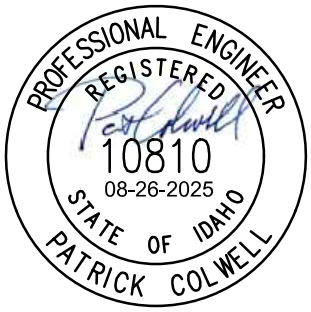
HARRIS CREEK HEIGHTS

SOILS, HYDROLOGY, & GEOLOGY REPORT



Prepared for:

Boise County

August 26, 2025

Prepared By:
Pat Colwell, P.E.
Colton Bunn, P.E.

ARDURRA

Introduction

This report is the description of the existing soils, hydrology, and geology of the property to be developed. (See Appendix A) The project lies in the northwest quarter of Section 33, Township 7 North, Range 4 East, Boise Meridian, Boise County, Idaho.

Soil Conditions

16 test pits were excavated on site by Bruce Baumhoff for the purposes of soils exploration, and ground water monitoring. A log of excavated soils was kept by Bruce Baumhoff (See Appendix B). The soils logs kept by Bruce Baumhoff were sent to the owner. The owner then provided the soils logs to Ardurra. No geotechnical engineer was present for the excavation of these test pits. Across the property test pits had a large amount of decomposed granite of varying densities, and consistencies. Topsoil on the property consisted of clays, silts, and sands. In multiple test pits a hard rock layer was encountered at approximately 8' deep. Roots from vegetation were observed between 3.5 to 7 feet deep.

This proposed development would consist of typical cut and fill earthwork to attain the desired graded configuration for construction of a roadway and other associated improvements for the construction of single-family residential structures.

Geology

The geology portion of this report is based on our review of the "*Geologic Map of the Idaho City 30 x 60 Minute Quadrangle, Idaho*" (See Appendix C). The map indicates that the property consists of two geologic sections. The first being the Columbia River Basalt Group, and the second being Biotite-muscovite granite.

Columbia River Basalt Group consists of dark color basalt with Olivine being found in most samples. This is supported by our onsite findings, of both hard rock layers, and basalt. The biotite-muscovite granite layer consists primarily of light color granite. This is consistent with the large amount of granite observed during excavation.

Both geologic sections are common in the Earth's crust and show that the area has not been affected by large floods. Base on these findings the property will be suitable for the development of a single-family residential subdivision.

