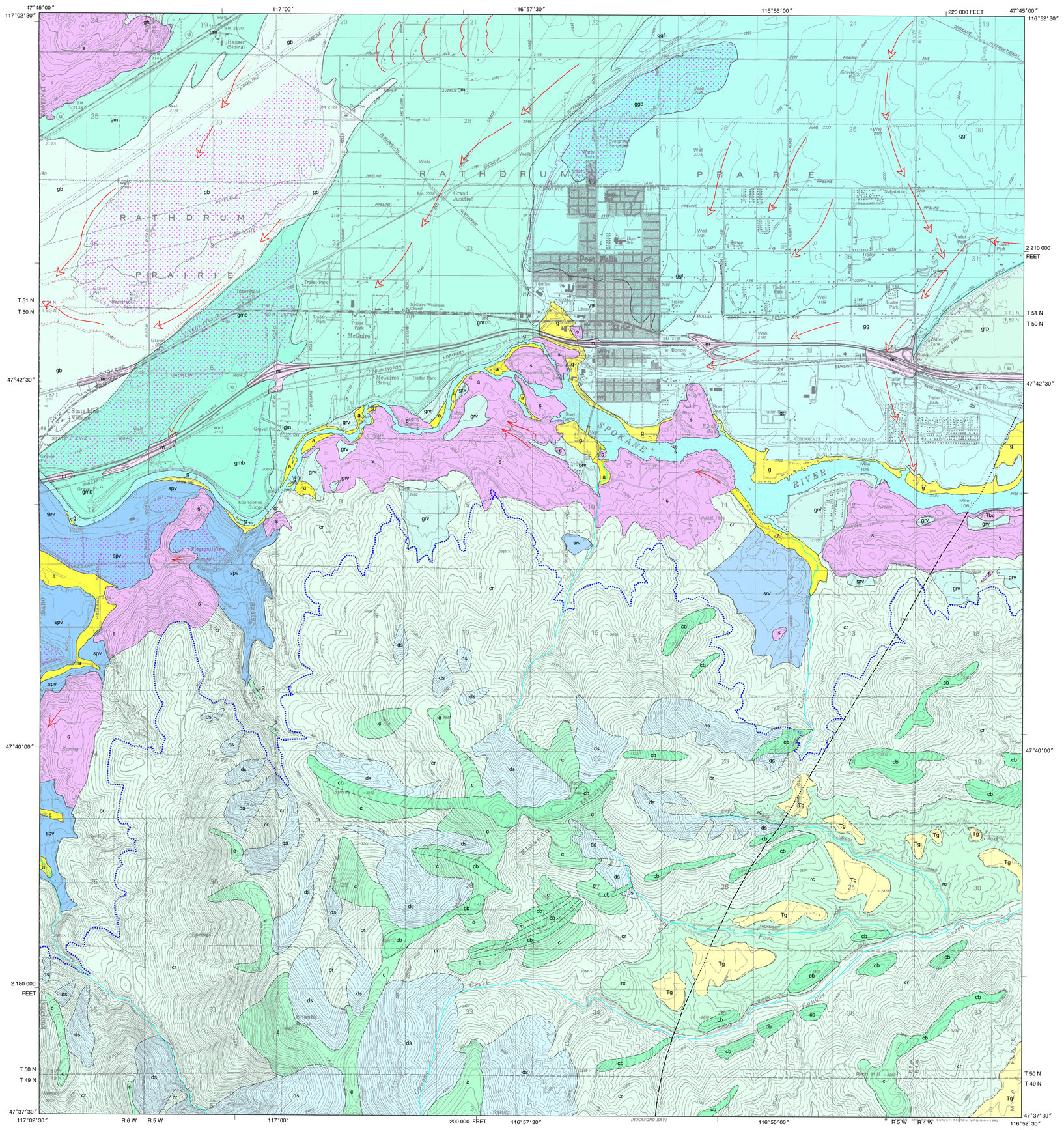
Surficial Geologic Map of the Post Falls Quadrangle and Part of the Liberty Lake Quadrangle, Kootenai County, Idaho

Roy M. Breckenridge and Kurt L. Othberg

1998



Base map from Digital Raster Graphic of the Post Falls and Liberty Lake quadrangles.

Control by USGS and NOS/NOAA.

Topography by photogrammetric methods from aerial photographs taken 1972 (Liberty Lake) and 1975 (Post Falls). Field checked 1973 (Liberty Lake) and 1977 (Post Falls). Map edited 1981 (Post Falls).

