deposits
cfR	colluvium mixed with alluvial fan deposits and bedrock outcrops
cgR	colluvium mixed with glacial deposits and bedrock outcrops
cgRG	colluvium mixed with glacial deposits, bedrock outcrops and glaciated bedrock
cR	colluvium mixed with bedrock outcrops
cRs	colluvium mixed with bedrock outcrops and slopewash
cs	colluvium mixed with slopewash
csa	colluvium mixed with slopewash, and alluvial deposits
csae	colluvium mixed with slopewash, alluvial and eolian deposits
csaR	colluvium mixed with slopewash, alluvial deposits and bedrock outcrops
csf	colluvium mixed with slopewash, and alluvial fan deposits
csfR	colluvium mixed with slopewash, alluvial fan deposits and bedrock outcrops
csg	colluvium mixed with slopewash, and glacial rubble
csga	colluvium mixed with slopewash, glacial rubble and alluvial deposits
csgG	colluvium mixed with slopewash, glacial rubble and glaciated bedrock
csgGq	colluvium mixed with slopewash, glacial rubble, glaciated bedrock and periglacial deposits
csgR	colluvium mixed with slopewash, glacial rubble and bedrock outcrops
csq	colluvium mixed with slopewash and periglacial deposits
csR	colluvium mixed with and slopewash with bedrock outcrops
csRg	colluvium mixed with and slopewash with bedrock outcrops and glacial deposits
csRq	colluvium mixed with slopewash with bedrock outcrops and periglacial deposits
csr	colluvium mixed with slopewash mixed with residuum
csrf	colluvium mixed with slopewash mixed with residuum and alluvial fan deposits
csrR	colluvium mixed with slopewash mixed with residuum and bedrock outcrops
csuR	colluvium mixed with slopewash mixed with grus and bedrock outcrops
cuR	colluvium mixed with grus with bedrock outcrops
e	eolian deposits
eA	eolian deposits covering old alluvial plain deposits
eAr	eolian deposits covering old alluvial plain deposits and residuum

eArx	eolian deposits covering old alluvial plain deposits mixed with residuum on truncated, upturned bedrock
ea	eolian deposits mixed with alluvial deposits
eap	eolian deposits mixed with alluvial and playa lake deposits
eaR	eolian deposits mixed with alluvial deposits and bedrock
ear	eolian deposits mixed with alluvial deposits and residuum
eat	eolian deposits mixed with alluvial deposits and terrace deposits
eb	eolian deposits covering dissected bench deposits
eb/m	eolian deposits covering bench deposits and/or mesa caprock with shallow residuum
eb/md	eolian deposits covering dissected bench deposits and/or dissected mesa caprock with shallow residuum
<i>ebd</i>	eolian deposits covering dissected bench deposits
ebdr	eolian deposits covering dissected shallow bench deposits and residuum
ep	eolian deposits mixed with playa lake deposits
epa	eolian deposits mixed with playa lake and alluvial deposits
epr	eolian deposits mixed with playa lake deposits and residuum
eR	eolian deposits mixed with bedrock outcrops
eRa	eolian deposits mixed with bedrock outcrops and alluvial deposits
eRr	eolian deposits mixed with bedrock outcrops and residuum
<i>eRrs</i>	eolian deposits mixed with bedrock outcrops, residuum, and slopewash
eRp	eolian deposits mixed with bedrock outcrops and playa lake deposits
eRs	eolian deposits mixed with bedrock outcrops and slopewash
er	eolian deposits mixed with residuum
era	eolian deposits mixed with residuum and alluvial deposits
erb/m	eolian deposits mixed with residuum on shallow bench deposits and/or a mesa caprock
erm	eolian deposits mixed with residuum on mesa caprock
<i>erp</i>	eolian deposits mixed with residuum and playa lake deposits
erR	eolian deposits mixed with residuum and bedrock
ers	eolian deposits mixed with residuum and slopewash
ersa	eolian deposits mixed with residuum, slopewash, and alluvial deposits
ersR	eolian deposits mixed with residuum, slopewash and bedrock
erT/t	eolian deposits mixed with residuum on a structural terrace and/or terrace deposit
erT/ta	eolian deposits mixed with residuum on a structural terrace and/or terrace deposits, and areas of alluvial deposits
erT/td	eolian deposits mixed with residuum on a dissected structural terrace and/or terrace deposit
ert	eolian deposits mixed with residuum and shallow terrace deposits
ertd	eolian deposits mixed with residuum on a dissected shallow terrace deposit
<i>ertx</i>	eolian deposits mixed with residuum and shallow terrace deposits on truncated, upturned bedrock
erx	eolian deposits mixed with residuum on truncated, upturned bedrock
<i>erxA</i>	eolian deposits mixed with residuum on truncated, upturned bedrock and old alluvial plain deposits
es	eolian deposits mixed with slopewash
esa	eolian deposits mixed with slopewash and alluvial deposits
esR	eolian deposits mixed with slopewash and bedrock outcrops
esr	eolian deposits mixed with slopewash and residuum
esra	eolian deposits mixed with slopewash, residuum, and alluvial deposits
et	eolian deposits covering terrace deposits
etd	eolian deposits covering dissected terrace deposits
etdr	eolian deposits covering dissected shallow terrace deposits and mixed with residuum
etr	eolian deposits covering shallow terrace deposits and mixed with residuum
<i>etrx</i>	eolian deposits covering shallow terrace deposits and mixed with residuum on truncated, upturned bedrock
et/T	eolian deposits covering terrace deposits and/or a structural terrace
et/Td	eolian deposits covering dissected terrace deposits and/or a dissected structural terrace
etx	eolian deposits covering shallow terrace deposits and truncated, upturned bedrock
<i>ext</i>	eolian deposits mixed with shallow terrace deposits on truncated, upturned bedrock
f	alluvial fan deposits
fA	alluvial fan deposits that grade into old alluvial plain deposits
fAs	alluvial fan deposits that grade into old alluvial plain deposits mixed with slopewash

