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JUNE 1938

UNITED STATES
DEPARTMENT OF THE INTERIOR
HAROLD L. ICKES, SECRETARY

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RECONNAISSANCE OF PLACER MINING DISTRICTS IN IDAHO COUNTY, IDAHO

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BY

S. H. LORAIN AND O. H. METZGER

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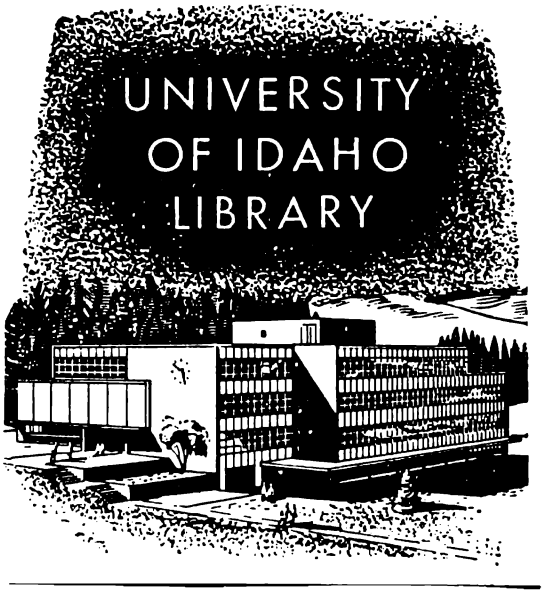
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UNITED STATES DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

RECONNAISSANCE OF PLACER MINING DISTRICTS IN IDAHO COUNTY, IDAHO[1]

By S. H. Lorain[2] and O. H. Metzger[3]

CONTENTS

1/ The Bureau of Mines will welcome reprinting of this paper provided the following footnote acknowledgment is used: "Reprinted from Bureau of Mines Information Circular 7023."

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ILLUSTRATIONS

INTRODUCTION

This paper briefly describes the principal known commercial and near commercial deposits of gold-bearing gravel and the principal placer mining operations of Idaho County, Idaho. It is one of a series of similar papers on western mining districts.

The data used in writing this paper were gathered during the summer of 1937. Information concerning gold-bearing gravels was obtained from prospectors and operators, while operators supplied most of the data on mining operations. No attempt was made actually to test the gravels. The principal object of the examination was to indicate placer areas worthy of further investigation by prospective operators.

Doubtless, there are some known placer deposits in the county which the authors have overlooked; moreover, new deposits yet remain to be discovered. However, in view of the intensive search for placer deposits conducted in the early days and again since the recent revival of placer gold mining, it is not likely that many important deposits remain unknown in this area.

ACKNOWLEDGMENTS

The authors wish to express their thanks for the whole-hearted cooperation rendered by the prospectors, mine operators, and other residents of Idaho County. In preparing some sections of the paper, frequent reference has been made to earlier writings, which will be acknowledged later.

The maps shown herein are based on maps supplied by the United States Forest Service.

LOCATION

Idaho County (fig. 1) covers an area of 8,539 square miles in north-central Idaho. Most of it lies between latitudes 45° N. and 46° 30' N., and between longitudes 114° 30' W. and 116° 30' W.

Grangeville, the county seat and largest town, is on U. S. Highway 95, 79 miles by road southeast of Lewiston, Idaho, and 210 miles by road north of Boise, Idaho.

HISTORY OF PLACER MINING

According to Jellum,[4/] the first discovery of gold in north central Idaho was made by a trapper named Jean de Lassier in the summer of 1857. This discovery was on Orofino Creek in what is now Clearwater County.

4/ Jellum, S. P., Some Central Idaho Gold Districts: Northwest Mining News, Spokane, Wash., 1909.

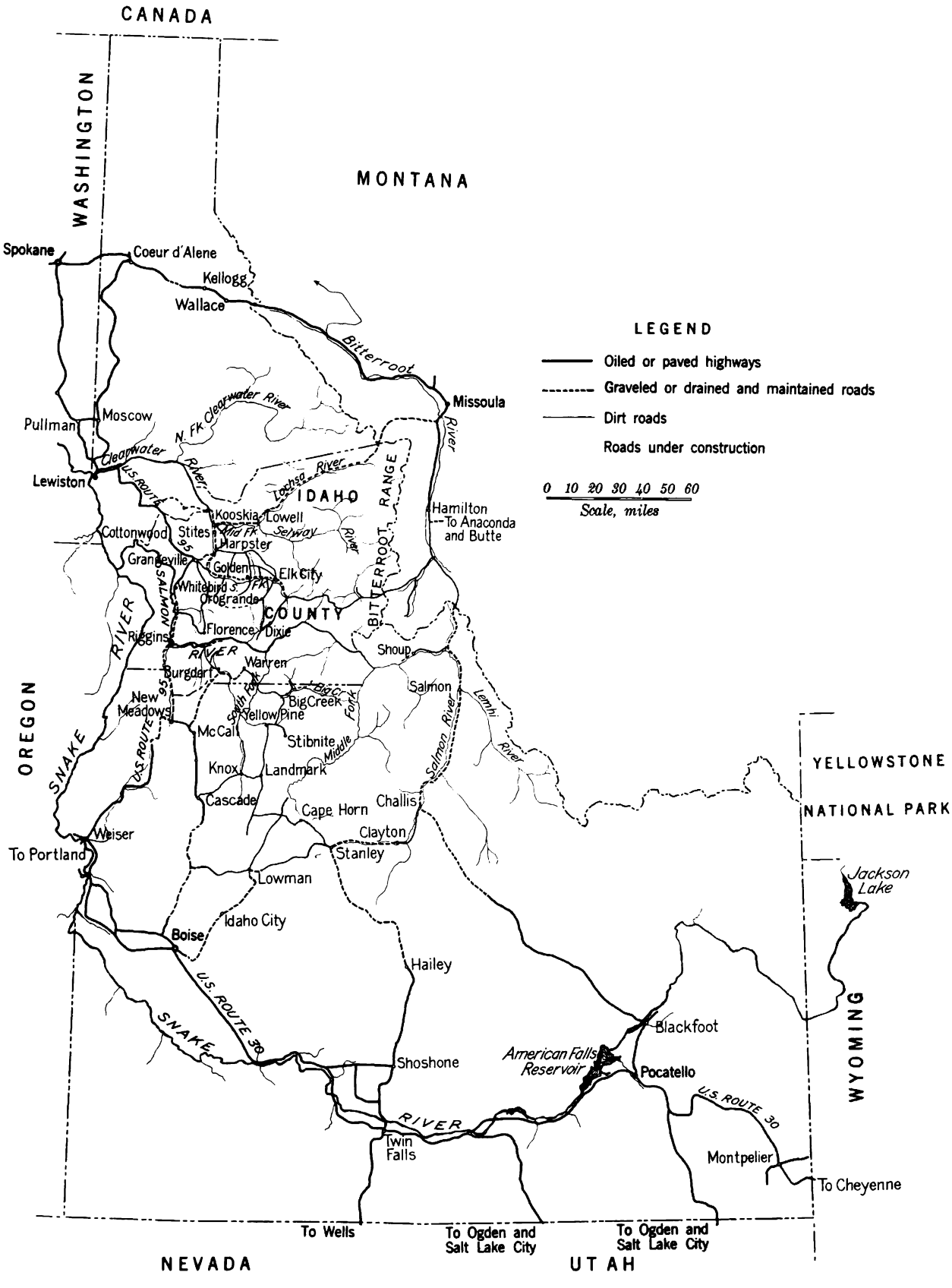


Figure 1.—Key map, Idaho County, Idaho, showing road connections with adjoining territory.

Credit for the discovery, however, is usually given to Capt. E. D. Pierce, who led a party of men into the region late in 1859 or early in 1860 and discovered gold on Canal Gulch, a tributary of Orofino Creek, near the present townsite of Pierce. According to Trimble[5], Pierce returned to Walla Walla and, in November 1860, Sergeant I. C. Smith led 60 men to Canal Gulch, where they engaged in mining during the following winter. Forty-one claims are said to have yielded gold averaging 27 cents to the pan. Early the following March, four or five hundred men left Walla Walla for the diggings, and by August 1861, 2,500 men were at work.

Trimble further states that early in 1861 a party of 52 men from Orofino penetrated the unknown region of the South Fork of the Clearwater. Part of these men were turned back by hostile Indians, but the rest discovered the Elk City district. By the winter of 1861-62, Elk City is said to have had 2,000 inhabitants.

The first discovery of gold in the Florence district is said by Laney[6] to have been made by a party of 23 men, who left Orofino early in 1861. After testing bars along the Salmon River and while exploring for a practicable route through to Elk City, they made a very rich discovery of placer gold in September a short distance north of the Salmon. Before winter set in, the townsite of Florence had been laid out and 500 to 800 men were in the district. Trimble[7] states that the gravel ran as high as $40 a pan and that miners were averaging $100 a day. Trimble also states that by June 1862 the town books of Florence recorded 1,319 claims worked by about 4,200 men. The richest ground was found on Baboon Gulch, from which a man named Weiser is said to have taken $6,600 in one day.

The Warren district was discovered by James Warren, who according to Laney,[8] organized a party at Lewiston, Idaho, in August 1862 and within a month returned to report the discovery of new and rich diggings south of the Salmon River. By November, 400 men were in the district taking out $14 to $20 a day. Trimble states that by 1865 there were 1,500 men in the Warren district, but that by 1867 the number had dropped to 500.

Other placer deposits, such as those at Newsome, Dixie, and the bars along the Salmon, were discovered almost simultaneously with those already mentioned. Activity was intense for a few years, but, with the exhaustion of the richest deposits, white miners began leaving the region, to be followed, about 1872, by a swarm of Chinese, who for some years worked ground left by the white miners and reworked many of the old tailings.

5/ Trimble, William J., The Mining Advance Into the Inland Empire: Univ. of Wisconsin Bull. 368, 1914.
6/ Laney, F. B., Unpublished manuscript.
7/ Worked cited.
8/ Worked cited.

After the exhaustion of the rich "skim" diggings, a number of large hydraulic mines were operated on the high gravels along the South Fork of the Clearwater and on the benches in the vicinity of Burgdorf; a few attempts at dredging were made at various times. Nevertheless, the total placer production of the region continued to decline until 1917, after which production was negligible until the beginning of the recent depression, when the placer production of Idaho County increased from 153 ounces of gold in 1930 to 17,432 ounces in 1933.

Higher gold prices, the development of new equipment, especially the small bucket dredge and the dragline plant, together with greatly improved roads, all have combined during the past four years to make possible the working of many deposits that formerly could not have been worked at a profit. In the summer of 1937, three bucket dredges, two draglines, and two hydraulic operations were working on a fairly large scale; numerous small plants were producing some gold. Two plants of the dragline type were under construction and large-scale testing operations were under way at several points.

PRODUCTION

No accurate records of early production were kept but numerous widely varying estimates have been made. The most conservative, and probably most dependable, estimates known to the writers are those of Lindgren[9], and Thomson and Ballard[10]. These estimates are given in the following table:

Estimated early production of gold in Idaho County

District	Lindgren	Thomson and Ballard
Florence	$15,000,000 to $30,000,000	$22,500,000
Elk City	$5,000,000 to $10,000,000	18,500,000
Warren	Over $15,000,000	---
Newsome	---	2,000,000
Dixie	---	1,500,000
Other districts	---	2,500,000

These estimates indicate that prior to the recent revival in gold mining, Idaho County had produced between $40,000,000 and $60,000,000 in gold. The estimates include both placer and lode gold; the placer production has been so greatly in excess of that from the lodes, however, that in such an estimate a subdivision would be pointless.

9/ Lindgren, Waldemar, A Geological Reconnaissance Across the Bitterroot Range and Clearwater Mountains in Montana and Idaho: Geol. Survey Prof. Paper 27, 1904.

10/ Thomson, F. A., and Ballard, S. M., Geology and Gold Resources of North Central Idaho: Idaho Bureau of Mines and Geology Bull. 7, 1924.

In Professional Paper 27 of the Geological Survey, Lindgren presents the following tables of gold production in Idaho County, compiled from mint records:

1895 - $243,700	1899 - $166,000
1896 - 155,350	1900 - 152,000
1897 - 236,500	1901 - 161,500
1898 - 203,500	1902 - 157,023

It is probable that considerable gold was produced during this period which was not recorded by the mint.

Since 1905 the yearly production of both placer and lode gold in Idaho County has been compiled from official records and published in Mineral Resources of the United States and in its successor, the Minerals Yearbook. The following table is abstracted from these publications:

Year	Placer production, ounces of fine gold	Lode production, ounces of fine gold	Total, ounces of fine gold
1905	2,289	8,254	10,543
1906	3,371	4,902	8,273
1907	1,964	3,393	5,357
1908	2,064	7,268	9,332
1909	1,380	8,546	9,926
1910	888	2,201	3,089
1911	931	2,710	3,641
1912	1,246	2,728	3,974
1913	909	1,153	2,062
1914	982	1,132	2,114
1915	1,360	3,341	4,701
1916	1,033	5,222	6,255
1917	553	9,698	10,251
1918	232	3,738	3,970
1919	238	394	632
1920	175	32	207
1921	448	522	970
1922	363	655	1,018
1923	402	752	1,154
1924	239	1,562	1,801
1925	440	1,158	1,598
1926	450	210	660
1927	394	274	668
1928	289	1,334	1,623
1929	234	2,035	2,269
1930	153	3,633	3,786
1931	2,869	1,664	4,533
1932	8,577	4,557	13,134
1933	17,432	8,211	25,643
1934	17,418	6,819	24,237
1935	18,728	8,254	26,982
1936	13,303	15,656	28,959
Total	101,354	122,008	223,362

In 1935 some production was reported from 406 placer mines and 46 lode mines; in 1936 the reported production came from 229 placer mines and 50 lode mines. The drop in number of producing placer mines and in total placer production apparently is due to increased general employment with resultant falling off in number of individual placer miners.

TOPOGRAPHY

With the exception of a comparatively small area of rolling farm land in the northwestern corner of the county near Grangeville, the region is rugged and mountainous throughout. There are, however, no well-defined mountain ranges; the region may best be described as a deeply dissected plateau. Most of the upland area is from 4,000 to 7,000 feet above sea level; the higher ridges are about 8,000 feet above sea level and a few peaks reach an altitude of over 9,000 feet. The upland area is characterized by a mature topography and by U-shaped valleys suggestive of glacial action; these valleys are occupied by the smaller streams and the headwaters of the larger streams. The rivers and some of the larger creeks occupy deep steep-walled canyons, which are eroded down to from 3,000 feet to 1,400 feet above sea level.

The most striking topographic feature of the region is the Salmon River canyon, which cuts from east to west across the southern part of the county, then turns abruptly northward, and crosses the county from south to north. This canyon is between 4,000 and 5,000 feet deep and has formed an effective barrier to cross-country travel. Other rivers whose canyons cut deeply into the region are the Selway, Lochsa, South Fork of the Salmon, and South Fork of the Clearwater; the Middle Fork of the Salmon forms part of the eastern boundary of the county.

CLIMATE AND VEGETATION

The lower parts of the deep canyons are characterized by mild winters and excessively hot summers; rainfall is light and vegetation sparse. Water for irrigation is easily obtainable, however, and luxuriant truck gardens may be cultivated on the river bars and lower bench land.