Projection and 10,000-foot grid ticks: Idaho coordinate system, west zone (transverse Mercator). 1927 North American Datum.

UTM Grid and 1971 Magnetic North Declination at Center of Map

SCALE 1:24,000

Contour Interval 40 Feet
Dotted Lines Represent 20-Foot Contours

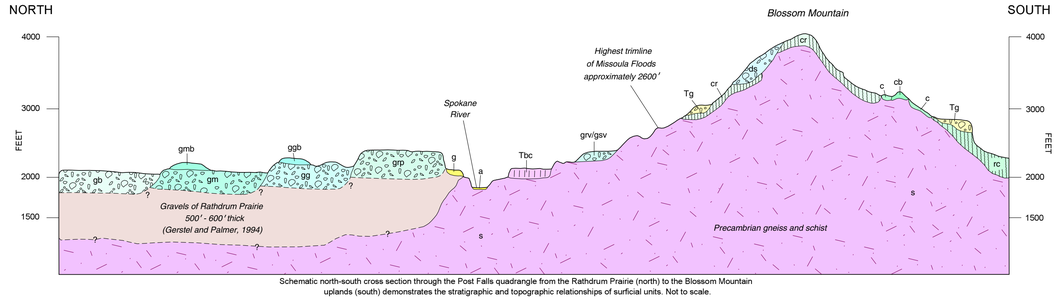
QUADRANGLE LOCATION

Field work conducted 1996-1997.

Field work and map preparation funded in part by U.S. Geological Survey's STATEMAP program.

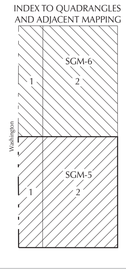
Reviewed by Wendy J. Washington State Division of Geology and Earth Resources.

Digital cartography by Jane S. Freed, Steve Mulberry, and Loudon R. Stanford at the Idaho Geological Survey's Digital Mapping and Information Lab.



Schematic north-south cross section through the Post Falls quadrangle from the Rathdrum Prairie (north) to the Blossom Mountain uplands (south) demonstrates the stratigraphic and topographic relationships of surficial units. Not to scale.

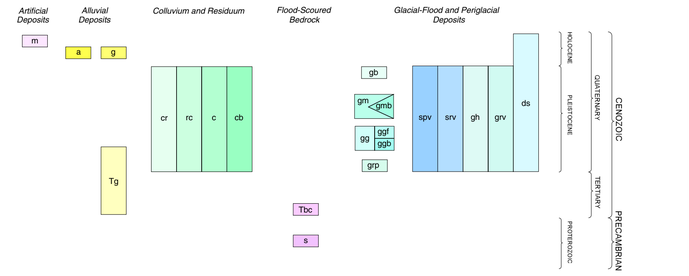
INDEX TO QUADRANGLES AND ADJACENT MAPPING



SGM-6
1. Newman Lake
2. Rathdrum

SGM-5
1. Liberty Lake
2. Post Falls

CORRELATION OF MAP UNITS



INTRODUCTION

This map product addresses the increasing demand for geological information in urban areas. The area covered by the map is experiencing the most rapid growth in Idaho. The geologic mapping was funded in part by STATEMAP, a national cooperative program of the U.S. Geological Survey with the state geological surveys.

The map represents the geology of the materials and soils exposed near the earth's surface. The thickness of these deposits varies from a few feet in the upland areas to hundreds of feet in the Rathdrum Valley. The map is useful for determining the type and characteristics of the materials found at the surface and in the shallow subsurface by agricultural activities, building excavations, construction material excavations, ditches, and well holes. The information can be used by government, private industry and the public for planning, development, and resource characterization. In particular, the map provides new information about the Rathdrum Aquifer, the sole source water supply for over 200,000 people in Idaho and Washington. The map can be used as a guide for site locations but is not intended as a substitute for a detailed site-specific geotechnical evaluation.

Most users are more familiar with traditional geologic maps that show bedrock. Surficial maps show units with more diverse characteristics than rock type and lithology. Most surficial deposits are geologically young, Quaternary in age, and unconsolidated. The mapping criteria used here to subdivide the Quaternary units are based on their physical characteristics and the boundaries between them (allostratigraphy). In most places, the boundaries between these units are manifested in morphologic features.

DESCRIPTION OF MAP UNITS

ARTIFICIAL DEPOSITS

m — **Made ground (historical)**—Manmade deposits include disturbed, transported, and implaced construction materials derived from various local sources, mainly land along Interstate-90 at major interchanges. Smaller areas of made ground are not mapped.