fa	alluvial fan deposits that grade into alluvial deposits
fao	alluvial fan deposits that grade into alluvial and/or glacial outwash deposits
far	alluvial fan deposits that grade into alluvial deposits mixed with residuum
fas	alluvial fan deposits that grade into alluvial deposits mixed with slopewash
fb	alluvial fan deposits that grade into bench deposits
fbd	dissected alluvial fan deposits that grade into bench deposits
fbdr	dissected alluvial fan deposits that grade into bench deposits, mixed with residuum
fbdre	dissected alluvial fan deposits that grade into bench deposits, mixed with residuum and eolian deposits
fbds	dissected alluvial fan deposits that grade into bench deposits, mixed with slopewash
<i>fbe</i>	alluvial fan deposits that grade into bench deposits, with scattered eolian deposits
fbr	shallow alluvial fan deposits that grade into bench deposits, mixed with residuum
fbs	shallow alluvial fan deposits that grade into bench deposits, mixed with slopewash
fd	dissected alluvial fan deposits, usually showing topographic reversal
fdr	dissected alluvial fan deposits mixed with residuum
fdrs	dissected alluvial fan deposits mixed with residuum and slopewash
fds	dissected alluvial fan deposits mixed with slopewash
fe	alluvial fan deposits mixed with eolian deposits
fo	alluvial fan deposits mixed with glacial outwash
frsa	alluvial fan deposits mixed with residuum, slopewash, and alluvial deposits
fs	alluvial fan deposits mixed with slopewash
fsa	alluvial fan deposits mixed with slopewash and alluvial deposits
fse	alluvial fan deposits mixed with slopewash and eolian deposits
fsr	shallow alluvial fan deposits mixed with slopewash and residuum
fT/tsa	alluvial fan deposits that grade into a structural terrace and/or terrace deposits mixed with slopewash and alluvial deposits
ft	alluvial fan deposits that grade into terrace deposits
ftd	dissected alluvial fan deposits that grade into terrace deposits
ftdar	dissected alluvial fan deposits that grade into terrace deposits mixed with alluvial deposits and residuum
ftde	dissected alluvial fan deposits that grade into terrace deposits mixed with eolian deposits
ftdr	dissected alluvial fan deposits that grade into terrace deposits mixed with residuum
ftdre	dissected alluvial fan deposits that grade into terrace deposits mixed with residuum and eolian deposits
ftds	dissected alluvial fan deposits that grade into terrace deposits mixed with slopewash
fte	alluvial fan deposits that grade into terrace deposits mixed with scattered eolian deposits
<i>ftod</i>	dissected alluvial fan deposits that grade into dissected terrace deposits and glacial outwash
ftt	shallow alluvial fan deposits that grade into shallow terrace deposits, mixed with residuum
fts	alluvial fan deposits that grade into terrace deposits, mixed with slopewash
Gcg	glaciated bedrock mixed with colluvium and glacial rubble
Gcsg	glaciated bedrock mixed with colluvium, slopewash and glacial rubble
Gcuq	glaciated bedrock mixed with colluvium, grus and periglacial deposits
Gg	glaciated bedrock mixed with glacial deposits
Gga	glaciated bedrock mixed with glacial deposits and alluvial deposits
Ggc	glaciated bedrock mixed with glacial deposits and colluvium
Ggcs	glaciated bedrock mixed with glacial deposits, colluvium and slopewash
Ggr	glaciated bedrock mixed with glacial deposits and residuum
Ggs	glaciated bedrock mixed with glacial deposits and slopewash
Glg	glaciated bedrock mixed with landslide and/or glacial deposits
Gog	glaciated bedrock covered by outwash and glacial deposits
GR	glaciated bedrock mixed with bedrock outcrops
GRc	glaciated bedrock mixed with bedrock outcrops and colluvium
Gr	glaciated bedrock mixed with residuum
Grg	glaciated bedrock mixed with residuum and glacial deposits
Gsg	glaciated bedrock mixed with slopewash and glacial deposits
<i>Gsq</i>	glaciated bedrock mixed with slopewash and periglacial deposits
Gsu	glaciated bedrock mixed with slopewash and grus
Gucg	glaciated bedrock mixed with grus, colluvium and glacial deposits

Gucq	glaciated bedrock mixed with grus, colluvium and periglacial deposits
Guq	glaciated bedrock mixed with colluvium and periglacial deposits
Gusg	glaciated bedrock mixed with grus, slopewash and glacial deposits
g	glacial deposits
g?	possible glacial deposits
ga	glacial and alluvial deposits
gcsG	glacial deposits mixed with colluvium, slopewash, and glaciated bedrock
ge	glacial deposits mixed with eolian (loess) deposits
gG	glacial deposits mixed with glaciated bedrock
gGc	glacial deposits mixed with glaciated bedrock and colluvium
gh	glacial deposits mixed with hot spring deposits
glacier	areas of larger glacial ice, primarily in the Wind River and Teton Mountain Ranges
go	glacial deposits mixed with glacial outwash deposits
gR	glacial deposits mixed with bedrock outcrops
grG	glacial deposits mixed with residuum and glaciated bedrock outcrops
grs	glacial deposits mixed with residuum, and slopewash deposits
gs	glacial deposits mixed with slopewash deposits
gsa	glacial deposits mixed with slopewash, and alluvial deposits
gsaG	glacial deposits mixed with slopewash, alluvial deposits, and glaciated bedrock
gsG	glacial deposits mixed with slopewash and glaciated bedrock
gsR	glacial deposits mixed with slopewash and bedrock outcrops
gt	glacial deposits mixed with terrace deposits
h	hot spring deposits
Kra	karst features mixed with residuum and alluvial deposits
kr	clinker mixed with residuum
kra	clinker mixed with residuum and alluvial deposits
krs	clinker mixed with residuum and slopewash
krsI	clinker mixed with residuum, slopewash, and landslide debris
krsR	clinker mixed with residuum, slopewash, and bedrock outcrops
ksI	clinker mixed with slopewash and landslide debris
ksr	clinker mixed with slopewash and residuum
LAKE	larger lakes and reservoirs
l	landslide debris
la	landslide debris mixed with alluvial deposits
laR	landslide debris mixed with alluvial deposits and bedrock outcrops
lg	landslide debris and/or glacial/periglacial deposits
lsra	landslide debris mixed with slopewash, residuum, and alluvial deposits
M	open pit mine/quarry
MsR	areas of open pit mining mixed with slopewash and bedrock outcrops
m	mesa caprock
mde	dissected mesa caprock with scattered eolian deposits
mdr	dissected mesa caprock mixed with residuum
o	glacial outwash deposits
oe	glacial outwash deposits mixed with scattered eolian deposits
p	playa lake and playa lake deposits
pa	playa lake and playa lake deposits mixed with alluvial deposits
pe	playa lake and eolian deposits, often occurring in a deflation hollow
pediment	a feature that may be a pediment - needs to be defined in the field
pre	playa lake deposits mixed with residuum and eolian deposits
q	periglacial deposits
R	bedrock outcrop with no apparent surficial deposit
Rc	bedrock covered in places by colluvium
Rca	bedrock covered in places by colluvium and alluvial deposits
Rcg	bedrock covered in places by colluvium and glacial rubble
Rcl	bedrock covered in places by colluvium and landslide debris