The higher parts of the canyon walls and all of the upland area are within the Nez Perce, Idaho, Bitterroot, or Lolo National Forests and are well timbered with Ponderosa pine, Douglas fir, Engleman spruce, tamarack, and lodge-pole pine. The climate at these higher altitudes is cool in summer and cold in winter. Frost or an occasional light snowfall may occur in any of the summer months; the winter snows begin to pile up in November and remain on the ground until May or late June, depending on the altitude.

Weather statistics in the mining districts are not available; however, the following tables of weather statistics in the larger towns will give some idea of general weather conditions in the surrounding country.

Precipitation[1]

Town	Grangeville		Riggins		Warren
Altitude	3,323		1,685		5,352
Month	Precipitation, inches[2]	Snowfall, inches[3]	Precipitation, inches[2]	Snowfall, inches[4]	Precipitation, inches[5]
January...	2.15	15.8	1.22	4.2	2.45
February..	1.65	10.7	1.36	5.5	2.35
March.....	2.52	11.5	1.43	1.9	2.01
April.....	2.55	4.7	1.55	0.4	1.80
May.....	3.50	1.5	2.13	0	2.01
June.....	3.10	T	1.54	0	1.92
July.....	.85	0	.47	0	.79
August....	1.09	0	.63	0	1.22
September.	2.07	0.1	1.03	0	1.54
October...	2.34	1.4	1.11	0	1.32
November..	2.13	5.5	1.21	1.1	2.27
December..	1.82	10.6	1.48	2.3	2.93
	25.77	61.8	15.16	15.4	22.61

1/ Official records, United States Weather Bureau.
2/ Average of 20 years observation.
3/ Average of 16 years observation.
4/ Average of 10 years observation.
5/ Average of 12 years observation.

Temperatures

Month	Grangeville (11-year average)				Riggins (15-year average)			
	Mean maximum	Mean minimum	Highest	Lowest	Mean maximum	Mean minimum	Highest	Lowest
January....	34.6	20.3	55	-22	41.9	27.3	61	- 3
February...	39.2	23.3	62	-20	46.7	29.4	69	-12
March.....	44.8	28.0	68	- 5	52.8	32.6	76	3
April.....	53.3	34.3	82	21	63.2	37.6	90	23
May.....	60.6	40.3	96	28	69.8	42.8	98	28
June.....	68.4	45.7	93	32	76.6	47.2	104	31
July.....	81.5	52.2	104	39	89.0	52.6	107	39
August.....	83.1	51.7	102	37	87.6	52.0	110	40
September..	67.3	42.4	95	27	75.4	45.1	95	28
October....	57.3	36.1	81	13	65.2	38.8	88	22
November...	46.2	28.0	70	-11	51.1	32.9	77	-13
December...	37.9	22.8	58	-17	42.6	28.6	63	0
Year.....	56.2	35.4	104	-22	63.5	38.9	110	-13

The following table lists the monthly snow stake readings as recorded by the United States Forest Service at three points in the mountains of Idaho County. The Ranger Stations at which these observations were taken are all within a few hundred feet, one way or the other, of being 5,000 feet above sea level. Readings are in inches of snow actually on the ground.

Station	Adams						Dixie	Red River
Year	1930	1931	1932	1933	1934	1935	1936	1936
January...	12	34	42	36	19	30	42	17
February..	24	25	60	60	25	25	55	54
March.....	24	35	60	61	29	36	66	29
April.....	24	38	63	54	2	42	56	36
May.....	0	0	30	24	0	15	12	0
October...	0	0	0	0	0	1/0	0	0
November..	0	4	5	1/2	0	1/6	1	0
December..	14	42	15	12	10	1/10	18	12

1/ Average of Dixie Ranger station and Red River Ranger station.

TRANSPORTATION

Until recently the mining districts of Idaho County have been handicapped by lack of roads. Roads from the mining settlements to the railheads at Stites, Grangeville, or McCall were little more than wagon trails through the mountains, although some of them could be traversed by automobile during the summer months; in winter the region was almost entirely isolated. Most of the mines were connected with the settlements by pack trails only.

The employment of large numbers of men on public works during the depression has brought about great improvement in transportation conditions throughout the country. An excellent dirt and gravel forest highway follows the valley of the South Fork of the Clearwater from Grangeville to Elk City, Red River Ranger Station, Red River Hot Springs, and thence over the Bitterroot Mountains to Hamilton, Mont. This road is kept open for winter travel between Grangeville and Elk City, a two-hour drive by passenger car. Good mountain roads connect the highway with Dixie, Orogrande, and many other points in the area, as shown in figure 2. Since the construction and improvement of the main forest roads, private operators have built a number of short roads to individual mines.

Burgdorf and Warren may be reached over a good forest highway from McCall or from Riggins by way of French Creek. As is the case north of the Salmon, secondary roads have been built to most of the important mines and mining districts. Road distances are shown on figure 2.

U. S. Highway No. 95 (see fig. 1) is kept open for winter travel but, with the exception of the Grangeville-Elk City and Grangeville-Orogrande roads, the mining districts are closed to wheeled motor transport during

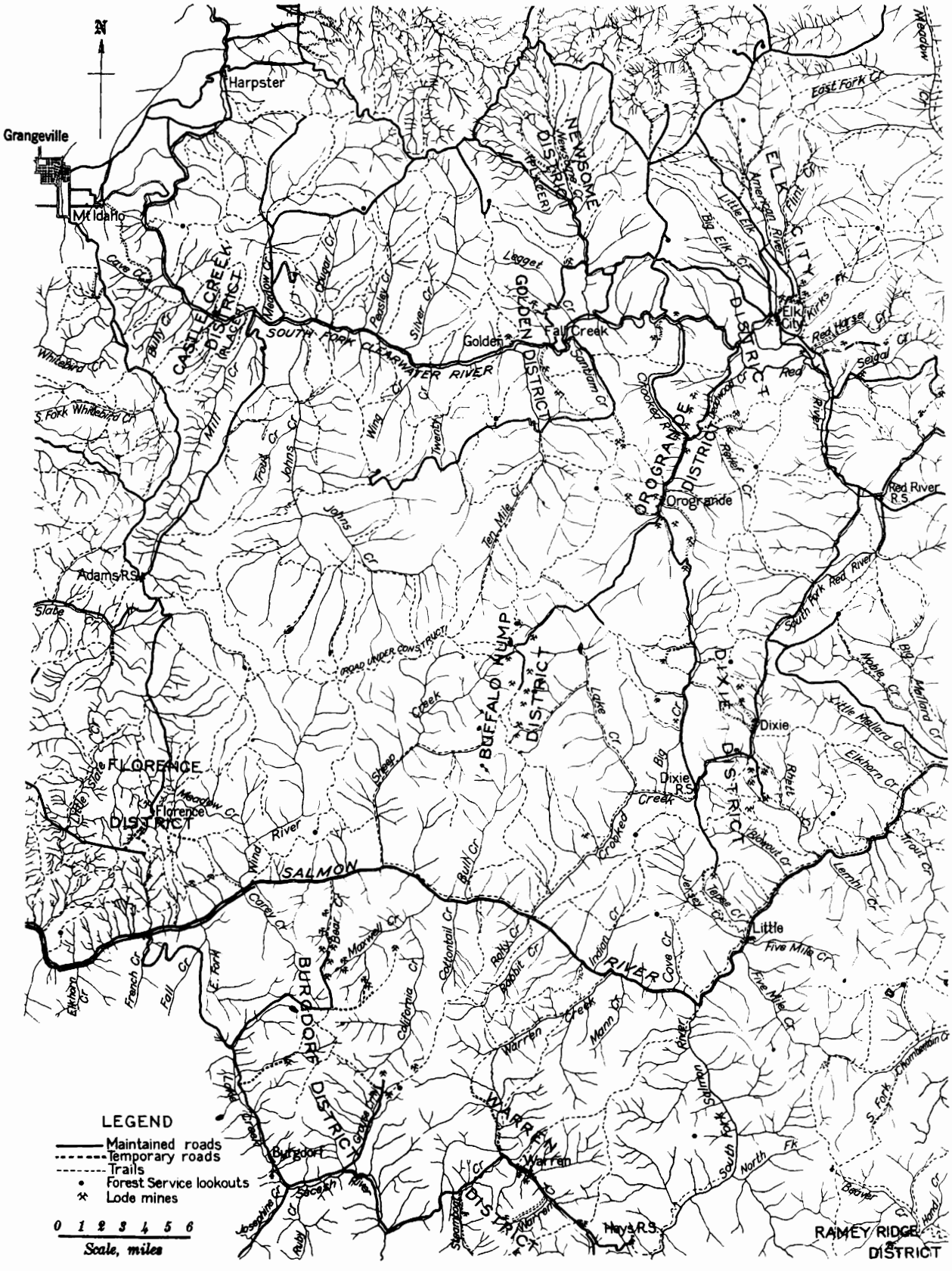


Figure 2.—Gold belt, Idaho County, Idaho, showing roads, trails, and mining districts.

the winter months. Supplies and passengers, however, are transported to the principal settlements by tractor-drawn sleds throughout the winter. The roads are usually closed to automobile travel sometime during November, although on some roads travel frequently continues until late in December. Automobile travel is usually resumed sometime during May or June, depending on the altitude.

At present there is no route of travel across or along the Salmon River except on Highway No. 95. However, a highway is under construction from Riggins to Salmon City along the bottom of the Salmon River canyon. In 1937 this road had been built to the eastward about 4 miles east of the mouth of French Creek and was entering the heart of the Idaho County mining districts. From Salmon City the road had been built westward to below Shoup, but at the present rate of construction will not reach the mining districts of Idaho County for a number of years. This road will be open for travel throughout the year, and the building of feeder roads from the upland areas down tributary valleys will permit north-south travel across the Salmon and afford quicker and easier access to most of the mining districts. This shortening of the routes of approach to many mining districts will also lengthen the travel season materially and will, in many cases, permit the roads to be kept open for all-year travel at comparatively small expense.

The railhead for districts north of the Salmon is now at Grangeville; for districts south of the Salmon at McCall. Both towns are served by the Union Pacific Railroad. There is no railroad connection between Grangeville and McCall; consequently, freight is shipped south from Spokane or Lewiston to Grangeville and north from Boise to McCall. The rail distance from Lewiston to Grangeville is 77 miles; from Boise to McCall, 148 miles.

Trucking Rates

Freight is trucked into the region north of the Salmon from Grangeville; into all but one of the Idaho County districts south of the Salmon, from McCall. The Ramey Ridge district and other territory tributary to Big Creek P.O. gets its freight by way of Cascade. A large proportion of the supplies brought into the region, or of the ore shipped out, is hauled by truck directly from the larger supply centers or to the smelters.

Because of the relatively small freight shipments in or out of central Idaho, rates are not yet well-established and tend to vary considerably for hauls of the same length. The following table presents some of the rates that were paid in the summer of 1937; these apply chiefly to small or irregular shipments. Where the rate is given in dollars per 100 pounds, it applies to irregular shipments of less than truck supplies, usually in load lots; when given in dollars per ton it applies to shipment of heavy freight, such as concentrates.

Between		Distance, miles	Rate		Rate per ton-mile
Elk City and	Grangeville	61	$0.40	hundredweight	$0.13
	Lewiston	138	.70	do.	.10
	Spokane	253	1.10	do.	.087
Dixie and Elk City		28	.35	do.	.25
	Kellogg, Idaho	337	8.50 1/	ton	.025
Orogrande and	Grangeville	66	.50	hundredweight	.15
	Kellogg, Idaho	314	14.00	ton	.045
Marshall Lake Mining Dist. 2/ and	McCall	48	5.00	ton	.10
or	do.	48	.50	hundredweight	.21
Warren	Boise	158	10.00	ton	.063
	do.	158	.90	hundredweight	.112
	Salt Lake City, Utah	545	26.00	ton	.048
Big Creek P.O. and	Cascade	83	.70	hundredweight	.17
	Boise	162	1.20	do.	.15

1/ Cost of supplies and labor only. Hauled 3 1/2 tons of concentrate in 3-ton Chevrolet truck at cost of $15 for gas and oil, and 3 days labor one man.

2/ The Marshall Lake mining district is about 17 miles by road north of Burgdorf P.O. Rates to Burgdorf should be slightly lower.

The above rates are on small and irregular shipments. Better rates could be obtained on large or regular shipments.

POWER

At Warren, a hydroelectric power plant of the Unity Gold Production Co. was supplying power for the Unity lode mine and the two dredges of the Baumhoff & Fisher Co. It is believed that a very small amount of power is still available for purchase from this source. All other mining operations in the county have to depend upon their own power plants; the placer mines were using either gasoline or Diesel power. Actual power costs at two plants are given under the description of the Deadwood dredge (p.) and the Dixie placer (p.).

Fuel

In 1937, mine operators were paying 11 to 12-1/2 cents a gallon for Diesel oil delivered to the vicinity of Elk City, Burgdorf, or Warren. More remote districts were paying as high as 14 or 15 cents a gallon. A standard grade of gasoline was selling at retail for the following prices:

Town	Price per gallon (including Federal tax)	State tax	Total
Grangeville.....	$0.22	$0.05	$0.27
McCall.....	.21	.05	.26
Elk City.....	.25	.05	.30
Dixie.....	.28	.05	.33
Burgdorf.....	.25	.05	.30

A rebate of the State tax is obtainable for gasoline used in stationary engines and other power plants not used on the roads.

LUMBER

Lumber may be purchased from the mills in either Grangeville or McCall, where rough lumber was selling for $16 to $18 a thousand. This lumber could be delivered to the more accessible mining districts at about $22 a thousand. Planed lumber was selling at from $18 to $25 a thousand at the mill.

LABOR AND WAGES

In Grangeville, McCall, and the various settlements in the mining districts is a supply of skilled and unskilled labor usually sufficient to meet the small demands of the placer operators.

Wages in general are lower than in more industrialized regions. There was no established wage scale, consequently wages varied considerably from place to place. Wages paid at placer mines, however, were usually within the limits given below:

	Rate per day
Winchmen.....	$5.20 to $6.00
Mechanics.....	5.00 to 6.00
Oilers, laborers, etc.	3.50 to 5.00
Shovel runners.....	6.00 to 9.00

GENERAL GEOLOGY

The general geology of north central Idaho has been described by Lindgren[11] and, more recently, by Shenon and Reed,[12] from whose work the following description was abstracted.

The oldest rocks in the area comprise a thick series of gneisses, schists, quartzites, and limestones, which appear to belong to the Belt series (pre-Cambrian).

The most abundant rocks in the area are the granodiorite and monzonite of the Idaho batholith, which intruded and profoundly altered the older rocks. The intrusion of this batholith has been assigned by some writers to the late Jurassic or early Cretaceous; others have assigned it to the late Cretaceous or early Eocene.

Subsequent to the intrusion of the batholith, central Idaho was deeply eroded to a region of low relief, and the thick covering of Beltian rocks was removed to expose granitic rocks over large areas. This surface was then uplifted and greatly dissected by erosion, but parts of the surface remain to the present day; in places these remaining parts stand at altitudes of 8,000 feet or more.

In Tertiary time the Columbia River lava and its interbedded sediments were deposited over the lower part of the region. Since then, possibly in part during the period of lava extrusion, faulting, and possibly warping, formed certain basin-like depressions, such as those of Elk and Newsome Creeks. These basins were partly filled with gravel, sand, and clay.

The drainage was again rejuvenated, and before the late Miocene time, the Salmon, Clearwater, and other trunk streams had cut deep canyons well below the base of the Columbia River lava while erosion was proceeding headward along the valleys of their tributaries.