ALLUVIAL DEPOSITS

a — **Alluvium (Holocene)**—Silt and sand deposits of the Spokane River and Cable, Cedar, and Skalan creeks. Locally includes lenses of reworked outwash gravels and flood sediments. The deposits are within the modern flood plain. Thickness 1 to 5 feet.

g — **Alluvial gravels (Holocene)**—Sandy gravels and sands. Mostly consists of reworked Pleistocene outwash and flood deposits. Forms a persistent terrace along the Spokane River above the Post Falls dam and a discontinuous terrace below the dam. Thickness 1 to 10 feet.

tg — **Lag gravels on relict alluvial surfaces (Tertiary)**—Consists of gravels of mature rounded quartzites and mixed lithologies derived from Precambrian Belt Supergroup and Mesozoic-Tertiary intrusives. Matrix of weathered saprolite. Exposed at Cedar Hill and in Cougar Creek and Mica Creek valleys. The gravels probably represent surfaces graded to the blockages caused by the Miocene plateau basalts.

COLLUVIUM AND RESIDUUM

cr — **Colluvium and residuum of intermediate depth (Quaternary and Tertiary)**—Colluvium is composed of pebble gravel in a clayey, silty sand matrix. The coarseness of the gravel typically increases with depth. Residuum is mostly a sandy silt saprolite that grades with depth into Precambrian schist and gneiss. Colluvium is predominant on steeper, north-facing slopes typically lower than 3,000 feet in elevation. Residuum is thinnest on south-facing steep slopes. Areas of gentle slopes, especially west-facing areas on the map, have a 3- to 6-foot mantle of loess and volcanic ash with weakly developed Holocene soil horizons (Weisel, 1981). A clayey buried soil typically occurs within 10 to 20 inches below the loess (Weisel, 1981) on gentle, stable slopes, but may be eroded from steeper slopes. Slopes are variable, and the steepest ones are typically located where stream incision has cut deeply into the regolith.

rc — **Residuum and colluvium composing deep regolith (Quaternary and Tertiary)**—Residuum is mostly a sandy silt saprolite that grades with depth into Precambrian schist and gneiss. Colluvium typically is shallow to deep, pebbly and cobbly silty sand that mantles the residuum. The residuum is relict from Tertiary weathering of bedrock and is thickest on stable remnant surfaces where it is overlain by Tertiary lag gravel (Tg). Locally, a silty clay buried soil occurs within 1.5 to 3 feet of the surface (Weisel, 1981).

c — **Colluvium and common small rock outcrops (Quaternary and Tertiary)**—Colluvium is composed of 1.5 to 6 feet of angular pebble and cobble gravel in a sandy silt matrix that overlies relatively unweathered gneiss, schist, and quartzite. Unit typically occurs on ridges and relatively steep slopes with south aspects. Typically lacks a mantle of loess and well-developed soil horizons (Weisel, 1981).

cb — **Colluvium and bedrock that form linear, erosion-resistant ridges (Quaternary and Tertiary)**—The thin and discontinuous colluvium is composed of angular pebble and cobble gravel in a sandy silt matrix. Bedrock outcrops are composed of Precambrian gneiss, quartzitic schist, or quartzite. Ridges parallel the strike of the regional foliation over a range of elevations, but are prominent at higher elevations where erosion predominates over deposition. Lacks a mantle of loess and well-developed soil horizons (Weisel, 1981).

GLACIAL-FLOOD AND PERIGLACIAL DEPOSITS

Gravels of Rathdrum Prairie

The gravel deposits of the Rathdrum Prairie are the result of repeated catastrophic flood releases from Pleistocene glacial Lake Missoula that ended about 12,000 years ago. Post Falls is about 30 miles downstream from the Clark Fork ice dam and 15 miles from the end of Lake Pend Oreille, where most of the flood waters were channeled. Within the Rathdrum Prairie, the proximal deposits consist mostly of boulder gravels with interbedded sands implaced by high flow regimes. Crude bedding and clast-supported boxwork textures are common. Early geologists in the region interpreted the valley gravels as glacial in origin. The actual limits of the Pleistocene advances of the Purcell Trench lobe are unknown due to catastrophic floods sweeping the area. Today's understanding of the repeated ice dam failures has led most researchers to consider them flood, not glacial, in origin. Tributary valleys along the sides of the Rathdrum Prairie are filled with more finely bedded flood deposits of sand and gravel. Early geologic reports attributed the tributary valley fills and associated lakes to damming by lateral moraines or kame terraces. We now know they are giant eddy bars. The gravels are irregularly mantled with loess, volcanic ash, and a component of silt from the Lake Missoula beds. They are also sporadically cemented with calcium carbonate in varying stages of development from only rinds on the bottom of clasts to a near complete matrix filling most of the pore space (Breckenridge and others, 1997b).