Rcr	bedrock covered in places by colluvium and residuum
Rcs	bedrock covered in places by colluvium and slopewash
Rcsg	bedrock covered in places by colluvium, slopewash, and glacial rubble
Rcsq	bedrock covered in places by colluvium, slopewash, and periglacial deposits
Rcsr	bedrock covered in places by colluvium, slopewash, and residuum
Rcsu	bedrock covered in places by colluvium, slopewash, and grus
Rcu	bedrock covered in places by colluvium and grus
Rcug	bedrock covered in places by colluvium, grus, and glacial rubble
Rcus	bedrock covered in places by colluvium, grus, and slopewash
Rd	dissected bedrock
Rdrc	dissected bedrock covered in places by residuum and colluvium
Rdre	dissected bedrock covered in places by residuum and eolian deposits
Re	bedrock covered in places by eolian deposits
RGc	bedrock and glaciated bedrock covered in places by colluvium
RGcg	bedrock and glaciated bedrock covered in places by colluvium and glacial rubble
RGcs	bedrock and glaciated bedrock covered in places by colluvium and slopewash
RGg	bedrock and glaciated bedrock covered in places by glacial rubble
RGgc	bedrock and glaciated bedrock covered in places by glacial rubble and colluvium
RGo	bedrock and glaciated bedrock covered in places by glacial outwash
RGr	bedrock and glaciated bedrock covered in places by residuum
RGug	bedrock and glaciated bedrock covered in places by grus and glacial rubble
Rg	bedrock covered in places by glacial deposits
Rgc	bedrock covered in places by glacial deposits and colluvium
Rr	bedrock covered in places by residuum
Rrc	bedrock covered in places by residuum and colluvium
Rrcs	bedrock covered in places by residuum, colluvium, and slopewash
Rrcse	bedrock covered in places by residuum, colluvium, slopewash, and eolian deposits
Rrg	bedrock covered in places by residuum and glacial rubble
RrM	bedrock covered in places by residuum with some areas of surface mines
Rrq	bedrock covered in places by residuum and periglacial deposits
Rrs	bedrock covered in places by residuum and slopewash
Rrsa	bedrock covered in places by residuum, slopewash, and alluvial deposits
Rrsc	bedrock covered in places by residuum, slopewash, and colluvium
Rrse	bedrock covered in places by residuum, slopewash, and eolian deposits
Rrsk	bedrock covered in places by residuum, slopewash, and clinker
Rs	bedrock covered in places by slopewash
Rsa	bedrock covered in places by slopewash and alluvial deposits
Rsc	bedrock covered in places by slopewash and colluvium
Rscr	bedrock covered in places by slopewash, colluvium, and residuum
Rse	bedrock covered in places by slopewash and eolian deposits
Rsf	bedrock covered in places by slopewash and alluvial fan deposits
Rsg	bedrock covered in places by slopewash and glacial rubble
Rso	bedrock covered in places by slopewash and glacial outwash deposits
Rsod	bedrock covered in places by slopewash and glacial outwash deposits, dissected
Rsr	bedrock covered in places by slopewash and residuum
Rsra	bedrock covered in places by slopewash, residuum, and alluvial deposits
Rsre	bedrock covered in places by slopewash, residuum, and eolian deposits
Rsrfe	bedrock covered in places by slopewash, residuum, and alluvial fan deposits
Rsrk	bedrock covered in places by slopewash, residuum, and clinker
Rsrkl	bedrock covered in places by slopewash, residuum, clinker, and scattered landslide debris
Rsrll	bedrock covered in places by slopewash, residuum, and scattered landslide debris
Rsu	bedrock covered in places by slopewash and grus
Ruc	bedrock covered in places by grus and colluvium
Ruce	bedrock covered in places by grus, colluvium and eolian deposits
Rucq	bedrock covered in places by grus, colluvium and periglacial deposits

Rucs	bedrock covered in places by grus, colluvium and slopewash
Rue	bedrock covered in places by grus and eolian deposits
<i>Rug</i>	bedrock covered in places by grus and glacial deposits
Ruo	bedrock covered in places by grus and glacial outwash
Ruq	bedrock covered in places by grus and periglacial deposits
Rus	bedrock covered in places by grus and slopewash
Rusc	bedrock covered in places by grus, slopewash, and colluvium
r	residuum
ra	residuum mixed with alluvial deposits
rab/m	residuum mixed with alluvial deposits on shallow bench deposits and/or mesa caprock
rae	residuum mixed with alluvial and eolian deposits
raes	residuum mixed with alluvial deposits, eolian deposits, and slopewash
raeT/t	residuum mixed with alluvial and eolian deposits on a structural terrace or terrace deposits
<i>raet/T</i>	residuum mixed with alluvial and eolian deposits on terrace deposits or a structural terrace
rap	residuum mixed with alluvial and playa lake deposits
raR	residuum mixed with alluvial deposits and bedrock outcrops
raRe	residuum mixed with alluvial deposits, bedrock outcrops, and eolian deposits
ras	residuum mixed with alluvial deposits and slopewash
rase	residuum mixed with alluvial deposits, slopewash, and eolian deposits
rasR	residuum mixed with alluvial deposits, slopewash, and bedrock outcrops
<i>raTd</i>	residuum mixed with alluvial deposits on a dissected structural terrace
raT/t	residuum mixed with alluvial deposits on a structural terrace or terrace deposits
raT/td	residuum mixed with alluvial deposits on a dissected structural terrace or terrace deposits
raT/tde	residuum mixed with alluvial deposits on a dissected structural terrace or terrace deposits, with scattered eolian deposits
raT/te	residuum mixed with alluvial deposits on a structural terrace or terrace deposits, with scattered eolian deposits
rat	residuum mixed with alluvial deposits and terrace deposits
raw	residuum mixed with alluvial deposits and lacustrine deposits
rb	residuum mixed with shallow bench deposits
rb/m	residuum mixed with shallow bench deposits or residuum on mesa caprock
rb/ma	residuum mixed with shallow bench deposits or residuum on mesa caprock, with scattered alluvial deposits
rb/md	residuum mixed with dissected shallow bench deposits or residuum on dissected mesa caprock
rb/mde	residuum mixed with dissected shallow bench deposits or residuum on a dissected mesa, with scattered eolian deposits
rb/me	residuum mixed with shallow bench deposits or residuum on mesa caprock, with scattered eolian deposits
<i>rcR</i>	residuum mixed with colluvium with bedrock outcrops
rcs	residuum mixed with colluvium and slopewash
rcsR	residuum mixed with colluvium and slopewash, with scattered bedrock outcrops
re	residuum mixed with eolian deposits
rea	residuum mixed with eolian and alluvial deposits
reas	residuum mixed with eolian, alluvial, and slopewash deposits
reR	residuum mixed with eolian deposits and bedrock outcrops
reRd	residuum mixed with eolian deposits on dissected bedrock outcrops
res	residuum mixed with eolian and slopewash deposits
resR	residuum mixed with eolian deposits, slopewash, and bedrock outcrops
resTd	residuum mixed with eolian and slopewash deposits on a dissected structural terrace
resT/t	residuum mixed with eolian and slopewash deposits on a structural terrace or terrace deposits
reT	residuum mixed with eolian deposits on a structural terrace
reT/t	residuum mixed with eolian deposits on a structural terrace or terrace deposits
reT/td	residuum mixed with eolian deposits on a dissected structural terrace or terrace deposits
reT/tR	residuum mixed with eolian deposits on a dissected structural terrace or terrace deposits, with scattered bedrock outcrops
reTd	residuum mixed with eolian deposits on a dissected structural terrace
ret/T	residuum mixed with eolian deposits on a terrace or structural terrace