11/ Work cited.

12/ Shenon, P. J., and Reed, J. C., Geology and Ore Deposits of the Elk City, Orogrande, Buffalo Hump, and Tenmile Districts, Idaho County, Idaho: Geol. Survey Circular 9, 1934.

In the late Miocene stage, the higher parts of the region were extensively glaciated.

Numerous gold-bearing veins were formed after the solidification of the batholith and before the deposition of the unconsolidated Tertiary sediments; the placer deposits of the region were formed by the weathering of these veins and the subsequent concentration and reconcentration of the gold derived from them.

PLACER DEPOSITS

Some gold may be found in most streams in Idaho County, but deposits of commercial importance are usually confined to the vicinity of areas where numerous gold-bearing veins are known to occur. Most of these veins are found in a northeasterly trending belt about 60 miles long by 30 miles wide, including the settlements of Elk City, Golden, Newsome, Orogrande, Florence, Dixie, Warren, and Burgdorf. Even within this productive area the commercial placers are seldom far from the local centers of lode mineralization; where exceptions to this rule do occur, it usually is found that present stream gravels are closely associated with ancient high channels that could have derived their gold from veins now removed by erosion. Scattered gold veins occur in other parts of the county, but in 1937 the only important placer mining activity outside of this belt was along the bars of the larger rivers, where most of the gold had apparently been transported from considerable distances.

The commercially important placer deposits of the region may be classified into three broad types, as follows:

1. Stream gravels along present stream valleys.
2. Bench gravels along the sides of present stream valleys.
3. High gravels deposited in Tertiary basins or channels (these deposits have been partly eroded and reconcentrated in present stream channels).

The geology of these various types of deposits has been studied and described in considerable detail by members of the Geological Survey.13/

The following maps show the situation and approximate size of those gravel deposits that seemed to the authors to be of commercial importance or to contain sufficient gold that a moderate improvement in the relative price of gold might cause them to become commercial.

13/ Reed, John C., Gold-Bearing Gravels of the Nez Perce National Forest, Idaho County, Idaho: Pamphlet 40, Idaho Bureau of Mines and Geology, Univ. of Idaho, Moscow, Idaho.
Pamphlets describing the Florence, Warren, and Dixie districts are in preparation.

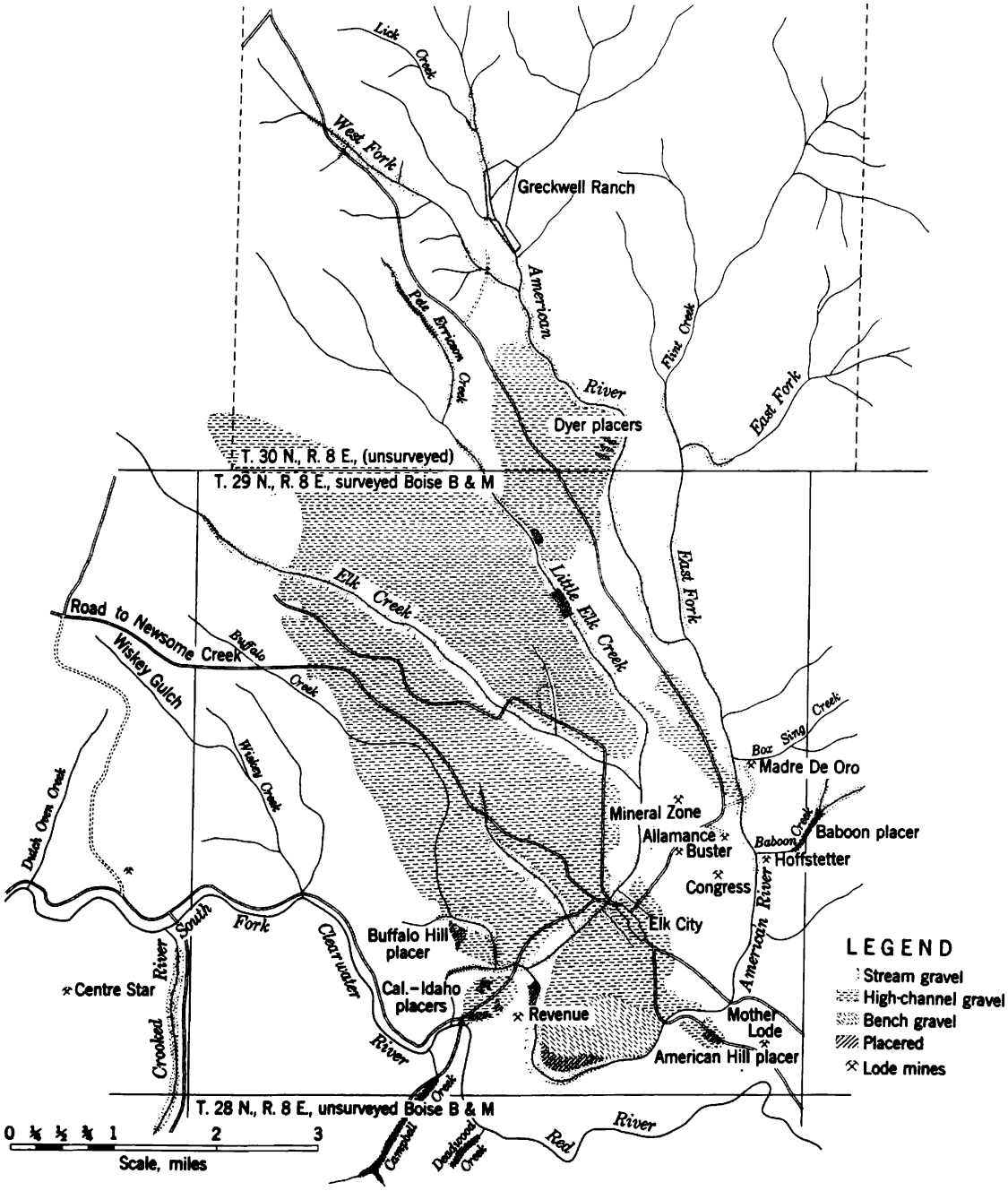


Figure 3.—Gravel deposits of the Elk City district, Idaho County, Idaho. (Position of high-channel gravel from maps by Reed.)

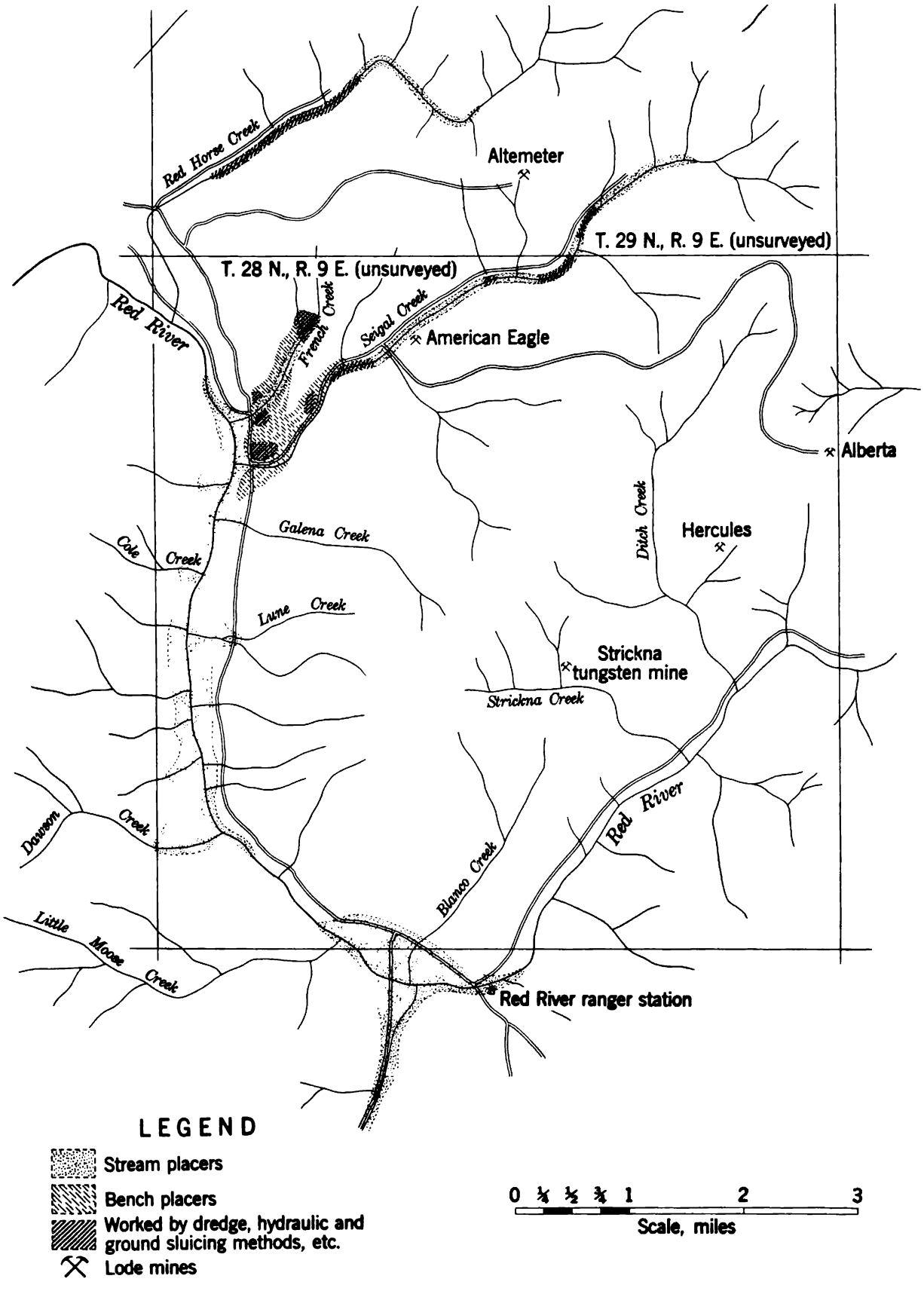


Figure 4.—Gravel deposits of the Red River district, Idaho County, Idaho.

The areas of gold-bearing gravel were mapped from rough pacing surveys and estimates. More accurate and detailed maps of many of the more important deposits have been prepared by the Geological Survey.14/

The descriptions accompanying the maps attempt to give data of specific value to the prospective operator. Most of these data were obtained by personal examination of the ground; estimates of values were necessarily based on local information. An attempt was made, however, to sift evidence from various sources and to present only such data as the authors considered to be reasonably reliable.

Elk City district

The Elk City placer deposits (see fig. 3) lie almost entirely in Townships 29 N., R. 8 E., and 30 N., R. 8 E. Most of the deposits are in the large basinlike depression containing Elk Creek, American River, and their tributaries. Placers near the mouths of Deadwood Creek, Campbell Creek, and Crooked River also may be included in this district.

Elk City is also the supply point for the lode and placer mines in the adjoining Red River district (fig. 4), which is separated from the Elk City district only by the Red River canyon and the divide between Red Horse Creek and Kirks Fork.

Elk City and the lower parts of the Elk Basin floor are approximately 4,000 feet above sea level; the sides of the basin slope gradually up to ridges, whose summits are 6,000 to 7,000 feet above sea level.

Numerous gold-bearing quartz veins, many of which have been commercially productive, are distributed widely throughout the districts. The most important centers of lode mineralization are in the vicinity of Elk City and on Seigal Creek; the most productive placer mines of the Elk City and Red River districts, respectively, have usually been situated in or close to these highly mineralized areas.

This occurrence of rich lode mineralization in a large structural basin suitable to the retention and concentration of placer deposits has made the Elk City district one of the most productive placer mining camps of Idaho. Reconcentration of gold from the high-level gravels that are found throughout the basin has contributed materially to the richness of the later stream deposits.

Although the rich "skim" diggings were exhausted in the early days, there are still a few deposits on the smaller streams that may be worked profitably by small-scale methods. Ground suitable for small dredge or dragline operation remains on a few creeks, notably Little Elk and possibly upper American River and lower Crooked River in the Elk City district, and Red Horse Creek and Seigal Creek in the Red River

14/ Work cited.

district. A large volume of dredging ground has been proved on lower American River and additional large volumes of possible dredging ground remain on Big and Little Elk Creeks and on Red River.

Probably the largest gold resources of the district are contained in the immense deposits of high-level gravels that cover much of the basin floor. So far, it has been commercially possible to work these deposits only in a few favored locations; they are described in more detail on page 35.

Stream gravels of the Elk City district

American River. - The American River joins the Red River about 2 miles southwest of Elk City to form the South Fork of the Clearwater River; at this point the river bottom is approximately 3,900 feet above sea level. From here to the Greckwell Ranch, American River has a gradient of between 40 and 60 feet to the mile. In July 1937 the flow at the Greckwell ranch was estimated at about 16 second-feet; at the confluence with Red River it is probably twice this amount.

The lower half mile of the American River flows through a narrow canyon with steep walls. This section of the stream has no placers, except possibly some very small bars that could be worked only by hand methods. Above this is about three-fourths mile of more open canyon containing placer deposits ranging in width from 50 to 150 feet. Considerable testing was done along this section, but no accurate data on the results of the tests were available. It appears likely, however, that commercial values exist, and it is possible that the whole section could be worked at a profit. This section of river is too narrow and contains too many boulders to permit efficient use of a bucket line dredge. The ground is owned by the C. E. Witter estate of Spokane, Wash. Part of it is held by location and part is patented.

Extending from Elk Creek for 2 miles upstream, the American River bottom ranges in width from a maximum of over 1,500 feet just above Elk Creek to a minimum of about 100 feet at the upper end. The stream gravels along this section of the river and some of the bench gravels were thoroughly tested by Fisher and Baumhoff, who recently acquired title to the ground. Several acres of ground on the south side of the river just above Elk Creek were dredged a number of years ago. The dredge tailings show very few boulders 1 foot in diameter and practically none that could not be handled by a 3-foot bucket line dredge. The depth of the gravel, as indicated by drilling, ranges from 12 to 22 feet with an average of about 15 feet. It is reported that Fisher and Baumhoff intend to hold the ground for future dredging operations.

From the upper end of the Fisher and Baumhoff ground, for about 2 miles above, the river flows through a narrow canyon. There are some small bar placers just below the bridge of the Elk City-Dixie road. Just

east of the road and about 300 feet north of the river are some bench gravels of the American Hill Placers. Aside from this, there are no placer deposits of importance along this section of the river.

Just below Baboon Gulch, the canyon opens into a valley. For 8 miles above this point the valley floor ranges in width from a few hundred feet to nearly 1,000 feet. A great many drill holes and test pits have been put down along the section of the river from Baboon Gulch to the lower end of the Greckwell Ranch. No large amount of systematic prospecting, however, has been done on any particular strip of ground. With the exception of two or three lines of holes that had been drilled and marked a number of years ago, the prospecting seems to have been done haphazardly and unsystematically. One line of holes was drilled across the river bottom just above Baboon Gulch at about the place where the Alamance and Buster veins cross the valley. The holes indicate values ranging from a few cents a yard to as high as 25 cents a yard, with an average of 10 to 12 cents a yard at the present price of gold ($35 per ounce). All testing above this seems to have shown rather discouraging results. A line of drill holes about 1,500 feet below the junction of the American and East American Rivers showed values of only 2 to 4 cents a yard. From the junction of the rivers to the Greckwell Ranch, there are probably 15 open pits that were excavated recently by interested parties. It is reported that two or three of these were in gravels containing up to 25 cents a yard. Most of the others, however, were blanks, or at least in very low-grade material. There are no known records of any testing having been done on the Greckwell Ranch or above. On Lick Creek, above the Greckwell Ranch, is a small shallow deposit that was worked to a limited extent by hand methods.