Hydrology

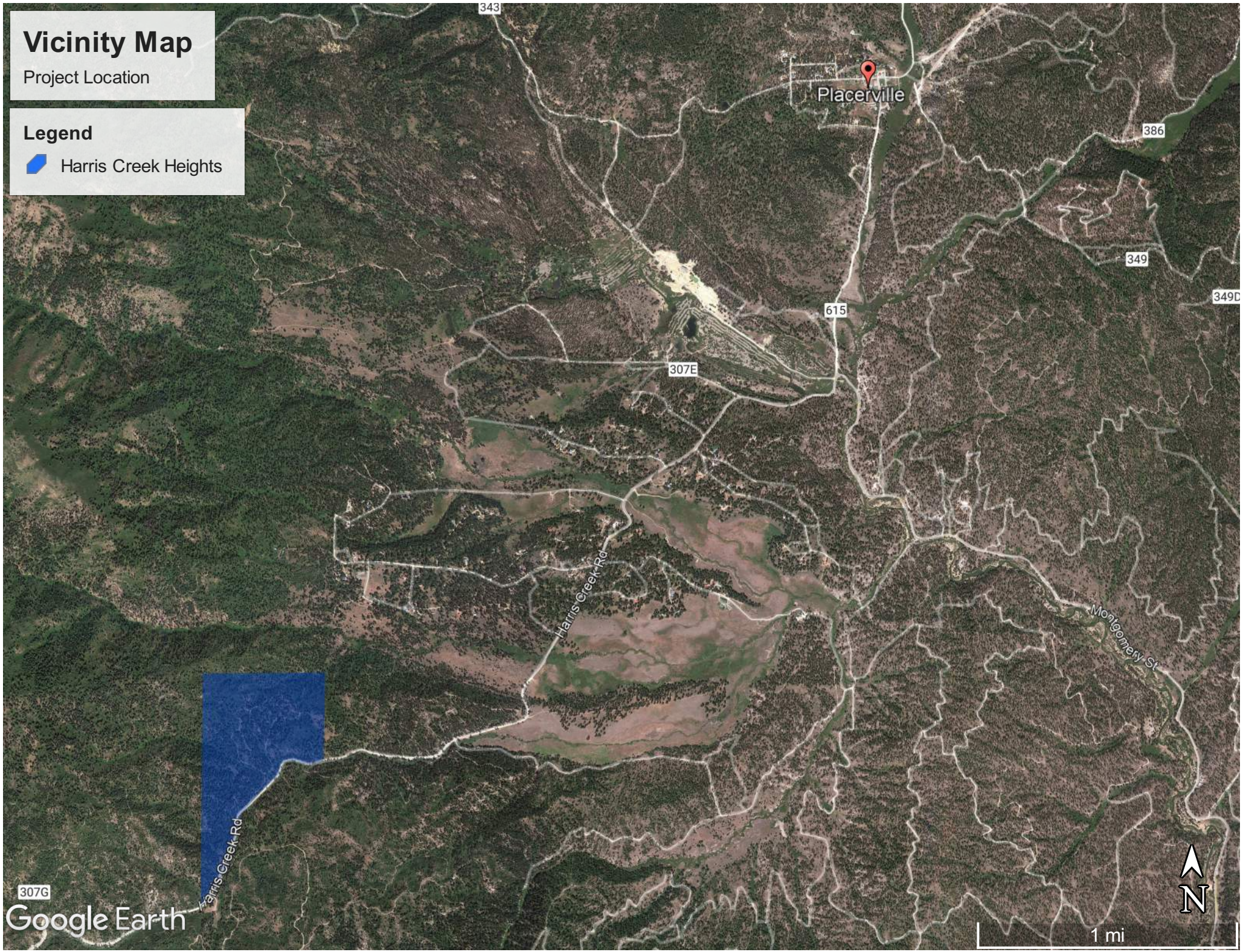
The existing hydrology of this property was observed through survey, and site exploration. Existing ground slopes on the property range from 0-75%. The entire property generally slopes toward Harris Creek Rd, which borders the southeast border of the property. Ground water in the area varies between half a foot and 9 feet below the surface based on proximity to existing creeks. There is an un-named creek that flows from the west side of the parcel towards Harris Creek. This creek acts as a natural drainage for the property. Storm water runoff from the entire property flows towards Harris Creek and continues running northeast. There is no standing water or signs of flooding on the property.

Conclusion

Based on information gathered from the onsite test pits, survey, and the Idaho Geological Survey we conclude that the site has suitable geological, and hydrological features to support the proposed development of single family housing.

APPENDIX A

VICINITY MAP


Vicinity Map
Project Location
Legend
Harris Creek Heights
Placerville
343
386
349
349D
615
307E
Harris Creek Rd
Harris Creek Rd
Montgomery St
307G
Google Earth
N
1 mi

APPENDIX B

TEST PIT LOGS

Test Pit Logs

Notes:

1. No Geotechnical Engineer was present for the excavation of these test pits.
2. Test pits were excavated by Bruce Baumhoff and a record of excavated soils encountered was kept. Bruce Baumhoff provided the excavated soils log to the owner who then provided them to Ardurra.
3. The test pit logs were formatted by Colton Bunn for the purposes of this report.
4. DG stands for decomposed granite.