Proximal Deposits on the Floor of Rathdrum Prairie

gb — **Gravel of Beck Road (Pleistocene)**—Flood gravels graded to the lowest valley-filling episode of flooding continuous with the Spokane Valley, about 2,100 feet at the Idaho-Washington state line. The gravels include the most-developed incision representing a large abandoned river channel meandering westward into Washington (Gerstel and Palmer, 1994). Two separate sets of thick-bedded foresets, 25-feet thick, are exposed in deep gravel pits on Beck Road. Total thickness exceeds 80 feet.

gm — **Gravel of McGuire (Pleistocene)**—Sandy flood gravels graded to an intermediate level of 2,140 feet near Post Falls. Although an extensive sheet, the gravel unit appears to be characterised by incision and scour unconformities; the surface is marked with channel erosion and lag deposits. Thickness 80 to 100 feet.

gmb — **Gravel of McGuire, stateline bar facies (Pleistocene)**—Coarse, poorly sorted, imbricate flood gravels with parallel bedding. Forms a large longitudinal bar extending several miles east to the Idaho-Washington state line. Graded to the gravel of McGuire. Thickness 20 to 40 feet.

gg — **Gravel of Green Ferry (Pleistocene)**—Coarse flood gravels. Consists of an extensive sheet of flood deposits in the quadrangle, graded to about 2,200 feet at Post Falls. Characteristic poor sorting and variation in bedding. Probably represents the last episode of major flood events. The unit is locally sandy, especially in the lee of Ross Point where steeply dipping thick-bedded sands were concentated. Also includes a fan facies and a bar facies. Thickness in excess of 100 feet.

ggf — **Gravel of Green Ferry fan facies (Pleistocene)**—Poorly sorted, sandy flood gravels with channel cut and fill structures. Formed by large coalescing fan complex. Characterized by scour and fill features and concentrations of lag boulders. Dissected by waning phases of flooding and smaller, later flood events. Thickness 10 to 80 feet.

ggb — **Gravel of Green Ferry bar facies(Pleistocene)**—Bouldery channel-bar facies flood gravels. Coarse and poorly sorted imbricated gravels with large-scale foreset beds. Forms a large channel bar with well-developed current ripples at the surface. Thickness 20 to 40 feet.

grp — **Gravel of Ross Point (Pleistocene)**—Coarse sandy gravel forms the highest preserved remnant flood terrace on the map at about 2,340 feet in elevation. Has the most soil development of the Rathdrum Prairie gravels. Represents the earliest of the flood deposits recognized in the area. Thickness exceeds 150 feet.

Distal Deposits Along Valley Sides and Tributaries

gh — **Gravel of Hauser (Pleistocene)**—Sandy flood gravels form the eddy bar that encloses the valley of Hauser Lake. Lower energy flow of flood water deposited finer facies behind the main bar form. Thickness of eddy bar may exceed 100 feet.

grv — **Gravel of Riverview Drive (Pleistocene)**—Sandy flood gravels on the southern margin of Rathdrum Prairie in mouths of tributary drainages. Bedded low-flow regime deposits formed in eddy bar environment. Thickness 40 to 80 feet.

srv — **Sand of Riverview Drive (Pleistocene)**—Gravelly flood sands on the southern margin of the Rathdrum Prairie. Planar medium-bedded sands of low flow regime. Mantles slopes inundated by floodwater. Thickness 10 to 20 feet.

spv — **Sand of Pleasant View (Pleistocene)**—Gravelly flood sands on margin of the Rathdrum Prairie. Bedded flow regime deposits represent eddy bar deposits that grade into lower energy sand and silt deposits up the valleys. Coarser facies of the flood bars of the unit are shown with the stippled pattern. Mantles slopes inundated by floodwater. Thickness as much as 100 feet near the west margin of quadrangle.

Periglacial Deposits in Uplands

ds — **Debris-flow and solifluction deposits (Quaternary)**—Composed of angular pebbles and cobbles in a silty sand matrix. Overlies weathered bedrock on steeply sloping, northerly aspects at elevations above 3,000 feet. Probably periglacial in origin. Surface typically mantled by 1to 2 meters of loess and volcanic ash with weakly developed, Holocene soil horizons (Weisel, 1981).