The depth of the gravel along the entire section of the American River from Baboon Creek to the upper end of the Greckwell Ranch is about 8 feet. Between Baboon Creek and Box Sing Creek the deposit consists of gravel ranging in size from coarse sand up to about 8-inch boulders. Boulders as large as 1 foot are not uncommon except at the lower end below Baboon Creek. Above Box Sing Creek the material is very fine, consisting almost entirely of coarse sand and small gravel up to 2 or 3 inches in size.

Of all the testing done from Baboon Creek to the Greckwell Ranch, only that in the vicinity of Baboon Creek indicates commercial possibilities. The isolated places above Baboon Creek that showed appreciable values might indicate the position of small channels or areas of gravel that could be worked at a profit. Most of the testing, however, was too limited, too unsystematic, and too carelessly done to prove that such areas or channels actually exist. The most promising places are along the west side of the creek, where the eroded gold-bearing high-channel deposits between American River and Little Elk Creek would most likely be redeposited.

All of the ground south of the forks of the American and East American Rivers is patented, partly as mining but mostly as agricultural land. From Baboon Creek to Box Sing Creek are a number of mining claims, some of which belong to the Alamance Mining Co. and some to the Congress Mining Co. From Box Sing Creek to the junction of the American and East American Rivers the land is owned mostly by Mark Lyons and Mrs. L. B. Feltz of Elk City. From the forks of the rivers to the Greckwell Ranch the ground is held by location. James Dyer of Elk City has about 2 miles along the river from the forks up. The rest is held by Mark Lyons, Jim Lewis, and others of Elk City. The Greckwell Ranch is patented land belonging to Dick Greckwell of Elk City. The ground above the Greckwell Ranch on Lick Greek, so far as known, is open to location.

East American River. - East American River flows nearly due south, entering the American River about 2 miles above Baboon Creek. The gradient is from 60 to 100 feet in a mile at the lower end and slightly more at the upper end. Early in July the flow is from 5 to 7 second-feet, but later in the season it falls to around 4 or 5 second-feet.

Stream gravel deposits are found along the stream from its confluence with American River to about three-fourths mile above its junction with Flint Creek, a total distance of about 2-1/2 miles. At the lower end the creek bottom is from 50 to 75 feet wide; from three-fourths mile above the fork to Flint Creek it is from 100 to 150 feet wide.

Only a little testing has been done anywhere along the stream, but about 1-1/2 miles above the fork several hundred cubic yards of gravel have been worked by hand methods and ground sluicing by John Oberhoffer of Elk City. It is said that it averaged about 25 cents a yard. The depth of the gravel ranges from 5 to 7 feet. It contains few boulders larger than 1 foot, except at the lower end, where the creek bottom is narrow. Above Flint Creek the gravel is smaller, the largest pieces being only from 4 to 5 inches. A few test pits have been dug along this part of the river, but it was impossible to get any information about them.

The deposits on Flint Creek have very much the same general characteristics as those of the upper part of the East American River. Two or three test holes had been dug, but no information was available concerning the results obtained. The ground belongs to John Oberhoffer of Elk City.

Buffalo Creek. - Buffalo Creek flows from the north and enters the American River about a mile above the confluence of the American and Red Rivers. In the early spring there is a considerable flow of water in Buffalo Creek, but by July 15 the lower end becomes completely dry. The creek is about 5 miles long, but only about three-fourths mile of its lower end has any placers. From its junction with American River

for about one-fourth mile to the north it is from 50 to 75 feet wide with a gradient of 70 to 80 feet in a mile. All of this section was worked by a small power shovel and a portable washing plant 8 or 10 years ago. Data concerning the operations are not available.

The upper part of the deposit is about half a mile long and in places up to 800 feet wide. The gradient along this section is from 30 to 40 feet in a mile. Unfortunately, it was used as a tailings dump for the Buffalo Hills placer operations (fig. 3). The entire area is covered with tailings to a depth of 8 to 20 feet. In recent years several test holes were put down to bedrock. It is reported that the original placer gravel is from 8 to 10 feet deep with values as high as 50 cents a yard.

Practically all of the ground is owned by the C. E. Witter estate of Spokane, Wash. Part of it is patented and part is held by location.

Elk Creek. - Elk Creek flows into the American River from the north about one-fourth mile above Buffalo Creek. The flow at the lower end is from 3 to 5 second-feet during July and August. At the upper end, above where the water is used for irrigation, the flow is from 6 to 8 second-feet. The creek has a total length of about 10 miles, with stream gravels extending from its confluence with American River for more than 7 miles upstream. The deposits are continuous except for a short canyon about three-fourths mile above the mouth.

From the mouth of the creek to the canyon the creek bottom ranges in width from over one-fourth mile at the lower end to about 400 feet at the upper end. This section was tested very thoroughly by Fisher and Baumhoff of Warren and is stated to have been proved suitable for dredging ground. The depth of the gravel probably averages more than 20 feet; one hole 40 feet deep did not reach bedrock. The land is part of a stock-raising ranch and has been used for agricultural purposes for a great many years. Fisher and Baumhoff have an option on the property with a view to using it with adjoining American River property as a site for future dredging operations.

Very little is known about the tributary that enters Elk Creek from the northwest about half a mile above the mouth of Elk Creek. It is being used as agricultural land.

Beginning just east of Elk City and extending up Elk Creek for 6 miles are what are known as Elk Meadows. These meadows constitute one of the largest stream gravel deposits in the upper basin of the South Clearwater River. They are exceeded in size only by two deposits on Red River to the southeast of Elk City. From Elk City to the junction of Elk Creek and Little Elk Creek they range in width from 400 to 2,000 feet. Above the junction of the two creeks they are narrower, ranging in width from a maximum of about 700 feet just west of the junction to a minimum of 150 feet at the upper end.

Little if any placer mining has been done anywhere along the main creek. Some prospecting and drilling was done just north of Elk City, but apparently not enough reliable information was produced upon which to form a definite opinion as to the value of the deposits for possible dredging ground. In places some fairly good values were encountered, but in other places the gravel was very lean. It is not known whether enough drilling was done to determine the existence of definite channels with commercial possibilities anywhere in the deposit. It is reported that in places the gravel is very deep, some holes having been drilled to 80 feet without finding bedrock.

Very little is known of the gravel deposits on Elk Creek above its junction with Little Elk Creek. They are undoubtedly much shallower than below the junction.

With the exception of the Thomas placer, all the land along Elk Creek from Elk City to the end of the creek gravel deposits is patented as agricultural land. Some of the land just south of the junction of the creeks belongs to the Litchfield estate; near Elk City, Mark Lyons and associates have large holdings. Above the junction the land is owned by Miss Gertrude Maxwell and Mrs. L. B. Feltz, both of Elk City.

Little Elk Creek. - Little Elk Creek, the only important tributary of Elk Creek, flows from the northwest and joins Elk Creek about a mile north of Elk City. Placers extend from the junction for about 4 miles upstream. The width of the gravels varies from about 800 feet at the lower end to 150 or 200 feet at the upper end.

Considerable placering has been done near the head of the creek and on several of the small tributaries that come in from the north. A number of years ago a dredge was operated about 2-1/2 miles above the junction with Elk Creek. At present, two small properties are being operated on a small scale by ground sluicing and shoveling.

The Shuck Placer, owned and operated by Hark Shuck of Elk City, is 4-1/2 miles by road from Elk City on the north side of Little Elk Creek. The workings are mostly in the high gravels and bench gravels adjacent to the creek gravels, but some creek gravels also are worked. In the spring of the year a small amount of water is available from a draw that comes in from the north. During the dry season, water is pumped from the creek by a small centrifugal pump operated by a gasoline engine. The ground is worked by ground sluicing and shoveling. The bench gravels at the workings are from 8 to 10 feet deep and the Creek gravels from 5 to 7 feet deep.

The Smith Placer is on Pete Erricson Creek, a north tributary of Little Elk Creek, at a distance of 8 miles by road from Elk City. The width of the deposit is from 200 to 300 feet and consists of 4 to 5 feet of pay gravel with from 2 to 3 feet of overburden. The gravel consists of angular fragments, the values having apparently been derived from a number of small veins that cross the upper part of the deposit.

The overburden is ground-sluiced off in the spring when there is a good supply of water. The pay gravel is then shoveled into sluice boxes. In the early summer the water must be impounded back of small dams during the night so that sluicing can be done during the day. Later on in the summer it sometimes requires two or three days for enough water to accumulate for a few hours' sluicing. The property is owned and operated by the Smith brothers of Elk City.

Prospecting on Little Elk Creek seems to have produced more favorable results than that on Big Elk Creek. About 2,500 feet above the forks of the two creeks, on the property of George Barnett of Elk City, a line of 14 holes was drilled across the creek bottom, which at that place is about 250 feet wide. Values indicated by these holes range from less than 1 cent to 26 cents a yard, the two outside holes being the lowest. The other 12 holes showed an average depth to bedrock of 10.6 feet and an average value of 12 cents a yard. This does not appear to be a local enrichment, as there are no veins in the immediate vicinity. Rather, it would appear that the gold was derived from veins that are known to cross the valley near the head of the creek, from tributary channels, and from the erosion of high gravels that lie on the ridges on each side of the creek.

The land along Little Elk Creek is mostly patented as agricultural land. The major portion of it is owned by George Barnett, George Bartunk, Hark Shuck, and A. M. Miller of Elk City. Late in 1937, Little Elk Creek was tested by Frank J. Friedle for Oregon interests; it is reported that preliminary results were encouraging.

Baboon Creek. - Baboon Creek flows into the American River from the east about 1-1/2 miles northeast of Elk City. It has a gradient of 250 to 300 feet in a mile at the lower end and from 150 to 200 feet at the upper end. It is dry during the greater part of the year. From its junction with American River for about 1,500 feet to the east the channel consists of a narrow V-shaped gulch in which there are no gravel deposits of importance.

From the east end of this gulch to the head of the creek, a distance of about a mile, the creek bottom has a width of 75 to 125 feet. All of the gravel along this section of the creek, including that in a tributary that comes in from the north, is gold bearing. Values up to 50 cents a yard are reported, but the average is probably much less than this. The creek gradient is steep enough to permit working by hydraulic methods. The deposit is known as the Baboon Placers. About 2,000 feet of the lower end has been worked, the last work having been done in 1918 and 1919. The gravel is from 10 to 15 feet deep at the lower end, but shallower at the upper end. It consists of material ranging in size from 1 inch up to over a foot, and in shape from sharp angular to well rounded. This would indicate that it was formed partly from the disintegration of country rock and

gold-bearing quartz outcrops near the summit between Baboon Creek and Box Sing Creek and partly from the erosion of high gravels that are present to a limited extent near the upper part of the creek. The gravel was washed by hydraulic methods. Water was taken from Box Sing Creek through a ditch 3-1/2 miles long. The ditch is in fair condition, but one of the flumes was burned in a recent forest fire. The upper end of the deposit, consisting of about 2,500 feet on Baboon Creek and 1,500 feet on the north tributary, has not been worked. The property belongs to George E. Hottenstein of Elk City.

West Fork Creek. - The West Fork of the American River flows into American River about half a mile below the Greckwell Ranch. Gravel deposits along this stream have been given very little attention until the last year or two. One deposit extends from the confluence of the creek with the American River for about 3,000 feet upstream. This has an average width of 150 to 200 feet and a depth of 5 to 7 feet. The material consists of sand and fine gravel with very few rocks as large as 6 inches. About half a mile above this is another and wider deposit extending along the creek from about where the road enters the canyon to the forks of the creek, a distance of about 1-1/4 miles. In places where tributary streams come in from the north and south, it is as wide as 500 feet, the average being from 200 to 250 feet. The depth appears to be from 7 to 10 feet, but a depth of 20 feet has been reported. The gravel is coarser than that of the lower deposit, having considerable material up to 5 or 6 inches. The material in both deposits ranges in character from slightly rounded to well rounded. A number of test pits have been dug on both deposits. Information concerning these pits is only hearsay and not reliable. Gold values as high as 70 cents per cubic yard have been reported. Any gold there may be probably is derived entirely from lode-gold veins, as the high-gravel deposits do not extend this far north. The lower deposit is held by location by W. H. Shea, Ted Fairhurst, and R. M. Richard of Elk City. The upper one has been located and relocated a number of times in recent years. W. H. Clinkenbeard holds eight claims on what is known locally as Table Meadows.

Red River District

The Red River valley is cut deeply into the surrounding county; the neighboring ridges rise from 1,500 to nearly 2,000 feet above the river valley. The tributaries from the north at the lower end of the river are crossed by many small gold-bearing veins. Several of these veins outcrop at the George Prezel Placer in the draw just west of Red Horse Creek. Others outcrop along Seigal Creek and French Gulch. The American Eagle mine, on Seigal Creek, is on one of the larger of these veins. High gravels and bench gravels are sparse in the vicinity of French Gulch and Seigal Creek. Lode mineralization is much weaker south of Seigal Creek; the veins are fewer and lower grade, and high gravels occur sparingly, if at all.

Stream Gravels of the Red River District

Red River. - Red River (fig. 4) is about 25 miles long. At its confluence with American River the altitude is about 3,900 feet. The gradient of the lower 15 miles is from 25 to 40 feet in a mile; above this, it is steeper. During the late summer and fall the flow is from 15 to 20 second-feet. During the flood season it is probably 250 or 300 second-feet.

The lower 6 miles of the stream flows westward through a canyon with steep walls. Virtually all of this section of the river was worked in the early days by hand methods. Some gold seems to have been found in bars from 8 to 12 feet above the stream level, but mostly in the gravel at about high-water level. It is probable that the ground was not worked completely as there was no way of handling water at depths below the stream level. The bed of the river as well as the small flats and bars adjacent to it are strewn with large rocks weighing from 1/2 to 25 tons. Conditions are unfavorable for dragline or other mechanical operations.

About 2,000 feet below French Gulch the canyon opens into a valley that extends up the river for 4 miles. The meadow lands along this section of the river range in width from 1,500 feet to over 2,000 feet. Considerable prospecting was done at the lower end of the meadows, where French Creek and Seigal Creek empty into Red River. At French Creek, a small dredging operation was attempted. From the limited amount of ground worked, it might be presumed that this operation was not successful. According to George Barnett, of Elk City, two lines of holes just below French Creek on the east side of the river showed gold values up to 45 cents per cubic yard and averaged 12 to 15 cents per yard with gold at $20.67 an ounce. A line of holes on the west side of the river just above Seigal Creek showed gold valued too low for dredging, even at the present price of gold. This would indicate that commercial possibilities are limited to a comparatively small area on the east side of the river from Seigal Creek down to the end of the meadows. The depth of the gravel, as indicated by the drill holes, is from 9 to 10 feet, with 3 to 4 feet of overburden.

The meadows have been patented as agricultural land and have been used exclusively for agricultural purposes for many years. The lower end belongs to Jim Prichard, of Elk City.

Beginning at the confluence of Little Moose Creek and Red River and extending up the river for several miles is another stretch of meadow land that is used for agricultural and stock-raising purposes. It is generally believed that these meadows have no value as gold placers under present conditions. It is probable that they contain some gold, but the absence of either commercial placer or lode gold deposits in the upper Red River drainage area indicates that the values are probably very low. It is reported that testing operations were begun on this section late in 1937.