Test Pit #1	
0-1'	Topsoil
1'-3'	Soft DG
3'-8'	Firm DG
Roots Depth 5.5'	

Test Pit #2	
0-2.5'	Topsoil & DG
2.5'-6.5'	Easy DG
6.5'-7'	Hard Rock
Roots Depth 4.5'	

Test Pit #3	
0-1.5'	Topsoil & DG
1.5'-8'	Firm DG
Roots Depth 5.5'	

Test Pit #4	
0-1.5'	Topsoil
1.5'-3.5'	Fractured Clay
3.5'-8'	Mixed DG & Thin Clay
Roots Depth 4.5'	

Test Pit #5	
0-2'	Clayey Topsoil
2'-4'	Sandy Clay
4'-8'	Clayey Soil
Roots Depth 4'	

Test Pit #6	
0-2'	Topsoil With Loose DG
2'-4.5'	Tight DG
4.5'-6'	Hard Rock
Roots Depth 3.5'	

Test Pit #7	
0-2'	Topsoil & Soft DG
2'-4.5'	Firm DG
4.5'-8'	Hard DG With Fractures
Roots Depth 4.5'	

Test Pit #8	
0-3'	Topsoil & Loose DG
3'-8'	Firm DG
Roots Depth 7'	

Test Pit #9	
0-1'	Topsoil
1'-2.7'	Clayey Sub Soil
2.7'-4.5'	Clay
4.5'-8'	White Granite
Roots Depth 3.5'	

Test Pit #10	
0-1.7'	Topsoil
1.7'-2.3'	Sandy Sub Soil
2.3'-7'	Granite Sand
7'-8'	Clay Granite
Roots Depth 5'	

Test Pit #11	
0-2.7'	Silty Topsoil
2.7'-5'	Clayey Sub Soil
5'-8'	Granite, Allluvial Gravely Sand
Roots Depth 6.3'	

Test Pit #12	
0-1.3'	Topsoil
1.3'-4'	Granite, Basalt, & Alluvium
4'-6'	Bigger Rock
Roots Depth 3.5'	

Test Pit #13	
0-2.5'	Silty Topsoil
2.5'-5.5'	Silty Iron Stained DG
5.5'-8'	White DG
Roots Depth 6.25'	