rfdR	residuum mixed with dissected alluvial fan deposits and bedrock outcrops
rftd	residuum mixed with dissected alluvial fan deposits that grade into dissected terrace deposits
rg	residuum mixed with glacial deposits
rgG	residuum mixed with glacial deposits and glaciated bedrock
rgR	residuum mixed with glacial deposits and bedrock outcrops
rgRG	residuum mixed with glacial deposits, bedrock outcrops, and glaciated bedrock
rL	residuum on Tertiary landslide debris
rm	residuum on mesa caprock
rmd	residuum on dissected mesa caprock
rmde	residuum on dissected mesa caprock with scattered eolian deposits
rme	residuum on mesa caprock with scattered eolian deposits
rmR	residuum on mesa caprock with scattered bedrock outcrops
ro	residuum mixed with glacial outwash
roR	residuum mixed with glacial outwash and bedrock outcrops
rpe	residuum mixed with playa lake and eolian deposits
rR	residuum mixed with bedrock outcrops
rRa	residuum mixed with bedrock outcrops and alluvial deposits
rRae	residuum mixed with bedrock outcrops, with scattered alluvial deposits and eolian deposits
rRcs	residuum mixed with bedrock outcrops, colluvium, and slopewash
rRd	residuum mixed with dissected bedrock outcrops
rRde	residuum mixed with dissected bedrock outcrops and scattered eolian deposits
rRds	residuum mixed with dissected bedrock outcrops and slopewash
rRdsa	residuum mixed with dissected bedrock outcrops, slopewash, and alluvial deposits
rRe	residuum mixed with bedrock outcrops and eolian deposits
rRg	residuum mixed with bedrock outcrops and glacial deposits
rRo	residuum mixed with bedrock outcrops and glacial outwash
rRs	residuum mixed with bedrock outcrops and slopewash
rRsa	residuum mixed with bedrock outcrops, slopewash, and alluvial deposits
rRsc	residuum mixed with bedrock outcrops, slopewash, and colluvium
rRse	residuum mixed with bedrock outcrops, slopewash, and eolian deposits
rs	residuum mixed with slopewash
rsa	residuum mixed with slopewash and alluvial deposits
rsae	residuum mixed with slopewash, alluvial, and eolian deposits
rsak	residuum mixed with slopewash, alluvial deposits, and clinker
rsaR	residuum mixed with slopewash, alluvial deposits, and bedrock outcrops
rsaRd	residuum mixed with slopewash and alluvial deposits on dissected bedrock outcrops
rsaT/d	residuum mixed with slopewash and alluvial deposits on a dissected structural terrace or terrace deposits
rsc	residuum mixed with slopewash and colluvium
rscR	residuum mixed with slopewash, colluvium, and bedrock outcrops
rse	residuum mixed with slopewash and scattered eolian deposits
rseR	residuum mixed with slopewash, scattered eolian deposits, and bedrock outcrops
rsf	residuum mixed with slopewash and alluvial fan deposits
rsfa	residuum mixed with slopewash, alluvial fan deposits, and alluvial deposits
rsfR	residuum mixed with slopewash, alluvial fan deposits, and bedrock outcrops
rsGg	residuum mixed with slopewash, glaciated bedrock, and glacial deposits
rsg	residuum mixed with slopewash and glacial deposits
rsgR	residuum mixed with slopewash, glacial deposits, and bedrock outcrops
rsk	residuum mixed with slopewash and clinker
rskA	residuum mixed with slopewash, clinker, and alluvial deposits
rske	residuum mixed with slopewash, clinker, and eolian deposits
rskR	residuum mixed with slopewash, clinker, and bedrock outcrops
rsL	residuum mixed with slopewash on Tertiary landslide debris
rsq	residuum mixed with slopewash and periglacial deposits
rsR	residuum mixed with slopewash and bedrock outcrops
rsRa	residuum mixed with slopewash, bedrock outcrops, and alluvial deposits