Red Horse Creek. - Red Horse Creek flows into Red River about 5 miles above the junction of American and Red Rivers. The lower mile and a half of the creek is in a steep canyon. The creek bottom in this canyon was prospected with rather discouraging results in the spring of 1937.

Placers begin at the upper end of the canyon, where the road crosses the creek, and extend upstream for 2-1/2 to 3 miles. They range in width from 50 to 200 feet and in depth from 9 to 10 feet, with about 4 feet of overburden. The deposit has been prospected thoroughly, and the lower end has been worked for a distance of about a mile and a half.. Most of the work was done by a dragline and portable washing plant.15/ At the lower end, just above the road, a small amount of hand work was done. The value of the material, exclusive of overburden, as determined by actual operations, ranged from 65 to 75 cents per yard.

The ground is owned by Scharley Simmons of Elk City; in 1937 it was operated under lease by C. T. Phillips and associates of Elk City.

In a small draw just east of Red Horse Creek is the George Prezel placer, owned and operated by George Prezel of Elk City. The deposit extends north from the road 2,500 or 3,000 feet along the bottom of the draw. The width ranges from 25 to 30 feet and the depth from 4 to 6 feet, about half being overburden and half gravel. The gravel consists of angular fragments, indicating the close proximity of its source. The gold is coarse and angular, probably having been derived entirely from a number of small veins that cross the property from east to west. Nuggets worth from $4 to $5 are not unusual.

The property has been operated by the owner since 1932. Water is available from March 15 until July 1, but during the end of the season it must be impounded in small reservoirs during the night to permit sluicing during the day. The material is handled by ground sluicing and shoveling. About 1,200 feet of the lower end of the deposit has been worked. Approximately 3,000 yards of material, including overburden, were handled since operations began. The mint returns were $1,123, indicating a value of 37.7 cents a yard for all of the material handled, or 75.4 cents for the pay gravel only.

French Creek. - French Creek flows into Red River about a mile above Red Horse Creek. It has a gradient of 100 to 150 feet in a mile. In the early spring there is enough water for ground sluicing, but during the dry season the creek bed becomes nearly dry. The lower 1,500 feet of the gulch is narrow and V-shaped and has no stream placers. Bench placers, however, occur along the sides above the creek bottom for a distance of a mile or more east of where the road crosses the creek. The bench deposits have been worked on each side of the creek for 800 feet east of the road.

15/ See description of Red Horse placer operations, p. 28.

Stream placers begin about 1,500 feet east of the road and extend up the main creek for about a mile and up a tributary creek from the north for about 3,000 feet. Most of the deposits in the tributary have been worked by ground sluicing and hydraulic methods. Very little information is available on the deposits in either the main or the tributary creek. Those of the main creek are covered with tailings to a depth of 8 to 10 feet for a distance of nearly 2,000 feet below the tributary.

It is probable that the values in the stream gravels are derived in part from the erosion and redeposition of bench gravels and in part from the breaking down of veins.

Seigal Creek. - Seigal Creek is one of the larger tributaries to the lower part of Red River. It is exceeded in size only by Red Horse Creek. It has a total length of about 6 miles, with a gradient of 65 to 85 feet in a mile. During July and August the flow is from 2 to 4 second-feet. In the early spring it is probably several times that amount.

Bench deposits occur along the creek for about a mile northeast of where the road crosses. Stream gravel deposits begin about a mile northeast of the road and extend up the creek for 3-1/2 miles. The lower two miles have an average width of about 200 feet; the upper mile and a half about 300 feet. At the lower end the gravel is about 5 feet deep with 3 feet of overburden. At the upper end it is from 2-1/2 to 3 feet deep with about an equal amount of overburden. It is stated that the gravel (exclusive of overburden) runs from 50 to 75 cents a yard, with values as high as $1 a yard.

Encouraging values are evident from the number of attempts made to work deposits. During the past five years at least three different parties installed washing plants and excavators of various types at various places along the creek. About a mile above the American Eagle mine the gravel was loaded into trucks by a small power shovel and hauled to a central washing plant located on the north hillside about 35 feet vertically above the creek bottom. The plant consisted of a receiving bin and about 30 feet of sluice boxes.

About 2 miles above the American Eagle mine a movable washer on skids was used. A small dragline was used for stripping overburden and loading the gravel into the bin of the washing plant. The plant consisted of a bin of about 2-1/2 yards capacity, a 3-1/2- by 10-foot trommel, a 6- by 10-foot stationary table, a tailings stacker, and a sand elevator. The tailings were stacked on each side of the washing plant, a space being left in the center for drainage.

In July 1937 there were no workings anywhere along the creek, but a small plant was moved in later in the season. One of the reasons given for the failure of operators to make a profit is that large amounts of heavy black sands blinded the riffles and made it impossible to do more than make a concentrate. At present, from 60 to 75 percent of the deposits remain unworked.

Operations of the Red River District

Red Horse Placer. - In 1937 C. T. Phillips and associates operated a dragline plant on a placer deposit on Red Horse Creek, 3-1/2 miles southeast of Elk City, Idaho, at an altitude of 4,400 feet.

The deposit is about 3 miles long and 50 to 200 feet wide; its average depth is about 10 feet. Bedrock is soft decomposed schist and gneiss cut by dikes of harder and more resistant rock. Bedrock gradient is about 50 feet to the mile. Boulders too large to go through the washing plant are scarce. When visited, the plant had been in operation about 2 months; the part of the channel being worked at that time was about 70 feet wide.

Equipment consisted of a model 25 Northwest shovel equipped with a 45-foot boom and a 1-1/4-yard dragline shovel, an RD 7 Caterpillar tractor with a LeTourneau angledozer, a 6-inch centrifugal pumping unit, and movable washing plant.

The washing plant was built on the ground. Because of the small amount of clay in the material to be worked, no trommel was provided.

The plant is 18 feet high to the top of the receiving hopper, 10 feet wide, and 52 feet long overall. It is built of 6- by 6-inch square timber reinforced by 2- by 8-inch longitudinal bracing. Round timber skids 20 inches in diameter at the front end and 10 inches in diameter at the rear end extend beneath each side of the framework; the skids are spaced 9 feet from center to center. Round timber rollers 10 inches in diameter are used under the skids.

Gravel is received in a steel-lined hopper 8 feet 1 inch long by 7 feet 4 inches wide, from which it drops 6 inches to a steel grizzly 7 feet 4 inches wide by 6 feet long. The grizzly is built of 3/4-inch grizzly irons spaced 1 inch apart and set on a 45-degree slope. Undersize from the grizzly drops into a 5-foot wide sluice set on a grade of 1-1/8 inches to the foot. The upper 8 feet of the sluice is riffled with 1-inch angle iron set 1 inch apart; the remaining 34 feet of sluice is riffled with metal lath over burlap, both protected by 3/16-inch-mesh smoke-stack screen. The sluice discharges at a height of 56 inches above the skids.

Oversize from the grizzly drops onto an A-shaped deflector or wing grizzly set astride the washing plant to discharge oversize to the two sides of the plant. The wings, or legs, of this grizzly are each 36 inches wide by 7 feet long, set on a 30-degree angle; that part directly over the sluice is built of 3/4-inch grizzly irons spaced 1 inch apart; the rest is built of 5/16-inch boiler plate.

Water at a pressure of 20 pounds to the square inch is directed onto the hopper through two 2-7/8-inch nozzles. A 2-inch header pipe drilled with eighty-four 3/16-inch holes delivers spray water onto the grizzlies.

Most of the ground to be worked is covered with a heavy growth of brush and small timber; this is removed by the angledozer, which also strips about 4 feet of overburden from the gold-bearing gravel. Brush and overburden are piled on both sides of the ground being worked. On a 70-foot-wide channel about 400 square yards can be cleared and stripped to a depth of 4 feet in 8 hours.

The lower 3 feet of gravel and a few inches to 1 foot of bedrock are delivered to the washing plant, which operates 12 hours a day. Gravel is dug by the dragline; bedrock is cleaned by the angledozer, which scrapes the bedrock material to a pile, from which it can be handled easily by the dragline.

In a 70-foot-wide cut, the washing plant is moved ahead about four times a day, about 8 feet at each move. Before each move, the angledozer cleans bedrock on the area last dug; after the washing plant has been moved, the angledozer stacks the tailings that accumulated at the last station and clears a drainage channel directly behind the plant. Small wing dikes are built at the rear of the plant to prevent tailing water from backing up into the digging pit. A cleared drainage channel about 10 feet wide, is maintained down the middle of the worked-out channel.

Riffles are cleaned up at 3- to 4-day intervals; each cleanup represents the yield from about 1,000 to 1,200 yards of material through the washing plant, or 2,500 to 3,000 cubic yards of total yardage handled. Up to the time of visit, recovery was said to be running about 10 percent above the preliminary test results.

Water consumption is about 1,350 gallons per minute during washing operations. This is approximately three times, by weight, the amount of gravel being washed through the sluice; it has been determined that about 40 percent of the material delivered to the hopper is discarded as oversize.

Water is brought from a storage dam on Red Horse Creek through 300 feet of 10-inch pipe and 2,500 feet of 10- by 3-foot ditch to the pumping unit, which delivers it under pressure to the washing plant. The ditch was built in 3-1/2 days by three men and the angledozer.

No electric power is available in the district. All units are driven by gasoline or Diesel engines. Connected horsepower is as follows:

	Horsepower
Shovel, Wisconsin gas engine.....	90
Angledozer, caterpillar Diesel engine.....	61
Pump.....do.	45
Total.....	196

Gasoline costs 23 cents a gallon delivered; fuel oil costs 11-1/2 cents a gallon delivered.

A regular crew of 7 men, in addition to the manager, is employed. The crew consists of 1 foreman; 1 shovel operator; 1 oiler; 2 caterpillar drivers; and 2 general laborers. One shift per day is worked.

Direct operating costs were stated to have been approximately 15 cents per yard. Mechanical difficulties are believed to have caused a suspension of operations late in the season of 1937.

Newsome, Golden, and Castle Creek Districts

The Newsome district (fig. 5) lies in a large structural depression known as Newsome Basin. In its general characteristics, Newsome Basin is very similar to Elk Basin, the floor is approximately 4,000 feet above sea level, and the sides slope upward to ridges whose summits are 6,000 to 7,000 feet above sea level. The basin is separated from the South Fork of the Clearwater River by high ridges, which are cut only by the narrow canyon of Newsome Creek.

Inasmuch as no road has been built up the Newsome Creek canyon, access to the Newsome district is difficult during the winter and spring months; the only available roads from the Clearwater canyon ascend the ridge in a series of steep switchbacks and then descend the northern slopes on mountain grades. From Fall Creek settlement to the old townsite of Newsome (now deserted) is 10 miles by road. There are several other routes into the district, but these are longer and also cross high mountain ridges.

The Golden, or Tenmile, district is on the South Fork of the Clearwater River directly south of the Newsome district; the small settlements at Golden and Fall Creek are supply points for both districts. Golden is about 41 miles from Grangeville by the main forest highway up the Clearwater.

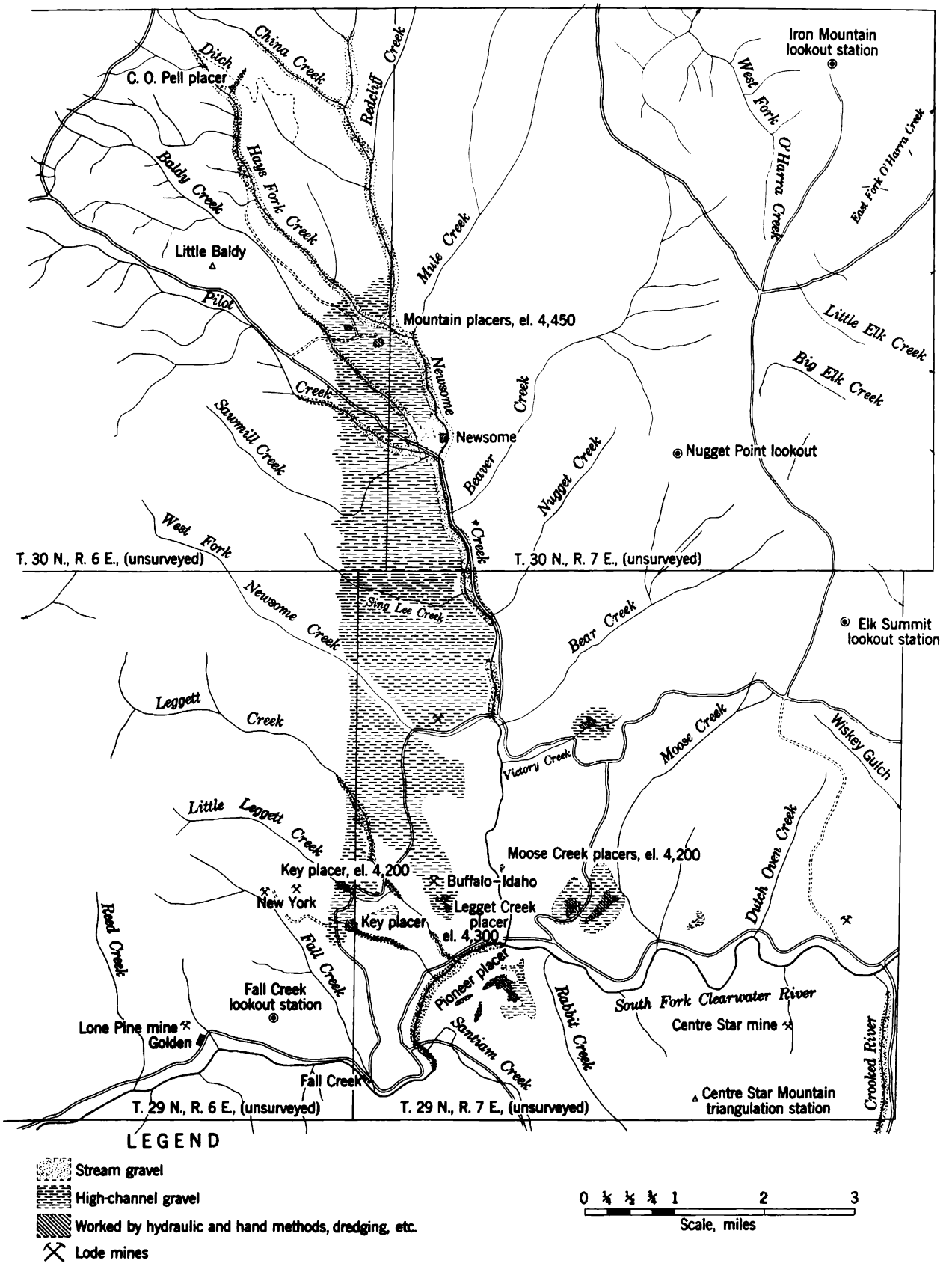
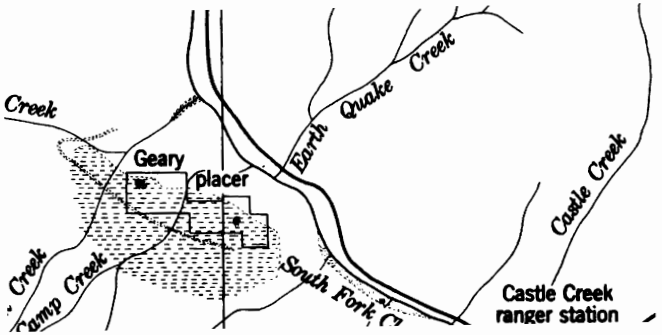


Figure 5.—Gravel deposits of the Newsome and Golden districts, Idaho County, Idaho. (Position of high-channel gravel from maps by Reed.)