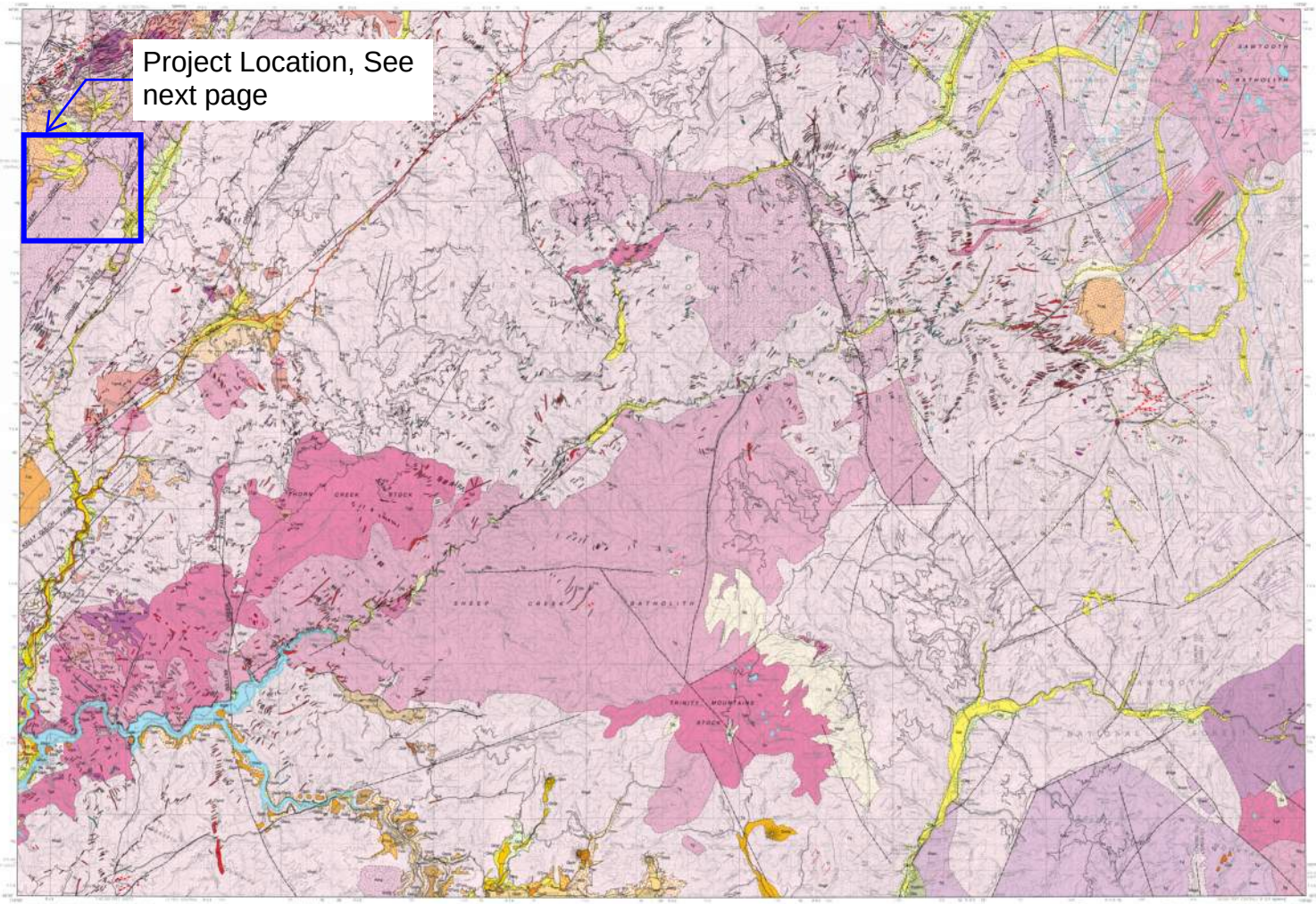
Test Pit #14	
0-1.5'	Loose DG
1.5'-4'	Soft DG
4'-6'	Firm DG
6'-7'	Hard Rock
Roots Depth 4'	

Test Pit #15	
0-2'	Topsoil
2'-3.5'	Sub Soil
3.5'-7'	Clayey Sub Soil
7'-8.5'	Sandy Clay With DG
Roots Depth 6.5'	

Test Pit #16	
0-1.7'	Topsoil
1.7'-4.7'	Clayey Sub Soil
4.7-8.5'	DG With Clay
Roots Depth 5'	

APPENDIX C

GEOLOGIC SURVEY MAP



Geologic Map of the Idaho City 30 x 60 Minute Quadrangle, Idaho

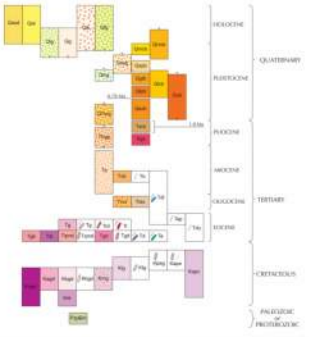
Mapped and Compiled by
Thor H. Kiilsgaard, Loudon R. Stanford, and Reed S. Lewis
2001

Prepared in cooperation with the U.S. Geological Survey
Funded in part by the U.S. Geological Survey's Mineral Resource Program
Digital cartography by Jane C. Freed at the Idaho Geological Survey's Digital Mapping and GIS Lab.
Map version 1.1 6-2003

Introduction

Most of this map was compiled from field work done for the Hailey 1° x 2° geologic map under the U.S. Geological Survey's CUSMAP program (Worl and others, 1991). The original geology produced on 7.5-minute field sheets by Thor Kiilsgaard for the Hailey project was digitally captured to form the basis of this map and a GIS database. Additional published and unpublished mapping, photogeology, and field work provided further information on the surficial and basalt units (see index to Sources of Geologic Mapping).