rsRd	residuum mixed with slopewash on dissected bedrock outcrops
rsRda	residuum mixed with slopewash, dissected bedrock outcrops, and scattered alluvial deposits
rsRe	residuum mixed with slopewash, bedrock outcrops, and eolian deposits
rsRg	residuum mixed with slopewash, bedrock outcrops, and glacial rubble
rsRK	residuum mixed with slopewash and bedrock outcrops with karst features
rsRk	residuum mixed with slopewash, bedrock outcrops, and clinker
rsRkl	residuum mixed with slopewash, bedrock outcrops, clinker, and scattered landslide debris
rsRl	residuum mixed with slopewash, bedrock outcrops, and scattered landslide debris
rsRM	residuum mixed with slopewash, bedrock outcrops, and mined-out areas
rsRq	residuum mixed with slopewash, bedrock outcrops, and periglacial deposits
rsT/t	residuum mixed with slopewash on a structural terrace and/or terrace deposits
rst	residuum mixed with slopewash and terrace deposits
rsxe	residuum mixed with slopewash on truncated, upturned bedrock and scattered eolian deposits
rT	residuum on a structural terrace
rTd	residuum on a dissected structural terrace
rTda	residuum on a dissected structural terrace mixed with scattered alluvial deposits
rTdae	residuum on a dissected structural terrace mixed with scattered alluvial and eolian deposits
rTde	residuum on a dissected structural terrace mixed with scattered eolian deposits
rTe	residuum on a structural terrace mixed with scattered eolian deposits
rTdeR	residuum on a dissected structural terrace, with scattered eolian deposits and bedrock outcrops
rTds	residuum on a dissected structural terrace mixed with slopewash
rTs	residuum on a structural terrace mixed with slopewash on the side slopes
rT/t	residuum on a structural terrace and/or terrace deposits
rT/ta	residuum on a structural terrace and/or terrace deposits mixed with scattered alluvial deposits
rT/tae	residuum on a structural terrace and/or terrace deposits mixed with scattered alluvial and eolian deposits
rT/td	residuum on a dissected structural terrace and/or terrace deposits
rT/tda	residuum on a dissected structural terrace and/or terrace deposits mixed with scattered alluvial deposits
rT/tdc	residuum on a dissected structural terrace and/or terrace deposits mixed with scattered eolian deposits
rT/te	residuum on a structural terrace and/or terrace deposits mixed with scattered eolian deposits
rT/tR	residuum on a structural terrace and/or terrace deposits, with scattered bedrock outcrops
rT/ts	residuum on a structural terrace and/or terrace deposits mixed with slopewash
rt	residuum mixed with shallow terrace deposits
rtd	residuum mixed with dissected terrace deposits
rtda	residuum mixed with dissected terrace deposits, with scattered alluvial deposits
rtdc	residuum mixed with dissected terrace deposits, with scattered eolian deposits
rte	residuum mixed with shallow terrace and eolian deposits
rtex	residuum mixed with shallow terrace deposits and eolian deposits on truncated, upturned bedrock
rt/Td	residuum on shallow dissected terrace deposits and/or a structural terrace
rt/Tdc	residuum on shallow dissected terrace deposits and/or a structural terrace, mixed with scattered eolian deposits
rt/Te	residuum on shallow terrace deposits and/or a structural terrace, mixed with scattered eolian deposits
rt/Ts	residuum on shallow terrace deposits and/or a structural terrace, mixed with scattered slopewash deposits
ru	residuum/grus
ruaR	residuum/grus mixed with alluvial deposits and bedrock outcrops
rus	residuum/grus mixed with slopewash
rusR	residuum/grus mixed with slopewash and bedrock outcrops
rx	residuum on truncated, upturned bedrock
rxa	residuum on truncated, upturned bedrock mixed with alluvial deposits
rxae	residuum on truncated, upturned bedrock mixed with alluvial and scattered eolian deposits
rxce	residuum on truncated, upturned bedrock mixed with scattered eolian deposits
rxte	residuum on truncated, upturned bedrock mixed with shallow terrace deposits and scattered eolian deposits
s	slopewash
sa	slopewash mixed with alluvial deposits
sae	slopewash mixed with alluvial and eolian deposits
saf	slopewash mixed with alluvial and alluvial fan deposits

APPENDIX B

TWENTY-FIVE ELEMENT CLASSIFICATION

Italics indicate classification codes present on 1:100,000 scale maps, but not present on the 1:500,000 scale map.

Ai	Old Alluvial Plain (with scattered deposits of e,r, and s)					
	Ad	Ade	Adr	Adre	Adrs	Ads
	<i>Ae</i>	<i>Aer</i>	<i>Are</i>	<i>eA</i>	<i>eAr</i>	
ai	Alluvium (with scattered deposits of t,s,e,r,u and g)					
	a	ae	aer	ar	are	<i>arR</i>
	ars	arse	arsg	arT/t	arw	asre
	at	ate	ater	atr	ats	<i>au</i>
	aw	ea	ear	eat	raw	ta
	tare	w				
aR	Shallow Alluvium (mixed with scattered bedrock outcrops)					
	aR	aRe				
bi	Bench (including e,s,o and b/m)					
	b	be	b/m	b/me	bo	br
	bre	<i>bs</i>	eb	eb/m	erb/m	rb
	rb/m	rb/ma	rb/me			
bdi	Dissected Bench (with scattered deposits of r,s,l and e)					
	bd	bde	bdl	bdr	bdre	bds
	b/md	b/mde	<i>bod</i>	eb/md	<i>ebd</i>	ebdr
	rb/md	rb/mde	sb/md	sbd	sbde	
tdi	Dissected Terrace Deposits (mixing with a,r,e, and s)					
	etd	etdr	rtda	rt/Td	rt/Tde	std
	stde	stdR	td	tda	tdae	tdar
	tde	tdR	tdr	tdre	tds	<i>tdsa</i>
	tdse	tdsr				
ti	Terrace Deposits (mixed with scattered deposits of a,r,e,s, and o)					
	et	rat	st	t	tae	<i>tao</i>
	tar	tare	te	tea	to	toa
	tod	ts				