Creek
Geary
placer
Quake
Creek
Castle Creek
Creek
Camp Creek
South Fork
Castle Creek
ranger station

In the early days, some rich stream placers were worked on Newsome Creek and its tributaries, as well as on some of the smaller creeks that flow southward into the Clearwater near Golden and Fall Creek. By far the greater part of the stream placer production came from Newsome Basin, where conditions for the accumulation of placer deposits are more favorable than on the much steeper gradients outside of the basin.

Unfortunately, most of the numerous gold veins that traverse parts of the region in the Golden district are found on the north slope of the Clearwater, where stream gradients are very steep. The gold of Newsome Basin seems to have been derived largely from reconcentration of the high gravels that cover much of the district. These high gravels extend, with some interruption, from the Clearwater to the head of Newsome Basin; they have been very productive in the Golden district, where several large hydraulic pits have been worked. Only a few comparatively small pits have been worked on the high gravels of the Newsome district, but whether this is due to less favorable working conditions or to lower values is not known. The high gravels in the basin are not as well exposed or, generally, as well situated for hydraulic mining as the high gravels nearer the Clearwater.

A large volume of dredge or dragline ground of commercial value was being actively exploited on Newsome Creek in 1937. Other stream deposits with possibilities for successful small-scale operations are on upper Newsome Creek, China Creek, Hays Fork, Baldy Creek, Legget Creek, and perhaps others.

As in Elk Basin, the high gravels of Newsome and Golden constitute an immense reserve of gold-bearing gravel, at least parts of which may have commercial possibilities.

The Castle Creek district (fig. 6), for the purposes of this paper, will be considered to include the placer deposits along the South Fork of the Clearwater River in the vicinity of Castle Creek ranger station, and also the gravel deposits in the drainage basins of Meadow Creek, Johns Creek, and Mill Creek (fig. 6).

Castle Creek ranger station, at an altitude of slightly over 2,000 feet, is approximately 24 miles from Grangeville by way of the main forest highway up the Clearwater. The bottom of the Clearwater canyon is here about 1,000 feet below the base level of the surrounding country; consequently, there are very heavy grades on the roads up Mill Creek and Meadow Creek where these roads climb out of the canyon. The high country south of the Clearwater may be reached from Mount Idaho without descending into the canyon; nevertheless there are many heavy grades on these back roads.

The gold production of the Castle Creek district has been comparatively insignificant. No producing lode mines have been developed in the district, nor are there any known centers of lode mineralization. Such placer mines as have been developed are on ancient high channels near the present course of the Clearwater, or actually in the present channel of the river, where gold may reasonably be assumed to have been transported from other districts.

There are large areas of high gravels in Meadow Creek Basin, and smaller unmapped areas in other parts of the district; there are also a number of fairly large deposits of more recent stream gravels. Some of these deposits may contain gold in commercial quantities, but, so far as known, none of them ever have been tested systematically; apparently, such preliminary testing as has been done was not encouraging.

Stream Placers

Newsome Creek. - Newsome Creek (fig. 5) flows into the South Fork of the Clearwater River about 6 miles below the junction of the Red River and the American River. The main Creek flows about S. 15° E. for about 15 miles; near the old townsite of Newsome it is joined by several large tributaries whose general course lies between S. 40° E. and S. 50°E. The elevation of the creek at its confluence with the South Fork of the Clearwater River is about 3,500 feet. The gradient is from 40 to 70 feet in a mile. In July and August the flow is from 12 to 15 second-feet.

The lower 2-1/2 miles of Newsome Creek flows through a canyon in which there are no placers of importance. From the upper end of this canyon to nearly a mile above China Creek, a distance of nearly 8 miles, the gravel deposits are continuous except for a short canyon just south of Nugget Creek. They range in width from 250 to 400 feet and in depth from 8 to 12 feet, with about 2 feet of overburden. They were worked imperfectly by hand methods by the early white miners and later by the Chinese. Considerable areas were left intact; in many places only from 3 to 5 feet of the top gravel was worked. From Hays Fork to the upper end, a distance of about 3 miles, the deposits are virgin.

In July and August 1937, the ground from Nugget Creek to the old town of Newsome was tested by Marchbank and Ferris of San Francisco. Low values were reported where the deposits had been worked most intensively. It seems, however, that the testing indicated good average values, as a dragline with a floating treatment plant was installed as soon as the testing was completed.

It is said that the results of testing just above the town of Newsome indicated the gravel to be too low grade to be of value. Very little is known of the virgin placers above Hays Fork.

Pilot Creek. - Pilot Creek and Baldy Creek flow into Newsome Creek from the northwest at the town of Newsome. Pilot Creek has a gradient of about 100 feet in a mile and a flow of 1 to 1-1/2 second-feet during July and August. Gravel deposits extend along the creek from its junction with Newsome Creek for a distance of about a mile and a half upstream. The deposits range in width from about 200 feet at the lower end to 75 feet at the upper end. They are thought to be not commercial, although they have not been tested systematically. Most of the ground at the lower end of the stream is included in a patented agricultural claim belonging to Jack O'Leary of Golden, Idaho; above the patented claim, O'Leary holds the ground by location.

Baldy Creek. - Baldy Creek has a gradient of about 100 feet in a mile and a flow of 2-1/2 to 3 second-feet during the dry season. Gravel deposits extending along the creek from the old town of Newsome for a distance of 2 miles upstream range in width from 200 feet at the lower end to about 50 feet at the upper end. The depth, as determined by a limited amount of prospecting, ranges from 4 to 6 feet, with about 2 feet of overburden. Some of the gravel is tightly cemented. The grade of the gravel is not definitely known, but the deposit is believed to have commercial possibilities. The land is held by location by Dr. George Miller and J. B. McAllister of Golden, Idaho.

Hays Fork. - Hays Fork enters Newsome Creek about 1-1/2 miles above the town of Newsome. The gradient is about 75 feet in a mile and the flow from 2 to 3 second-feet during July and August. The total length of the stream is about 4-1/2 miles. Gravel deposits extend from its confluence with Newsome Creek to within a half mile of its source. The width of the deposits ranges from 75 feet to about 300 feet. At the lower end the depth of the gravel is about 10 feet, with 2 to 3 feet of overburden. At the upper end the depth is about 6 feet with 1-1/2 to 2 feet of overburden.

There are a number of test pits all along the creek from the lower end to the end of the gravel. No information, however, was available regarding this testing. A feeble attempt was made at working the deposits about a mile above the junction with Newsome Creek. A small power shovel was used for excavating and probably some kind of a portable washing plant for recovering the gold. The creek channel was worked for a distance of about 300 feet over a width of 15 to 20 feet.

The C. O. Pell Placer is on a tributary from the north near the head of the main creek. It was worked to a limited extent in 1893 and 1894 by the Marvel Gold Mining Co; from then until 1930 it was idle. Since 1930 it was worked by the present owner, C. O. Pell. About 2,000 feet of the creek bottom has been worked for a width of 75 to 150 feet. The pay gravel has a depth of about 4 feet with 2 to 3 feet of overburden. The bedrock has a slope of 8 to 10 feet in a hundred.

Hydraulicking is carried on in the early part of the season when there is a sufficient water supply. Late in the summer, when the water supply is low, the bedrock is cleaned and the material shoveled into sluice boxes. Water is taken from Hays Fork through a ditch 3-1/2 miles long and then through a pipe line down to the workings. Mr. Pell, working alone, recovers from $500 to $1,000 worth of gold in a season. The gold is coarse. Nuggets worth $3 to $4 are quite common.

China Creek. - China Creek is a small tributary that flows into Newsome Creek from the west about 4 miles above the town of Newsome. The gradient is from 100 to 125 feet in a mile. During the dry season the flow is from 6 to 10 miner's inches. Gravel deposits extend from its junction with Newsome Creek for about a mile and a half upstream. They are quite narrow, ranging from 50 to 100 feet in width all the way up the creek. Little is known about the lower end, but the upper end is commercial. The deposits, however, are small and are suitable for only a one- or two-man operation.

Most of the upper end of the creek is owned by C. O. Pell, who intends to work it in connection with his Hays Fork property as soon as he can make the necessary provisions for water.

Legget Creek. - Legget Creek flows into the South Fork of the Clearwater River about half a mile below Newsome Creek. The gradient is about 100 feet in a mile and the flow from 2 to 3 second-feet.

At the lower end is about 2,000 feet of gravel ranging in width from 100 to 150 feet. It is covered with 10 to 15 feet of tailings from the Legget Creek hydraulic placers. At the upper end of the creek is about a mile and a half of gravel ranging in width from 75 to 200 feet and in depth from 4 to 8 feet, with about 2 feet of overburden. There are few test pits, and consequently very little is known of values. Some hand work was done just below where the road crosses the creek, but there is no record of production. Most of the ground is held by location by the Gold Bank Mining Co. of Golden, Idaho.

Buck Meadows. - Buck Meadows (fig. 6) are in the Castle Creek district about 5 miles south of the South Fork of the Clearwater River at an elevation of about 4,600 feet. They consist of stream gravel deposits extending about a mile along the upper end of American Creek. The width ranges from 200 to 600 feet and the depth from 8 to 10 feet, including about 2 feet of top soil.

Some interest was shown in these deposits in recent years and several test pits were dug. Preliminary examinations seem to have been discouraging. The ground is held by location by Ben Kassel and associates of Grangeville who have eight claims covering the meadows. A mountain road of the U. S. Forest Service passes within half a mile of the deposits.

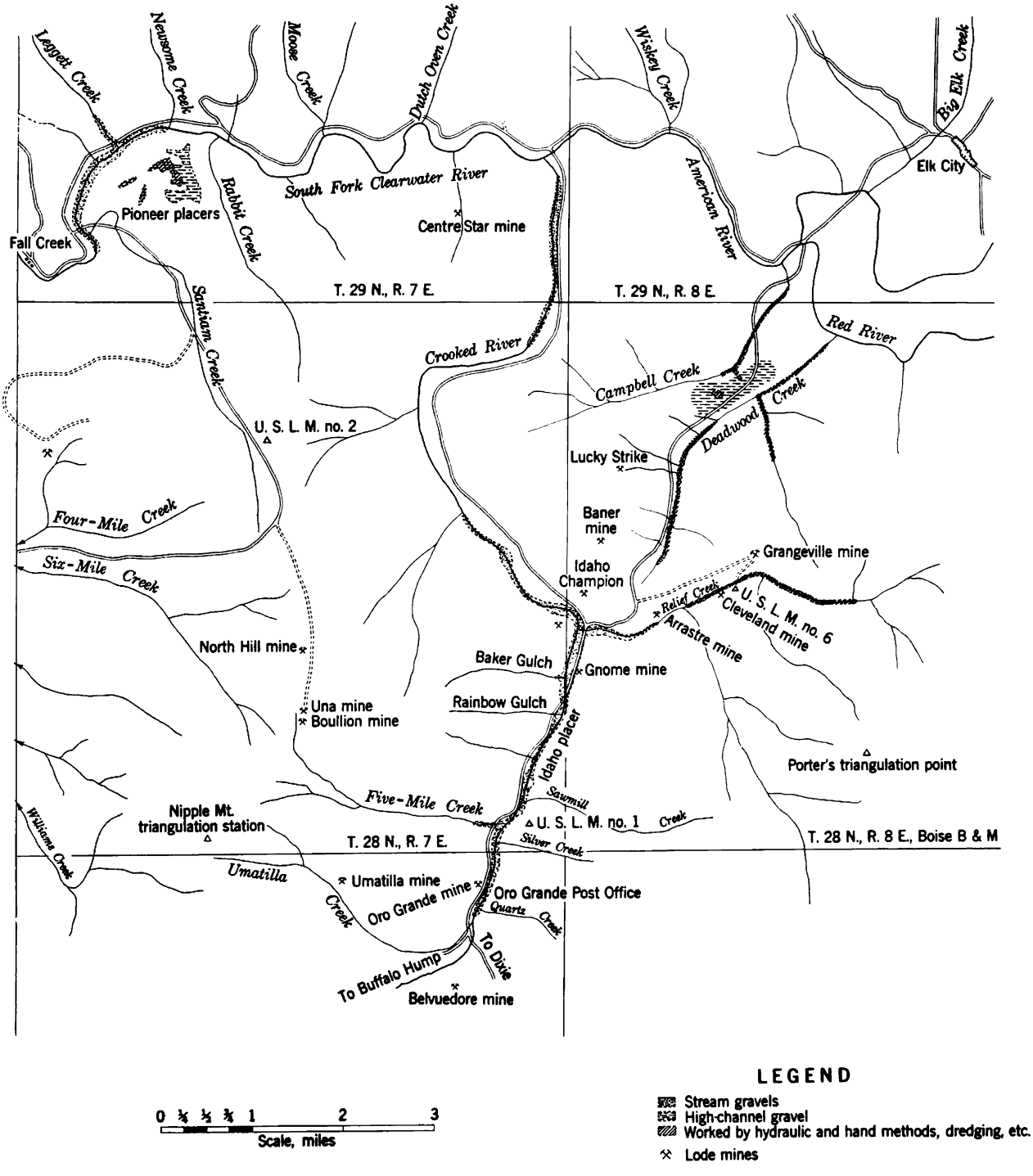


Figure 7.—Gravel deposits of the Orogrande district, Idaho County, Idaho. (Position of high-channel gravel from maps by Reed.)

High-Level Gravels of the Elk City, Newsome, and Castle Creek Districts

Gravel deposits, which have been described by Shenon and Reed[16] as having been formed on old erosion surfaces or in structural basins of Tertiary age, can be found at a number of points in central Idaho. Several of these, notably the gravels on Big Creek between Orogrande and Dixie (see p. 54), are in present stream channels and in this paper will simply be classified as stream deposits. The high-level gravels in the Elk Creek and Newsome Basins and along the South Fork of the Clearwater River, however, constitute a class of deposit that differs materially in physical characteristics from other placer deposits of the region; they present mining problems peculiar to the mode of occurrence. Together with the high channel deposits and low bench gravels of the Warren and Burgdorf districts (see pp. 59 to 79), these deposits probably constitute the largest reserve of gold-bearing gravel in Idaho County.

Shenon and Reed have discussed[17] the geology of the Elk City and Newsome gravels and have given detailed descriptions and in many cases individual maps of virtually all the important placer mines that have been opened on deposits of this type; consequently, this paper will confine itself to a brief summary of the geology, a general presentation of the mining problems involved, and to short descriptions of those properties that were active in 1937. The location of the principal pits and of the areas generally overlain by deposits of this type (as mapped by Shenon and Reed) are shown in figures 3, 4, 5, and 7.

According to Shenon and Reed,[18] the Elk City and Newsome Basins as well as other similar basins in the region were formed by structural deformation and partly filled with lake and stream sediments in Tertiary times; it seems to the writers of this paper that some of the high gravel deposits along the South Fork of the Clearwater may have been formed at about the same time in estuaries or small lakes along a meandering waterway whose course approximately coincided with that of the present river channel. After these gravels were laid down, a new cycle of erosion began; the rejuvenated streams dissected the high-level gravels and reconcentrated some of their gold in present stream channels; the uneroded portions remain as benches or low ridges in those parts of the old basin floors that have not been removed by erosion. In the aggregate, these remaining deposits constitute an immense volume of gravel, much of which is gold bearing.