Correlation of Map Units



Description of Map Units

Alluvium (Holocene)—Modern stream alluvium: sand, gravel, cobbles, and boulders. Includes some glacial outwash gravel and alluvial fans mostly composed of debris-flow deposits.

Sandy alluvium of side streams (Holocene and Pleistocene)—Medium to coarse sand interbedded with silty, fine sand and silt. Mostly derived from southward granitic Oldhorg and Banbury, 1992).

Alluvial fan gravels (Holocene and Pleistocene)—Sandy pebble and cobble gravel, sand, and granitic gravel derived from southward granitic Primarily formed by debris flows and by of high-energy streams (Pierce and Scott, 1982).

Landslide deposits (Holocene and Pleistocene)—Shape (where in Map)

Terrace gravel (Holocene and Pleistocene)—Sand, gravel, cobbles, and boulders. Partially derived from glacial advance upstream. Benches as much as 600 feet (183 m) above modern streams. Commonly capped by alluvial fans mostly composed of debris-flow deposits.

Glacial deposits, undivided (Holocene and Pleistocene)—Includes till, glaciofluvial/outwash sediments, outwash gravel, and some stream alluvium. Landforms include moraines, lake basins, outwash plains, and terraces. Deposited by small isolated glaciers, valley glaciers, and large ice cap centered outlet glaciers originating in the Sawtooth and Trinity Mountains. Relative dating of deposits indicates at least three glaciations in the Sawtooth Mountains (Stanford, 1982).

Basalt, undivided (Pleistocene?)—Basalt flows of uncertain age.

Basalt of Morris Creek (Pleistocene)—One canyon-filling flow from unknown vent in Morris Creek valley. Howard and others, 1982). Dark gray, vesicular, olivine-rich basalt. Ave composed of labradorite crystals of plagioclase (labradorite set in a matrix that is chiefly augite, ilmenite, and magnetite but which also contains olivine. Normal magnetic polarity. Thickness of 10 feet (6 m).

Basalt of Red Mountain (Holocene or late Pleistocene)—Basalt erupted from Red Mountain and flowed down Fall Creek (Bennett, 1986).

Gravel overlying the Smith Prairie Basalt and basalt of Geaves Terrace (Pleistocene)—Fair-graved sand deposited unto, and stream deposits formed in water-dammed behind, Smith Prairie Basalt and mostly coarse sand deposited over the basalt of Geaves Terrace. Thickness up to 100 feet (30 m) adjacent to canyon walls.

Smith Prairie Basalt, undivided (Pleistocene)—Includes three canyon-filling basalts (Howard and Shervais, 1973): two porphyritic basalts separated by a nonporphyritic basalt. Normal magnetic polarity. Mostly lithocentric and dark gray. Contains plagioclase, brown clinopyroxene, olivine, and opaques. Maximum measured thickness is 400 feet (120 m).

Gravel overlying basalt of Lava Creek (Pleistocene)—Fair-gravel deposited unto, and stream deposits formed in water-dammed behind, basalt of Lava Creek.

Basalt of Lava Creek (Pleistocene)—Dark to medium gray, very fine-grained basalt. Normal magnetic polarity.

Basalt of Geaves Terrace (Pleistocene)—Four flows of medium gray olivine basalt. Canyon-filling basalt probably erupted in Smith Prairie (Howard and others, 1982). Normal magnetic polarity. Olivine phenocrysts up to 1.5 mm in diameter. Age of 0.172 Ma ± 0.210 Ma (potassium-argon date from Oldhorg and Stanford, 1982). Some flows up to 600 feet (183 m) above the river. Thickness of about 100 feet (61 m).