<i>sag</i>	slopewash mixed with alluvial and glacial deposits
<i>sagG</i>	slopewash mixed with alluvial deposits, glacial deposits, and glaciated bedrock
<i>sagR</i>	slopewash mixed with alluvial deposits, glacial deposits, and bedrock outcrops
<i>saR</i>	slopewash mixed with alluvial deposits and bedrock outcrops
<i>saRe</i>	slopewash mixed with alluvial deposits, bedrock outcrops, and eolian deposits
<i>saRG</i>	slopewash mixed with alluvial deposits, bedrock outcrops, and glaciated bedrock
<i>sar</i>	slopewash mixed with alluvial deposits and residuum
<i>sare</i>	slopewash mixed with alluvial deposits, residuum, and eolian deposits
<i>sarR</i>	slopewash mixed with alluvial deposits, residuum and bedrock outcrops
<i>saT/td</i>	slopewash mixed with alluvial deposits on a dissected structural terrace and/or terrace deposits
<i>sat/Td</i>	slopewash mixed with alluvial deposits on dissected terrace deposits and/or a structural terrace
<i>sau</i>	slopewash mixed with alluvial deposits and grus
<i>sauR</i>	slopewash mixed with alluvial deposits, grus, and bedrock outcrops
<i>sb/md</i>	slopewash on dissected shallow bench deposits or on dissected mesa caprock with shallow residuum
<i>sbd</i>	slopewash on dissected bench deposits
<i>sbde</i>	slopewash on dissected bench deposits, with scattered eolian deposits
<i>sc</i>	slopewash and colluvium
<i>scgR</i>	slopewash mixed with colluvium, glacial deposits, and bedrock outcrops
<i>sca</i>	slopewash mixed with colluvium and alluvial deposits
<i>scaR</i>	slopewash mixed with colluvium, alluvial deposits, and bedrock outcrops
<i>scR</i>	slopewash mixed with colluvium and bedrock outcrops
<i>scRa</i>	slopewash mixed with colluvium, bedrock outcrops, and alluvial deposits
<i>scRq</i>	slopewash mixed with colluvium, bedrock outcrops, and periglacial deposits
<i>scRr</i>	slopewash mixed with colluvium, bedrock outcrops, and residuum
<i>scr</i>	slopewash mixed with colluvium and residuum
<i>scrR</i>	slopewash mixed with colluvium, residuum, and bedrock outcrops
<i>scuR</i>	slopewash mixed with colluvium, grus, and bedrock outcrops
<i>se</i>	slopewash mixed with eolian deposits
<i>sea</i>	slopewash mixed with eolian and alluvial deposits
<i>sf</i>	slopewash mixed with alluvial fan deposits
<i>sfa</i>	slopewash mixed with alluvial fan deposits that grade into alluvial deposits
<i>sfae</i>	slopewash mixed with alluvial fan deposits that grade into alluvial deposits, with scattered eolian deposits
<i>sfaR</i>	slopewash mixed with alluvial fan deposits that grade into alluvial deposits, with scattered bedrock outcrops
<i>sfb</i>	slopewash mixed with alluvial fan deposits that grade into bench deposits
<i>sfbd</i>	slopewash on dissected alluvial fan deposits that grade into bench deposits
<i>sfd</i>	slopewash mixed with dissected alluvial fan deposits
<i>sfdR</i>	slopewash mixed with dissected alluvial fan deposits and bedrock outcrops
<i>sfdR</i>	slopewash mixed with dissected alluvial fan deposits and residuum
<i>sfe</i>	slopewash mixed with alluvial fan and eolian deposits
<i>sfl</i>	slopewash mixed with alluvial fan deposits and landslide debris
<i>sfR</i>	slopewash mixed with alluvial fan deposits and bedrock outcrops
<i>sfRe</i>	slopewash mixed with alluvial fan deposits, bedrock outcrops, and eolian deposits
<i>sfr</i>	slopewash mixed with alluvial fan deposits and residuum
<i>sfra</i>	slopewash mixed with alluvial fan deposits, residuum, and alluvial deposits
<i>sfre</i>	slopewash mixed with alluvial fan deposits, residuum and eolian deposits
<i>sfrR</i>	slopewash mixed with alluvial fan deposits, residuum and bedrock outcrops
<i>sft</i>	slopewash mixed with alluvial fan deposits that grade into terrace deposits
<i>sftd</i>	slopewash mixed with dissected alluvial fan deposits that grade into dissected terrace deposits
<i>sft/Td</i>	slopewash mixed with a dissected complex of alluvial fan deposits that grade into terrace deposits and/or a structural terrace
<i>sfr</i>	slopewash mixed with shallow alluvial fan deposits that grade into shallow terrace deposits, and scattered residuum
<i>sftre</i>	slopewash mixed with alluvial fan deposits that grade into terrace deposits, with scattered residuum and eolian deposits
<i>sG</i>	slopewash mixed with glaciated bedrock

sg	slopewash mixed with glacial deposits
sgG	slopewash mixed with glacial deposits and glaciated bedrock
sgR	slopewash mixed with glacial deposits and bedrock outcrops
<i>slR</i>	slopewash mixed with landslide debris and bedrock outcrops
slrR	slopewash mixed with landslide debris, residuum, and bedrock outcrops
solif	solifluction; small areas of solifluction may be included in the landslide/glacial/periglacial or periglacial classifications
soR	slopewash mixed with glacial outwash and bedrock outcrops
soRd	slopewash mixed with glacial outwash and dissected bedrock outcrops
sR	slopewash mixed with bedrock outcrops
sRe	slopewash mixed with bedrock outcrops and eolian deposits
<i>sRre</i>	slopewash mixed with bedrock outcrops, residuum, and eolian deposits
sr	slopewash mixed with residuum
sra	slopewash mixed with residuum and alluvial deposits
srae	slopewash mixed with residuum, alluvial deposits, and eolian deposits
<i>sraf</i>	slopewash mixed with residuum, alluvial deposits, and alluvial fan deposits
srak	slopewash mixed with residuum, alluvial deposits, and clinker
srakl	slopewash mixed with residuum, alluvial deposits, clinker, and landslide debris
sraR	slopewash mixed with residuum, alluvial deposits, and bedrock outcrops
src	slopewash mixed with residuum and colluvium
srcR	slopewash mixed with residuum, colluvium, and bedrock outcrops
sre	slopewash mixed with residuum and eolian deposits
srea	slopewash mixed with residuum, eolian deposits, and alluvial deposits
<i>srefd</i>	slopewash mixed with residuum, eolian deposits, and dissected alluvial fan deposits
sreR	slopewash mixed with residuum, eolian deposits, and bedrock outcrops
srf	slopewash mixed with residuum and alluvial fan deposits
srfe	slopewash mixed with residuum, alluvial fan deposits, and eolian deposits
srfR	slopewash mixed with residuum, alluvial fan deposits, and bedrock outcrops
<i>srfRe</i>	slopewash mixed with residuum, alluvial fan deposits, bedrock outcrops, and eolian deposits
srg	slopewash mixed with residuum and glacial deposits
srl	slopewash mixed with residuum and landslide debris
srlR	slopewash mixed with residuum, landslide debris, and bedrock outcrops
srR	slopewash mixed with residuum and bedrock outcrops
srRa	slopewash mixed with residuum, bedrock outcrops, and alluvial deposits
srRe	slopewash mixed with residuum, bedrock outcrops, and eolian deposits
srRf	slopewash mixed with residuum, bedrock outcrops, and alluvial fan deposits
srRk	slopewash mixed with residuum, bedrock outcrops, and clinker
srRkl	slopewash mixed with residuum, bedrock outcrops, clinker, and landslide debris
srRl	slopewash mixed with residuum, bedrock outcrops, and landslide debris
srRq	slopewash mixed with residuum, bedrock outcrops, and periglacial deposits
srur	slopewash mixed with residuum/grus and bedrock outcrops
st	slopewash mixed with terrace deposits
std	slopewash mixed with dissected terrace deposits
stde	slopewash mixed with dissected terrace deposits and scattered eolian deposits
stdR	slopewash mixed with dissected terrace deposits and scattered bedrock outcrops
su	slopewash mixed with grus
sua	slopewash mixed with grus and alluvial deposits
suaR	slopewash mixed with grus, alluvial deposits, and bedrock outcrops
sucR	slopewash mixed with grus, colluvium, and bedrock outcrops
sufR	slopewash mixed with grus, alluvial fan deposits, and bedrock outcrops
<i>sug</i>	slopewash mixed with grus and glacial deposits
suR	slopewash mixed with grus and bedrock outcrops
suRg	slopewash mixed with grus, bedrock outcrops, and glacial deposits
<i>sur</i>	slopewash mixed with grus/residuum
sura	slopewash mixed with grus/residuum and alluvial deposits