FLOOD-SCOURED BEDROCK

tbc — **Basalt scoured by Lake Missoula Floods (Miocene)**—Basalt of Columbia River Basalt Group. Forms sporadic rimrock along the margins of Rathdrum Prairie. Mostly eroded by Pleistocene glaciation and repeated Lake Missoula Floods. May be present in the subsurface of Rathdrum Prairie. Outcrop at the eastern edge of this map along the Spokane River is the N2 flow of the Grande Ronde Basalt of normal magnetic polarity (Breckenridge and others, 1997a).

s — **Precambrian metamorphic rocks of the Belt Supergroup and gneiss, schist, and granite scoured by Lake Missoula Floods (Precambrian)**—Mapped as Prichard Formation by Griggs (1973) and as undivided metamorphic rocks by Weis (1968) south of Rathdrum Prairie. Mapped as the Hauser Lake gneiss by Weissenborn and Weis (1976) north of Rathdrum Prairie.

SYMBOLS

Contact: dashed where approximately located.

Fault: small dash where inferred; dotted where concealed.

Abandoned channels of Lake Missoula Floods drainageways; generally erosional pathways during waning flows.

Channels scoured in bedrock by Lake Missoula Floods; mostly on margins of Rathdrum Prairie on spurs and divide crossings.

Theoretical maximum inundation level of Lake Missoula Floods.

Giant current ripple field; rolling topography from ground level. Crests visible from the air and on aerial photographs.

Slope face of gravel flood bar or erosional scarp.

Plunge pool depression eroded by Lake Missoula floodwaters.

Stippled areas represent active surfaces of remnant flood bars.

REFERENCES

Breckenridge R.M., K.L. Othberg, and J.H. Bush, 1997a, Stratigraphy and paleogeomorphology of Columbia River basalt, eastern margin of the Columbia River Plateau: Geological Society of America Abstracts with Programs, v. 29, no. 5, p. 6.

Breckenridge, R.M., K.L. Othberg, J.H. Welhan, C.R. Knowles, and P.A. McDaniel, 1997b, Geologic characteristics of the Rathdrum Aquifer: Inland Northwest Water Resources Conference Abstract, p. 23.

Gerstel, W.J., and S.P. Palmer, 1994, Geologic and geophysical mapping of the Spokane Aquifer-Relevance to growth management: Washington Geology, v. 22, no. 2, p. 18-24.

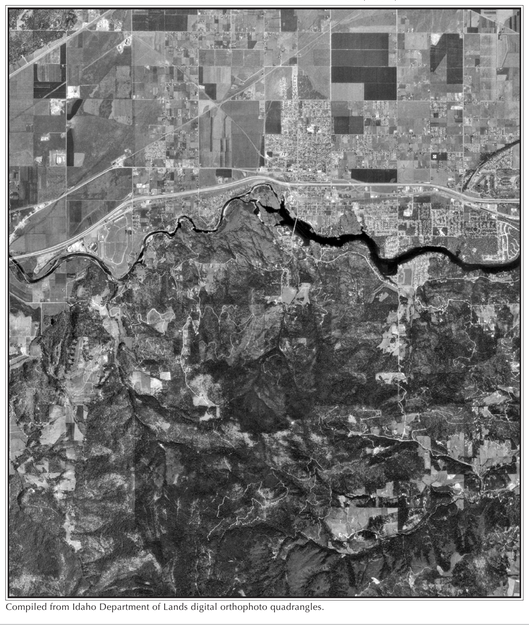
Griggs, A.B., 1973, Geologic map of the Spokane quadrangle, Washington, Idaho, and Montana: U.S. Geological Survey, Miscellaneous Investigations Series, Map I-768, scale 1:250,000.

Weis, P.L., 1968, Geologic map of the Greenacres quadrangle, Washington and Idaho: U.S. Geological Survey GQ-734, scale 1:62,500.

Weisel, C.J., 1981, Soil survey of Kootenai County area, Idaho: U.S. Department of Agriculture Soil Conservation Service, 255 p.

Weissenborn, A.E., and P.L. Weis, 1976, Geologic map of the Mount Spokane quadrangle, Spokane County, Washington, and Kootenai and Bonner counties, Idaho: U.S. Geological Survey, Geologic Quadrangle Map GQ-1336, scale 1:62,500.

Vertical Aerial Photo Mosaic of the Area (1992)



Compiled from Idaho Department of Lands digital orthophoto quadrangles.

Published and sold by the Idaho Geological Survey
University of Idaho, Moscow, Idaho 83844-3014