Basalt of Lucky Peak (Pleistocene)—Single flow of dark gray to black, aphyric, very fine-grained basalt. Canyon-filling basalt probably erupted in Smith Prairie (Howard and others, 1982). Normal magnetic polarity. Thickness of about 125 feet (37 m).

Gravel overlying both the basalt of Smith Creek and Steamboat Rock Basalt (Pleistocene and Pliocene)—Fair-graved sand, and stream deposits formed in water-dammed behind, Smith Creek and Steamboat Rock basalts. Also includes some fair-graveln deposited on the Steamboat Rock Basalt surface downstream from Long Gulch.

Basalt of Smith Creek (Pleistocene)—Medium to light gray and altered aphyric basalt. Xenocrysts and xenoliths of granitic rocks are common. Reverse magnetic polarity.

Steamboat Rock Basalt (Pliocene)—Numerous flows of olivine basalt. Upper flows are medium gray plagioclase-phyric basalt and diabase. Lower flows are dark to medium gray microporphyritic basalt. Reverse magnetic polarity. Maximum thickness of 1800 feet (1800 m) (Howard and Shervais, 1973). Age of 1.8 Ma ± 0.2 Ma potassium-argon date from Howard and others (1982).

Basalt and gravel of Long Gulch (Pliocene?)—Two basalt flows and gravel above and between the flows. Light gray and very fine-grained aphyric upper flow. The lower flow is black and mostly glass. Normal magnetic polarity. May be basalt of Lucky Peak (Oldhorg and others, 1992).

High gravel (Pliocene)—Consists of poorly sorted to cemented sand, gravel, cobbles, and boulders eroded from rocks of the Idaho batholith and from various rivers. Gravel may be equivalent to the gravel of Bonneville Point of Oldhorg and Stanford (1992).

Payette formation (Miocene)—Scoriaceous, lapilli-size gray, loosely consolidated olivine sandstone and siltstone and interstratified conglomerate and fine-bedded, dark-gray to black shale in which are abundant impressions of aquatic reeds. Lower and upper siltstone layers and plant fragments. Minimum thickness of 570 feet (175 m).

Columbia River Basalt Group (Miocene)—Dark-gray to black basalt, commonly porphyritic with euhedral labradorite phenocrysts of plagioclase (andesine to labradorite) up to 6 mm in length. Olivine is a common mineral in most samples, occurring as phenocrysts larger than those of plagioclase.

Basaltic dikes (Miocene)—Dark green microporphyritic basaltic andesite and basalt dikes consisting mostly of labradorite and augite. Most probably correlate with the Columbia River Basalt Group, but those in the southernmost part of the Idaho batholith may be younger.

Rhyolite of Clear Creek (Oligocene)—Light-gray, almost white, very fine-grained, crystal poor rhyolite. A complex of a matrix of quartz and potassium feldspar in which are angular pieces of quartz, sanidine, and oligoclase that range from 2 to 1 mm long. Age of about 34 Ma ± 2.4 Ma (zircon using the fission-track method: Kiilsgaard and others, 1987).

Rhyolite ash and arkose (Oligocene)—Water-lain rhyolitic ash, conglomerate, and arkose. Age of 32.7 Ma ± 2.7 Ma (zircon using the fission-track method: Kiilsgaard and others, 1987).

Andesite (Eocene)—Dark gray to black, fine-grained, and weakly porphyritic. The phenocrysts are plagioclase and commonly 2 to 4 mm long.

Altered biotite granodiorite (Cretaceous)—Fine-stained, medium- to coarse-grained, equigranular to porphyritic granodiorite. Biotite is altered to chlorite or to mixed chlorite, which accounts for the characteristic reddish stain. Inhlapon on the rock are altered to clay minerals or sericite.

Hornblende biotite granodiorite (Cretaceous)—Gray, medium-grained hornblende-biotite granodiorite. Present only as two small exposures southwest of Idaho City.