surR	slopewash mixed with grus/residuum and bedrock outcrops
Tr	Structural terrace with residuum
T/tdra	Dissected structural terrace and/or terrace deposits mixed with residuum and alluvial deposits
T/tr	Structural terrace and/or shallow terrace deposits mixed with residuum
T/tra	Structural terrace and/or shallow terrace deposits mixed with residuum and alluvial deposits
Tdr	Dissected structural terrace mixed with residuum
t	terrace deposits
ta	terrace deposits mixed with alluvial deposits
tae	terrace deposits mixed with alluvial and eolian deposits
tao	terrace deposits mixed with alluvial and glacial outwash deposits
tar	shallow terrace deposits mixed with alluvial deposits and residuum
tare	shallow terrace deposits mixed with alluvial deposits, residuum, and eolian deposits
td	dissected terrace deposits
tda	dissected terrace deposits mixed with alluvial deposits
tdae	dissected terrace deposits mixed with alluvial and eolian deposits
tdar	dissected terrace deposits mixed with alluvial deposits and residuum
tde	dissected terrace deposits mixed with scattered eolian deposits
tdR	dissected terrace deposits mixed with bedrock outcrops
tdr	dissected terrace deposits mixed with residuum
tdre	dissected terrace deposits mixed with residuum and eolian deposits
tdrx	dissected terrace deposits mixed with residuum on truncated, upturned bedrock
tds	dissected terrace deposits mixed with slopewash
tdsa	dissected terrace deposits mixed with slopewash and alluvial deposits
tdse	dissected terrace deposits mixed with slopewash and eolian deposits
tdsr	dissected terrace deposits mixed with slopewash and residuum
te	terrace deposits mixed with scattered eolian deposits
tea	terrace deposits mixed with eolian and alluvial deposits
ter	shallow terrace deposits mixed with eolian deposits and residuum
to	terrace deposits mixed with glacial outwash deposits
toa	terrace deposits mixed with glacial outwash and alluvial deposits
tod	dissected terrace deposits mixed with glacial outwash deposits
t(R)r	bedrock cut terrace, may have terrace deposits, and/or residuum present
tr	shallow terrace deposits mixed with residuum
travertine	a travertine deposit near Dubois
tre	shallow terrace deposits mixed with residuum and scattered eolian deposits
trx	shallow terrace deposits mixed with residuum on truncated, upturned bedrock
ts	terrace deposits mixed with slopewash
tsr	terrace deposits mixed with slopewash and residuum
t/T	terrace deposits and/or a structural terrace (cannot determine from air photos)
t/Tae	terrace deposits and/or a structural terrace mixed with alluvial and eolian deposits
t/Td	dissected terrace deposits and/or a dissected structural terrace
t/Tda	dissected terrace deposits and/or a dissected structural terrace mixed with alluvial deposits
t/Tde	dissected terrace deposits and/or a dissected structural terrace mixed with scattered eolian deposits
t/Tdr	dissected terrace deposits and/or a dissected structural terrace mixed with residuum
t/Tdra	dissected terrace deposits and/or a dissected structural terrace mixed with residuum and alluvial deposits
t/Tdre	dissected terrace deposits and/or a dissected structural terrace mixed with residuum and eolian deposits
t/Te	terrace deposits and/or a structural terrace mixed with scattered eolian deposits
t/Tr	shallow terrace deposits and/or a structural terrace mixed with residuum
tx	shallow terrace deposits on truncated, upturned bedrock
txe	shallow terrace deposits on truncated, upturned bedrock, with scattered eolian deposits
u	grus
uaR	grus mixed with alluvial deposits and bedrock outcrops
uas	grus mixed with alluvial deposits and slopewash
uga	grus mixed with glacial and alluvial deposits
uR	grus mixed with bedrock outcrops

uRe	grus mixed with bedrock outcrops and scattered eolian deposits
ursR	grus/residuum mixed with slopewash and bedrock outcrops
us	grus mixed with slopewash
usa	grus mixed with slopewash and alluvial deposits
usaR	grus mixed with slopewash, alluvial deposits, and bedrock outcrops
<i>usGq</i>	grus mixed with slopewash, glaciated bedrock, and periglacial deposits
usgG	grus mixed with slopewash, glacial deposits, and glaciated bedrock
usgR	grus mixed with slopewash, glacial deposits, and bedrock outcrops
usR	grus mixed with slopewash and bedrock outcrops
usRG	grus mixed with slopewash, bedrock outcrops, and glaciated bedrock
usRq	grus mixed with slopewash, bedrock outcrops, and periglacial deposits
usr	grus mixed with slopewash and residuum
usrR	grus mixed with slopewash, residuum, and bedrock outcrops
v	volcanic neck
w	lacustrine deposits
we	lacustrine deposits mixed with eolian deposits

tre

Shallow Terrace Deposits (mixed with scattered deposits of e and r)

ert	etr	rt	rtd	rtde	rte
rt/Te	rt/Ts	ter	tr	tre	tsr
t/T	t/Tae	t/Td	t/Tda	t/Tde	t/Tdr
t/Tdra	t/Tdre	t/Te	t/Tr		

fi

Alluvial Fan and Gradational Fan Deposits (mixed with scattered deposits of s,r, and e)

af	afe	afr	afs	aft	asf
f	fA	fAs	fa	fao	far
fas	fb	<i>fbe</i>	fbs	fe	fo
frsa	fs	fsa	fse	fsr	fT/tsa
ft	fte	ftr	fts	sf	sfa
sfae	sfb	sfe	<i>sfl</i>	sfr	<i>sfra</i>
sfre	sft	sfr	<i>sftre</i>		

fdi

Dissected Alluvial Fan and Gradational Fan deposits (mixed with scattered deposits of s and r)

fbd	fbdr	fbdre	fbds	fbr	fd
fdr	fdrs	fds	ftd	ftdar	ftde
ftdr	ftdre	ftds	<i>ftod</i>	rfdR	rftd
sfd	sfd	sfd	sftd	<i>sft/Td</i>	

mi

Mesa

erm	<i>m</i>	mde	mdr	rm	rmd
rmde	rme	rmR			

ei

Eolian (mixed with scattered deposits of r,a, and s)