In the vicinity of Elk and Newsome Creeks the bedrock of the high-level gravels is, in practically every case, between the 4,000 and 4,400-foot contours; in most cases it is close to the 4,200-foot contour. Farther down the stream it is much lower than this. The vertical height

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16/ Work cited.
17/ Work cited.
18/ Work cited.

of these high gravels above the present stream channels depends to a large extent on the depth to which recent erosion has progressed; naturally, it is less near the upper ends of valleys than near the lower ends. For instance, at the Dyer placer on American River, bedrock is only about 50 feet above the river, whereas the pits near the mouth of Newsome Creek, 15 miles below Elk City, are about 600 feet vertically above the south Fork of the Clearwater; at the Geary placer, 25 miles farther downstream, bedrock is 750 feet above the Clearwater but at an elevation approximately 1,000 feet lower than the Elk City deposits.

These bench gravels are from a few feet to 200 feet deep; most of the old pit faces are between 40 and 100 feet high, but few pits have been worked into the deepest parts of the deposits. The character of the gravels exposed in the hydraulic pits indicates that they were, for the most part, laid down in comparatively quiet water; except near bedrock they are composed chiefly of sand, clay, or very fine gravel; large boulders are rare. As pointed out by Shenon and Reed,19/ it is probable that sediments accumulated while deformation went on. In at least one place stream gravels cut the lake beds and are, in turn, covered by lake deposits. However, most of the coarser gravels occur on or very near bedrock; these bedrock gravels frequently are composed of angular, unsorted material, but in other cases they are composed of well-rounded quartzite pebbles and small boulders, which obviously were laid down in stream channels; they often carry high gold values. The overlying fine sediments frequently carry values low in gold and occasionally are rich; but available evidence strongly favors the inference that most of the gold in these high-level gravels is close to bedrock. It is claimed that many of the large pits worked in the early days averaged from 10 to 18 cents a yard throughout, but the gold in the pits that were being worked in 1937 was close to bedrock; furthermore, it is obvious, from even casual examination, that commercial values in the fine sediments are confined to small areas and that the large remaining volume of the fine sediments is extremely low grade. For instance, at the Cal-Idaho pit it was estimated that although the entire 100- to 160-foot face averaged about 6 cents a yard, at least 90 percent of the total values came from the first few feet above bedrock. Similarly, at the Dyer pit on American River a 50-foot-high face was said to average only 6 cents a yard, although some shallow ground in one corner of the pit was yielding about 35 cents a yard from 6 to 7 feet of gravel on bedrock. At the Windmiser placer, near the confluence of the Crooked and Clearwater Rivers, a small section of old stream channel yielded about $2.60 per square yard of bedrock, but adjacent and overlying deposits of fine sediments were too low-grade to be worked profitably by small-scale methods. At the Geary placer, near Castle Creek, a small exposure of stream gravel on bedrock had been rich enough to be worked spasmodically by small-scale methods for many years, but the adjoining large pits had been idle from the early days until the recent revival of gold mining.

19/ Work cited.

The location of the large pits already worked apparently has been governed not only by the occurrence of commercial values but by the proximity of lower valleys for tailings disposal as well. Reason for abandoning these pits frequently is obscure, but in at least several cases it was apparent that bedrock was dipping away from the working face so rapidly that deep bedrock ditches were made necessary for tailing disposal; it is probable, therefore, that operations ceased when bedrock became so low as to prevent economical handling of material. In other cases, it is probable that the paystreak was simply lost or worked out. There is much evidence to support the belief that the highest bedrock values are in ancient stream channels that have been covered by still water deposits; therefore, it may be that when these old channels were lost or worked out the total gold values recovered from the pit became too low to permit continuance of operations.

It is doubtful if there are more than a very few places where these high gravels may be worked with hope of ultimate success so long as haphazard prospecting and exploring methods are followed; the most available deposits containing gold in paying quantities have doubtless been exhausted. It is the belief of the writers of this Information Circular that careful and systematic mapping and testing is a necessary preliminary to the further commercial exploitation of these deposits. If detailed surveys of the surface exposures were made first, and the most favorable areas were then surveyed by geophysical methods to determine the location of concentrations of black sands and, possibly, the depth and attitude of bedrock, it might be possible, by drilling, to block out some large volumes of commercial gravel and to so locate the point of attack that operations will not be halted by difficulties with tailings disposal.

At present virtually nothing is known of the value or volume of the actual remaining high-level gravels in Idaho County; this can be determined only by surveys of the type described. Geophysical methods might not be successful here but, without their aid, it is difficult to see how the commercial prospecting of these deposits could be carried out. It is certain that past operations have moved only a very small percentage of the total volume of this type of deposits in the district; it may be assumed, therefore, that the remaining gold resources are large. Statistics of past production are not available, but a rough estimate of the size of the ten largest pits indicates that about ten million yards of gravel was moved by the earlier operators. Old published accounts usually state that the values averaged from 10 to 18 cents a yard, but these statements are not backed by actual production figures. Shenon and Reed[20/] determined by survey that the Moose Creek operations uncovered about 40 acres (194,000 square yards) of bedrock, from which they estimated a total production of about $386,000 was obtained. Hence,

20/ Work cited.

it appears that this ground yielded about $2 per square yard of bedrock, or, assuming an average depth of 60 feet, it yielded approximately 10 cents per cubic yard of gravel moved with gold at $20.67 an ounce. With gold at $35 an ounce, the grade would be much higher than that of gravels that are being worked by any of the present operators.

Some consideration has been given to the possibility of drift-mining some of the richest ground, but so far the practicability of this method, as applied to these deposits, has not been demonstrated. If, however, sufficient volumes of commercial gravel could be blocked out, there is no reason why water for hydraulic mining could not be brought in by ditches as was done in the early days. The country is well adapted to cheap ditch construction with the aid of modern equipment; furthermore, the gravel is almost entirely free from large boulders and is loosely packed. Water duty at current operations on high banks is estimated to be about 4 cubic yards per miner's inch per 24 hours. Bedrock is usually a soft decomposed gneiss or granite, which can be cleaned easily. Therefore, in spite of the fact that operations would be limited to 60 to 90 days a year, it would seem that hydraulic mining is about the cheapest known method of working these deposits if sufficient preliminary testing is done to insure adequate bedrock drainage and tailings disposal. Areas to which hydraulic methods are not applicable must, of course, be mined by other methods, but it will be difficult if not impossible to make intelligent plans until more is known regarding the amount and distribution of the gold.

Hydraulic Operations of the Elk City District

In the Elk City district, three hydraulic operations - the Cal-Idaho, the Dyer, and the Windmiser - were active in 1937.

Cal-Idaho. - The placer mine of the Cal-Idaho Mining Co., about 1-1/2 miles southwest of Elk City (see fig. 3), was being operated under lease by James Green. This large pit has been worked each season for a number of years; from 1932 to 1936, inclusive, it produced 436 ounces of fine gold. During three years for which records are available the average recovery was 4 1/2 cents a yard. In 1937, about 150,000 yards were moved between April 15 and July 1, but toward the end of the season a big slide covered the giants and threatened to destroy the penstock and part of the flume. The pit face was from 100 to 160 feet high; it was said to average 6 cents a yard from top to bottom, but most of the values were said to occur in the first 3 feet above bedrock, the overlying material carrying only about 1 cent per yard.

Water is brought from Kirk's Fork to the workings in an 8-mile ditch and delivered to the nozzles under a 160-foot head. Early in the season there is sufficient water to operate a 6-inch and a 4-inch nozzle, but after the first 30 days only the 4-inch nozzle can be used; after the first of July water must be stored and used intermittently. The volume of gravel moved in 1937 indicates a water duty of approximately 4 cubic yards per miner's inch per 24 hours.

Sluice boxes are set in a rock cut to permit bedrock at the face to be worked; pole riffles are used, and an undercurrent is provided at the lower end.

It was estimated by the operators that with the present set-up material could be handled for a direct operating cost of about 1 1/2 cents per yard.

Dyer. - The property of James Dyer and associates consists of 600 acres of placer ground about 4-1/2 miles due north of Elk City. About 500 acres is on the west side of the river and takes in principally high-level gravels of the vicinity. One hundred acres is along the American River and covers about 2 miles of stream gravels. There is a fairly good road from Elk City to within about one-fourth mile of the hydraulic pit that was operated in 1937.

There are three pits (fig. 3) running east and west about 1,000 feet west of the American River and sloping eastward to the river. They range in width from 75 to 200 feet and in length from 400 to 600 feet. Only the center pit was operated in recent years. The east pit was abandoned many years ago because the bedrock is too flat to permit adequate tailings disposal. The gravel at the upper end of this pit is approximately 125 feet thick.

The bedrock in the center pit has a slope toward the American River of 8 to 10 feet in a hundred. The thickness of the gravel at the east end is from 8 to 10 feet and at the west end from 50 to 60 feet. The gravel is quite loose and contains very few boulders that cannot be handled by hand.

Water is taken from the West Fork of the American River through a 7-mile ditch. For a short period during the greatest run-off about 300 inches of water is available, but during the greater part of the season there is only about 200 inches. Two hundred and twenty-five feet of 7-inch pipe from the end of the ditch to the pit provides a head of about 85 feet. Generally there is enough water for 30 to 40 days of piping with full head.

The sluice boxes, 24 by 24 inches, are set at a slope of 8 inches in 12 feet. Riffles consist of Douglas fir blocks 7 inches high by 8 inches wide, spaced 1-1/2 inches apart, with the round side up. These last from four to five seasons.

The clean-up is treated in a barrel amalgamator. The gold is quite coarse, ranging in size from a pin head to a rice grain.

According to early operators, the gravel at the west end of the pit runs around 6 cents a yard and at the east end about 35 cents. This is probably due to the fact that the low-grade overburden at the east end of the pit was eroded away, leaving only the higher-grade material near bedrock.

In the 1935 season, four men worked 35 10-hour shifts, or a total of 140 10-hour man-shifts in the upper part of the center pit. One giant with a 3-inch nozzle moved 35,000 cubic yards of material that yielded $2,000. This indicates a value of 6 cents a yard for the material in that part of the pit and a man-shift production of $14.25. Assuming a volume of 300 inches of water in use for 20 hours a day, the duty would be 4 yards per miner's inch per 24 hours.

During the 1936 season, one man worked alone in the lower pit for 10 days, moving 485 yards of material that yielded $170. This indicates a value of 35 cents a yard and a man-shift production of $17.

Windmiser. - Frank Windmiser was operating a small pit near the top of the ridge in the angle formed by the junction of the Crooked River with the South Fork of the Clearwater. The deposit is about 400 feet above the river at an altitute of 4,200 feet. The best values are found in rounded stream gravels (chiefly small quartzite boulders) about a foot or so above bedrock. The stream gravels are overlain by fine sediments that carry comparatively low gold values. In 1937, a pit about 90 feet long by 30 feet wide by 4 to 15 feet deep had been excavated to bedrock, it was said to have yielded about 78 cents a yard, most of which was from the coarse stream gravel on bedrock.

Water was obtained from a small stream which flows through the property, and delivered to the face through a 1-inch nozzle under a 30-foot head. In 1937, a full head was available continuously from April 15 to May 15, after which only an intermittent flow was obtainable. After July 1 only enough water for cleaning bedrock was available.

Placer Mines of the Golden and Castle Creek Districts

Key. - In the Golden district, the Key placer, on Little Leggett Creek, was being tested by D. R. Brazington. The ground belongs to the Key Placers Corporation of Spokane, Wash. The part of the deposit being actively tested is composed largely of side hill wash and gulch gravels apparently derived from high-level gravels on the ridge above. These gulch gravels generally were less than 8 feet deep but were said to carry commercial values. Just over the hill from the workings on Little Leggett Creek an area of side-hill wash about 100 yards long by 75 yards wide by about 4 feet deep had been mined some years ago; approximately 8 additional acres had been cleared but not mined. Immediately below these workings is a meadow about 400 yards long by 150 feet wide, which contained about 4 feet of gravel (fig. 5). The gradient of the meadow is about 200 feet to the mile; that of the side-hill deposit was considerably steeper. The stream bed was virtually dry when visited on July 30. Little Leggett Creek, however, carries about 3 second-feet of water in the dry season.

Geary. - In 1937 work had been resumed at the Geary or Big Cove placers, which had been idle, except for small sniping operations, for many years. This deposit is at a considerable distance from other commercial deposits of high gravels but is of the same general type. Its great height above the present river, its isolation from the present river channel by a rock ridge, and its intercalated gravel and lignite beds indicate that it was probably formed at about the same time as the high gravels of the Elk and Newsome Basins.

This deposit is situated a short distance south of and about 750 feet above the South Fork of the Clearwater (see fig. 6); it is bounded by Cove Creek on the west and by Bully Creek on the east and appears to be covered by lava to the south. Two large pits about a mile apart were worked in the early days; a small section of the easterly pit has been mined spasmodically until recently; it is estimated that about 600,000 yards of gravel have been mined from the two pits.

In 1937 a new pit was being mined near the extreme easterly end of the deposit by the Granite Creek Dredging Co., but operations had ceased because of water shortage before the pit was visited (July 31). Water was brought in ditches from the headwaters of the several small streams that cross the property; it was said that 10 to 15 second-feet were available during the first thirty days of water flow in the spring. Water was delivered under a 100-foot head.

Robert McAllister, of Star Route, Grangeville, holds several claims adjoining the original Geary Placer on the northwest. He had started a cut on what appeared to be the lowest bedrock exposure with the object of ultimately developing a drift mine on bedrock gravels.

Orogrande District

Although an important center of lode mining, the Orogrande district has produced comparatively little placer gold. The rich stream and gulch diggings, which were the source of most of the placer production of other camps of the region, appear to have been developed at only a few points near Orogrande, notably on Relief Creek. However, there is a considerable volume of potential dredging ground on Crooked River (see fig. 7).

Orogrande Post Office is about 66 miles by road from Grangeville at an altitude of slightly less than 5,000 feet. The first 54 miles of this road is the main forest highway up the South Fork of the Clearwater River; the last 12 miles is a comparatively new and rather second-rate road up Crooked River. In recent years this road has been maintained for year-round travel because of the relatively large lode-mining operations at Orogrande.

Stream Gravels

Crooked River. - Placer ground on Crooked River extends continuously from about one-fourth mile above Orogrande mine to the head of the canyon about 2 miles below the mouth of Relief Creek, a total distance of approximately 5 miles. The valley bottom along this stretch of river varies from about 100 feet to several hundred yards wide; its average width is probably close to 300 feet. So far as known, this ground has never been tested systematically throughout; it may be safely assumed, however, that it will average at least 10 feet deep; undoubtedly there are large areas that are 20 to 30 feet or more deep. Except in the narrowest parts, it is unlikely that the deposit contains many large boulders. Tailings from the mills of the Orogrande-Frisco and Gnome mines have spread over considerable areas in the vicinity of these mines but, except in a few places, they do not appear to be deep enough to interfere seriously with dredging operations. The river gradient is about 65 feet to the mile.

The fractured and mineralized zone on which the Orogrande-Frisco mine is working crosses the upper end of Crooked River, and a similar zone crosses near the Idaho Champion mine; there are also a number of smaller and comparatively high-grade gold veins along the main river and its tributaries. Just below the Gnome mine some bench gravel was worked by hand methods in the early days. Stream placers, some of them rich, have been worked on Baker Gulch, Rainbow Gulch, Relief Creek, and other tributaries. There is no doubt, therefore, but that the Crooked River gravels are gold bearing. Late in the summer of 1937, D. E. Henderson of Mt. Vernon, Wash., began testing near the Orogrande mine with the object of developing ground for dredge operations; his preliminary results were said to be encouraging.