Tonalite (Cretaceous)—Gray to dark gray, medium-grained, equigranular tonalite in which andesine is the principal component. May contain as much as 20 percent or more of hornblende. Contains primary epidote. Less-silic foliated granite to granodiorite.

Roof pendant (Proterozoic or Paleozoic)—Garnet-thopside gneiss, quartzite, and biotite-sillimanite schist of uncertain age.

Symbols

Contact: dashed where approximately located or inferred

Fault: dashed where approximately located; dotted where concealed; bar and ball on downthrown side

Strike and dip of beds

Strike and dip of foliation

Quartz vein: arrow indicates dip of vein

Igneous breccia

Volcanic vents or vent

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Index to Sources of Geologic Mapping

1 Bennett, E.H., 1986
2 Howard, K.A., and J.W. Shervais, 1973
3 Kiilsgaard, T.H., and others, 1987
4 Kiilsgaard, T.H., 1981
5 Kiilsgaard, T.H., and V.L. Freeman, 1979
6 Kiilsgaard, T.H., Unpublished geologic mapping
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8 Oldhorg, R.G., Unpublished geologic mapping
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12 Stanford, L.R., 1982
13 Worl, R.G., and others, 1991 (that part mapped by T.H. Kiilsgaard)

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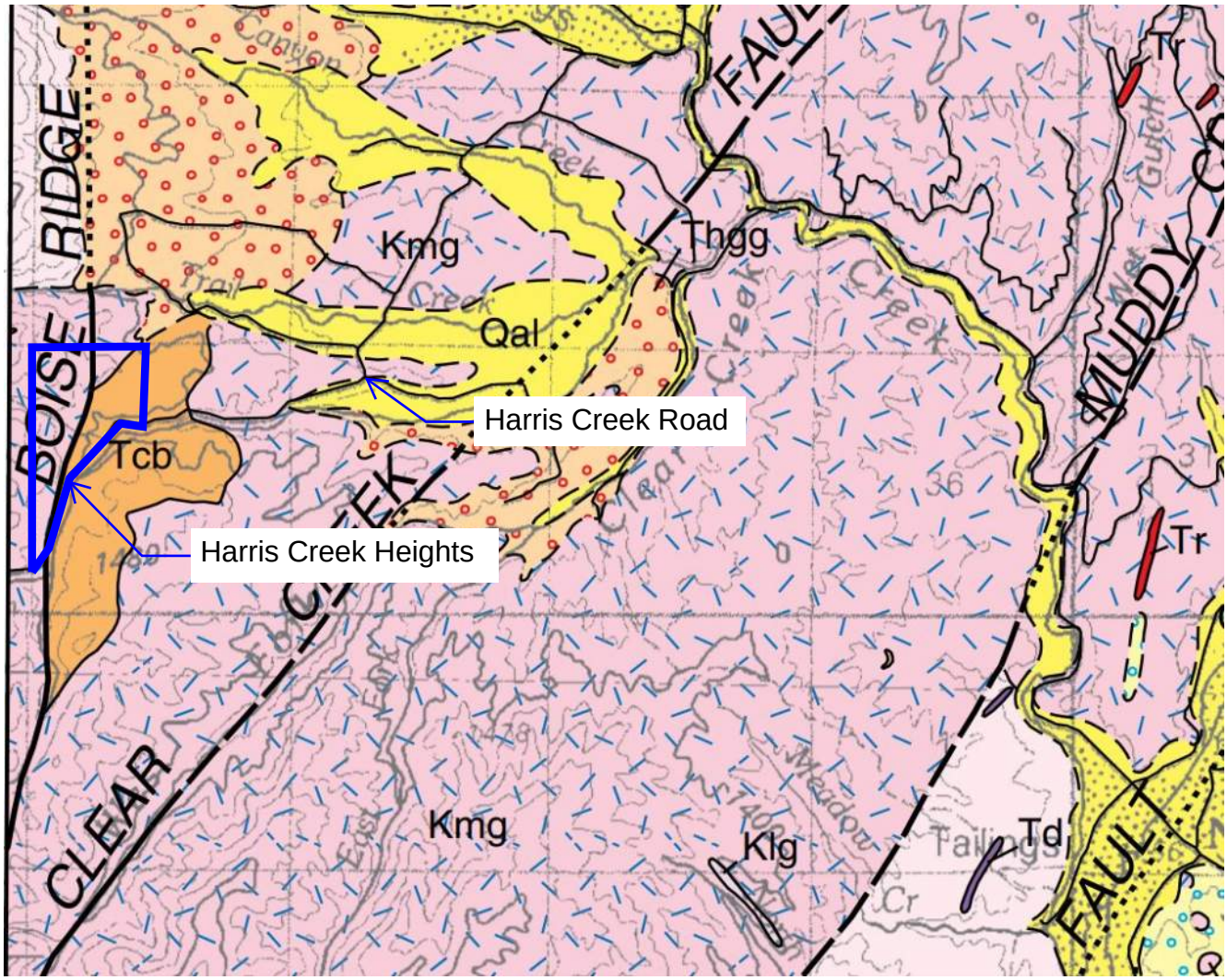
Geologic Survey Snip