e	eRp	er	era	erR	ers
ersa	ersR	ertd	erT/t	erT/ta	erT/td
es	esr	esra	et/T	et/Td	

oai

Glacial Outwash and Alluvium (mixed with scattered deposits of g,t,h,R,r,s and u)

acg	ag	agh	ah	ao	ga
gh	go	gt	o	oe	<i>Rso</i>
<i>Rsod</i>	Ruo	ro	roR	rRo	soR
soRd					

gi

Glacial Deposits (mixed with scattered deposits of s,r,u,a,c,l, and/or R)

cgR	cgRG	csg	csgG	csgR	csRg
Gog	g	g?	gcsG	ge	gGc
grs	gs	gsa	gsaG	gsG	gsR
lg	RGo	rg	<i>rsGg</i>	rsg	rsgR

rsRg	sag	sagG	sagR	saRG	scgR
sg	sgG	sgR	srg	<i>sug</i>	suRg
uga	usgG	usgR			

li Landslide (mixed with scattered deposits of a,s,r,L, and R; landslides too small and numerous to show separately)

l	<i>la</i>	laR	<i>lsra</i>	Rcl	rL
rsL	rsRl	<i>slR</i>	slrR	srl	srlR
srRl					

pea Playa Deposits (mixed with scattered deposits of a,e, and r; playa deposits too small to show separately)

aep	ap	eap	ep	epa	epr
<i>erp</i>	p	pa	pe	pre	rap
rpe	we				

sci Slopewash and Colluvium (mixed with scattered deposits of s,r,u,g,q,a,e, and/or R)

as	ase	aseR	asR	asRe	asr
c	cf	cfR	cR	cRs	cs
<i>csa</i>	<i>csae</i>	csaR	csf	<i>csfR</i>	<i>csga</i>
csgGq	csq	csR	csRq	csr	csrf
csrR	csuR	cuR	esa	Gcuq	Guq
q	Rcsq	Rucq	Ruq	rcs	rcsR
rsc	rscR	rsq	rsRq	s	sa
sae	saf	saR	saRe	sar	sare
sarR	saT/td	sat/Td	sau	sauR	sc
sca	scaR	scR	scRa	scRq	scRr
scr	scrR	scuR	<i>se</i>	<i>sea</i>	<i>sfaR</i>
sfdR	sfR	sfRe	sfRr	sG	solif
sR	sRe	<i>sRre</i>	sr	sra	srae
<i>sraf</i>	sraR	src	srcR	sre	srea
<i>srefd</i>	sreR	srf	srfc	srfR	<i>srfRe</i>
srR	srRa	srRe	srRf	srRk	srRq
sruR	su	sua	suaR	sucR	sufR
suR	<i>sur</i>	sura	surR	<i>usGq</i>	usRq

ri Residuum (mixed with a,e,s,u, and/or R)

r	ra	rab/m	rae	raes	raeT/t
<i>raet/T</i>	raR	raRe	ras	rase	rasR
raT/t	raT/td	raT/de	raT/te	<i>rcR</i>	re
rea	reas	reR	reRd	res	resR
resTd	resT/t	reTd	reT/t	reT/td	ret/T
rRa	rRae	rRcs	rRde	rRds	rRdsa
rRe	rRs	rRsa	rRsc	rRse	rs
rsa	rsae	rsaR	rsaRd	rsaT/td	rse
rseR	rsf	rsfa	rsfR	rsR	rsRa
rsRd	<i>rsRda</i>	rsRe	rsT/t	rst	

ui Grus (mixed with a,e,s,u, and/or R)

ru	ruaR	rus	rusR	<i>u</i>	uaR
uas	uR	uRe	ursR	us	usa
usaR	usR	usr	usrR		

Ri Bedrock/Glaciated Bedrock (including hot spring deposits and volcanic rocks; mixed with scattered shallow deposits of e,u,s,c,r,g, and a)

eaR	eR	eRa	eRr	<i>eRrs</i>	eRs
esR	Gcg	Gcsg	Gg	Gga	Ggc
Ggcs	Ggr	Ggs	Glg	<i>GR</i>	GRc
Gr	Grg	Gsg	<i>Gsq</i>	Gsu	Gucg
Gucq	<i>Gusg</i>	gG	gR	<i>grG</i>	h
R	Rc	<i>Rca</i>	Rcg	Rcr	Rcs
Rcsg	Rcsr	Rcsu	Rcu	Rcug	<i>Rcus</i>
<i>Rd</i>	<i>Rdrc</i>	Rdre	Re	RGc	RGcg
RGcs	RGg	RGgc	RGr	RGug	<i>Rg</i>
Rgc	Rr	Rrc	Rrcs	Rrcse	Rrg
Rrq	Rrs	Rrsa	Rrsc	Rrse	Rrsk
Rs	Rsa	Rsc	Rscr	Rse	<i>Rsf</i>
Rsg	Rsr	Rsra	Rsre	Rsrf	Rsrk
Rsrkl	Rsrkl	Rsu	Ruc	Ruce	Rucq
Rucs	Rue	<i>Rug</i>	Rus	Rusc	rgG
rgR	rgRG	rR	rRd	rRg	t(R)r
travertine	usRG	v			

Mi Mined Areas

M	MsR	RrM	rsRM
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Ki Karst areas

arK	Kra	rsRK
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ki Clinker (mixed with scattered deposits of r,s,a and/or R)

kr	<i>kra</i>	krs	krsl	krsR	ksl
ksr	rsak	rsk	rska	<i>rske</i>	rskR
rsRk	rsRkl	srak	srakl	srRkl	

xi Truncated Bedrock (mixed with scattered shallow deposits of e,t,r,a,A,b, and s)

Aerx	<i>brx</i>	<i>bx</i>	bxe	eArx	<i>ertx</i>
erx	<i>erxA</i>	<i>etrx</i>	etx	<i>ext</i>	pediment
rsxe	rtex	<i>rx</i>	<i>rxA</i>	<i>rxae</i>	<i>rx</i>
rxte	tdrx	trx	<i>tx</i>	<i>txe</i>	

Ti

Structural Terrace (including and/or mixed with a,e,r,s, and t. Most often classified as T/t.)

<i>raTd</i>	reT	reT/tR	rT	<i>rTd</i>	<i>rTda</i>
<i>rTdae</i>	rTde	rTdeR	<i>rTds</i>	rTe	rTs
rT/t	rT/ta	rT/tae	rT/td	rT/tda	rT/tde
rT/te	rT/tR	<i>rT/ts</i>	Tdr	Tr	T/tdra
T/tr	T/tra				

Codes also shown on map:

LAKE - large bodies of water
glacier - large glaciers of the Wind River Mountains