Tcb **Columbia River Basalt Group (Miocene)**—Dark gray to black basalt, commonly porphyritic with euhedral lathlike phenocrysts of plagioclase (andesine to labradorite) up to 4 mm in length. Olivine is a common mineral in most samples, occurring as phenocrysts larger than those of plagioclase.

Tb **Basaltic dikes (Miocene)**—Dark green microporphyritic basaltic andesite and basalt dikes consisting mostly of labradorite and augite. Most probably correlate with the Columbia River Basalt Group, but those in the southernmost part of the Idaho batholith may be younger.

Tccr **Rhyolite of Clear Creek (Oligocene)**—Light gray, almost white, very fine-grained, crystal poor rhyolite. It consists of a matrix of quartz and potassium feldspar in which are angular pieces of quartz, sanidine, and oligoclase that range from 1 to 3 mm long. Age of about 34 Ma ± 2.4 Ma (zircons using the fission track method; Kiilsgaard and others, 1997).

Tras **Rhyolitic ash and arkose (Oligocene)**—Water-lain rhyolitic ash, conglomerate, and arkose. Age of 32.7 Ma ± 2.7 Ma (zircons using the fission track method; Kiilsgaard and others, 1997).

Ta **Andesite (Eocene)**—Dark gray to black, fine-grained, and weakly porphyritic. The phenocrysts are plagioclase and commonly 2 to 4 mm long.

Tap **Aplite dikes (Eocene)**—Pink, fine-grained aplite.

Kpeg **Pegmatite dikes (Cretaceous)**—Coarsely crystalline dikes consisting principally of quartz, feldspar, biotite, and muscovite.

Kape **Pegmatite and aplite dikes (Cretaceous)**—Light gray, fine-textured aplite with quartz and feldspar minerals the principal constituents. Pegmatites are light gray to white and distinguished by the large grain size of contained minerals.

Kapc **Pegmatite and aplite complex (Cretaceous)**—Aplite and pegmatite dikes cross-cutting subordinate amounts of biotite granodiorite.

Klg **Leucocratic granite (Cretaceous)**—Light gray and fine- to medium-grained biotite granite with a distinctive anhedral texture. Similar to aplite.

Kmg **Biotite-muscovite granite (Cretaceous)**—Massive, light gray, medium- to coarse-grained, and equigranular to porphyritic muscovite-biotite (two-mica) granite, grading to granodiorite.

Kbgd **Biotite granodiorite (Cretaceous)**—Light gray, medium- to coarse-grained, equigranular to porphyritic granodiorite in which oligoclase is the chief component. Grades to granite.

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