Development of the Crooked River placers has undoubtedly been retarded by the large number of owners, many of whose claims were conflicting. Among the chief claimants may be numbered the Orogrande-Frisco Mining Co., the Gnome Mining Co., the Lucky Five Mining Co., the Idaho Champion Mining Co., and the heirs of the Hogan estate.

Lower Crooked River and Campbell Creek. - Lower Crooked River and Campbell Creek are actually in the Elk City district, but for convenience they are discussed here.

Gravel deposits are continuous for approximately two miles along lower Crooked River, from the head of the short canyon at its mouth to the foot of the long canyon that continues upstream to within 2 miles of the mouth of Relief Creek. These deposits are from 150 to 600 feet wide; their average width probably would be close to 300 feet. The stream gradient on this part of the river is approximately 50 feet to the mile.

The richest channels within the deposit, particularly near the lower end of the river, were worked by Chinamen in the early days, but large areas of virgin ground were left. A number of test holes were sunk in the worked-over ground as well as in the virgin ground during the summer of 1937. These holes and other old workings indicated an average depth of deposit of 6 to 10 feet, including 1 to 3 feet of topsoil; no large boulders were observed in the test holes or old tailings. Inasmuch as no effort has been made to begin mining operations, it appears that the results of testing were unsatisfactory or that other factors intervened. The deposit undoubtedly carries some gold; although there may be some hard bedrock, other physical conditions may appear favorable for a dragline outfit or small dredge. The ground is reported to be held by Mrs. Margaret Cunningham for whom Wm. C. McNutt, 522 Breier Building, Lewiston, Idaho, is agent.

So far as known, the stream gravels on Campbell Creek were exhausted in the early days. However, there are some high gravels (altitude 4,000 feet) on the low ridge near the upper end of the old stream diggings (fig. 7). Many of the dry gulches in this area were worked as "skim" diggings in the early days, and at one place a pit about 100 feet in diameter was recently mined by hydraulic methods; most of the equipment is still on the ground and in good condition. The pay gravel was about 4 feet deep and was said to have yielded fair wages to the operators.

Relief Creek. - The upper end of Relief Creek was worked out by hand methods in the early days; the thoroughness with which the ground was worked indicates that it must have been fairly rich. The Lucky Five Mining Co. recently constructed a stationary washing plant near the mouth of Relief Creek and began excavating with a caterpillar-mounted angledozer; they moved a small amount of gravel is 1936 and 1937, but their operations have been spasmodic. It is claimed that the ground washed yielded 80 cents a yard; the gravel and overburden was about 10 feet deep and generally free from large boulders.

Gravel deposits at the mouth of Relief Creek are 100 yards or more wide but become narrower upstream; about three-fourths of a mile above the mouth the valley becomes a comparatively steep walled canyon for about half a mile to the beginning of the old hand workings near the Cleveland mine.

Deadwood Creek. - Deadwood Creek has been worked almost continuously from source to mouth. The lower part (see fig. 7) was worked by hand methods in the early days; the upper part was dredged between 1934 and 1937.

The placer deposits on upper Deadwood Creek averaged about 125 feet wide and 14 to 18 feet deep, including 5 to 8 feet of valueless or very low-grade overburden; the ground was generally free from large boulders. The bedrock gradient was about 100 feet to the mile; the stream flow at

low water about one-fourth second-foot. A small amount of virgin ground that might be suitable for very small-scale operations remains at the extreme upper end of the creek just above the dredged area. Records indicate that the dredge ground became progressively richer upstream; therefore it seems reasonable to expect that the adjoining ground would average 20 cents a yard or better.

Operations of the Orogrande District

Deadwood Creek Dredge. - From 1935 to 1937, inclusive, D. E. Henderson operated a small bucket dredge on the upper end of Deadwood Creek, which is a tributary of Red River.

The dredge was of standard design, equipped with 65 buckets of 2-cubic-foot capacity each. The bucket line, mounted on a 45-foot digging ladder, moved at the rate of 33 buckets per minute. The dredge as constructed would dig 20 feet below water and 10 feet above; it was held and maneuvered on a single steel spud and shore lines.

The trommel was 46 inches in diameter, constructed in five 3-foot sections. The first three sections were punched with 3/8-inch, 1/2-inch, and 5/8-inch holes, respectively; the last two sections were punched with 3/4-inch holes. Approximately 400 square feet of table surface was provided; riffles were made of 1-1/4-inch angle iron except in the tail chutes, where 1/2-inch-mesh, no. 8 smoke-stack screen over brussels carpet was used. Very little gold was recovered in the tail chutes; most of the gold was fairly coarse and stopped in the upper riffles.

The tailing stacker, about 55 feet long overall, extended 40 feet beyond the dredge.

Wash water was delivered under a pressure of 80 pounds to the square inch. One 2-inch nozzle discharged into the buckets, one into the hopper, and six (four up and two down) into the trommel. An 1,100-gallon-per-minute high-pressure centrifugal pump supplied wash water, and an 800-gallon-per-minute low-pressure pump supplied water to the tables. At extreme low water it was necessary to bring water from Relief Creek to supplement the very small flow in Deadwood Creek.

Power was generated by two Diesel engines. A 75-horsepower engine drove the ladder and screen; a 50-horsepower engine drove the pumps and other equipment. Fuel oil at 11 cents per gallon delivered cost $10 a day for the dredge alone; lubricants cost $1 a day. Fuel oil for a caterpillar tractor used for clearing land and other odd jobs cost another $1 per day, bringing the total fuel and oil cost to approximately $12 per day.

For 24-hour operation, an average crew of 12 men was employed; this crew consisted of 3 wenchmen, 3 engineers, 3 deckhands, and 1 to 3 shoremen.

Overburden containing a large percentage of sod and roots was dug dry and rolled directly through the trommel without washing. Including all lost time and shut down, an average of between 800 and 1,000 yards of material was handled per day; when working continuously in good ground, about 1,800 yards a day could be handled.

The operating season extended from May to November, inclusive; in 1936 there were 190 working days. It would have been possible to start earlier and work later but at greatly lowered efficiency.

South Fork of the Clearwater River

The South Fork of the Clearwater River is formed by the confluence of Red River and American River about 2 miles southwest of Elk City; from this point it flows almost due west about 34 miles (24 miles by air line), then flows due north and joins the Middle Fork of the Clearwater at Kooskia, a total distance of about 60 miles. The gradient is approximately 30 feet to the mile; at the upper end of the river the flow is 30 to 45 second-feet during the dry season; at the lower end the flow is several times this amount.

Parts of the river are covered by the Elk City, Golden, and Castle Creek districts. Practically all the placers of commercial importance occur along the upper 34 miles between Elk City and the mouth of Cove Creek. All of this part of the river channel may be said to be gold-bearing, but conditions favorable to the accumulation of commercial placer deposits occur at only a comparatively few places. The river has cut a narrow, steep-sided canyon to a depth of several hundred to 1,000 feet below the base level of the surrounding country; consequently, it has been possible for placers to accumulate only in small "bars" on the inner side of bends or in narrow strips along the few places where the river valley is slightly wider than the actively eroding channel. These deposits frequently contain good gold values but usually contain a large percentage of boulders, which interfere seriously with mining operations.

Many of the small bars just above the water level are worked spasmodically by "snipers", who set up a sluice box along the river and shovel in by hand; in one or two places small drift mines have been worked in the low bench deposits.

The largest placer deposits are between Santiam Creek and Crooked River and between Cove Creek and Mill Creek.

Stream Gravels

Santiam Creek to Crooked River. - From Santiam Creek to Crooked River, a distance of about 5 miles, the valley bottom is wide enough to have numerous gravel bars, which form a more or less continuous deposit along this part of the river. These bars are seldom, if ever, more than 200

feet wide and are very irregular in size and shape; they are said to average 8 to 20 feet deep. Large boulders, many of them weighing 1 to 10 tons, are numerous. Although, obviously, this gravel is difficult to work, it is claimed that recent testing indicated values of approximately $1 a yard.

Late in the summer of 1937, Frank T. Hickox and S. D. Alexander assembled a new floating washing plant and 2-cubic-yard dragline shovel near the Santiam bridge with the intention of working the river channel and bars from this point to the mouth of Crooked River.

Cove Creek to Mill Creek. - Robert McAllister has a placer claim on Cove Creek near its mouth, where there has been some reconcentration of gold from the high gravels near the head of Cove Creek. From the mouth of Cove Creek to above Mill Creek there are numerous small bars and low benches suitable for small-scale operations; many of these bars have yielded from 15 to 50 cents a yard. There are, however, two deposits suitable for somewhat larger-scale operations; these are the Telegram placer and the Fisher placer.

Telegram Placer. - For about 1 mile above the mouth of Castle Creek, low bench gravels 10 to 20 feet deep and up to several hundred feet wide extend along the south side of the river; bedrock is 8 to 15 feet above the river; large boulders are numerous. The most recent attempt to work these gravels was by dragline shovel and stationary washing plant; gravel was transported from the shovel to washing plant in trucks. Apparently, the operation was a failure, as only a small yardage was handled before it was abandoned. The heavy overburden and large boulders doubtless were important factors contributing to the failure. It was said that pay gravel averaged about 40 cents a yard; however, the depth of the pay gravel is not known. The overburden became deeper toward the mountain.

This ground is patented. A. S. Hardy, of Grangeville, Idaho, is said to be the agent of the owner.

Fisher Placer. - The Fisher placer is part of an old channel lying on a bench about 200 feet vertically above the river, near the mouth of Meadow Creek. A large pit was mined by hydraulic methods in the early days; nevertheless, a large volume of unworked gravel remains. This deposit was described and mapped in detail by Reed,[21] who states that the unworked face of the pit sampled 18 cents to the yard.

Florence District

In the immediate vicinity of Florence (fig. 8) is an area about 4 miles long by 2 miles wide, which, in the early 1860's, was mined intensively by hand methods; the gravels were extraordinarily rich but were

21/ Work cited.

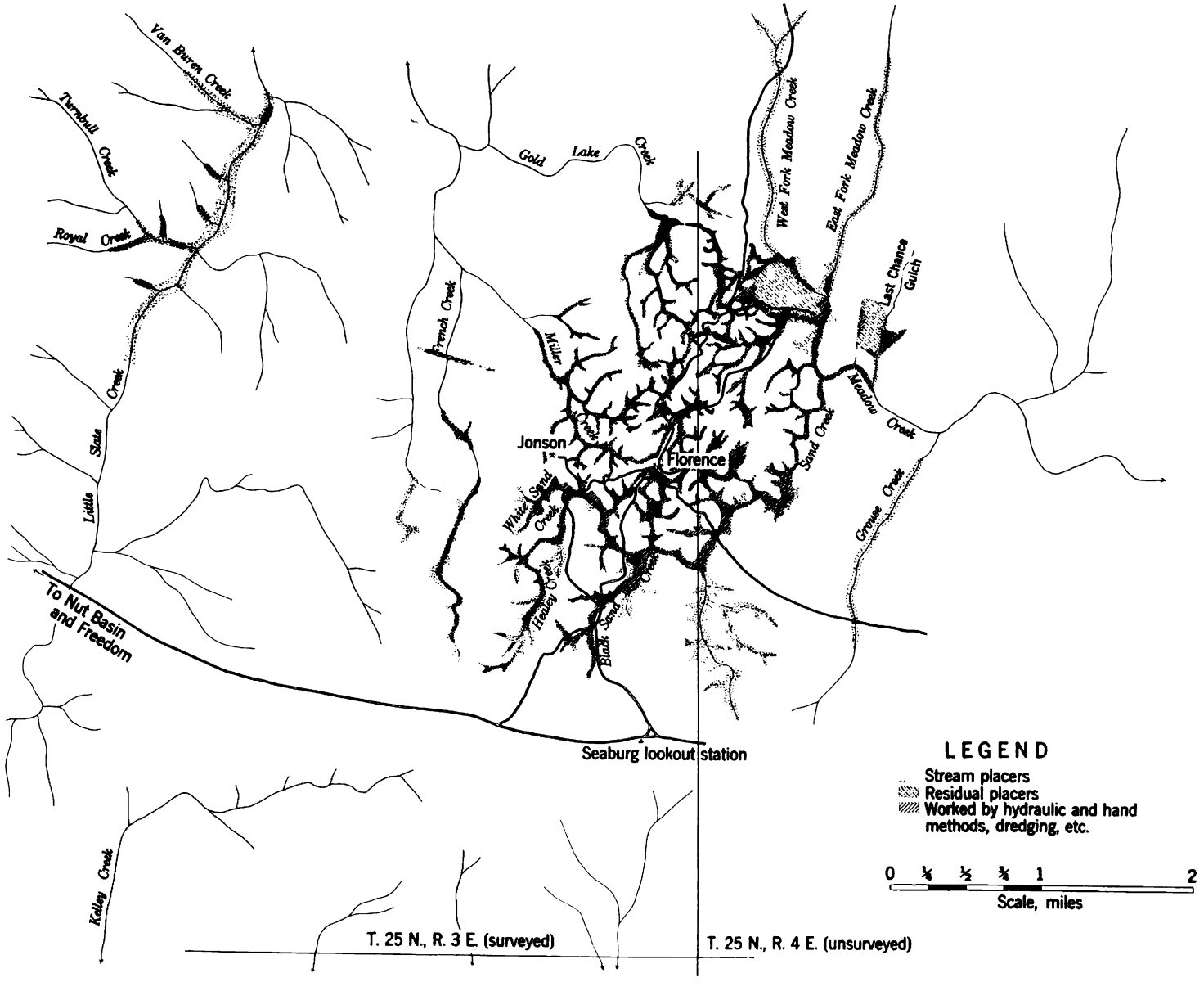


Figure 8.—Gravel deposits of the Florence district, Idaho County, Idaho (after Reed).

shallow and were, for the most part, soon exhausted by white men and reworked by Chinamen. Except for a few small, spasmodic operations, the district has been inactive for many years. However, there are a few remaining areas of virgin ground that were not suitable for mining by hand methods but may be suitable for small dredge or dragline operations, it may also be possible by these methods to rework some of the old ground that was not thoroughly cleaned up.

The stream placer deposits at Florence are usually from 4 to 10 feet deep; most of them are in the bottoms of creeks or dry gulches, but some are found on higher ground, even near the tops of low ridges. This fact, together with the angularity of the gravel and the gold particles, indicates that the deposits are largely residual in nature or were transported for very short distances only; evidently they were derived from the numerous small but high-grade quartz veins that traverse the district. The residual character of the gold is further indicated by its low degree of fineness; it usually is between 600 and 650 fine.

The entire district is underlain by a bedrock of soft, decomposed quartz monzonite; it lies between 6,000 and 6,300 feet above sea level in a swampy region of low relief. With the exception of Meadow Creek, the streams are very small, becoming almost, if not quite, dry during mid-summer; shortage of water has always been a handicap to the district. On the other hand, the low stream gradients and swampy ground doubtlessly prevented the thorough cleaning of bedrock in the deeper ground; it is probable that some of this ground could be reworked by dragline methods, as is being attempted on White Sand Creek. Here a dragline, with a floating washing plant, was removing about 5 feet of overburden (mostly old tailings) and washing about 3 feet of pay dirt that lay on bedrock. The operation was technically inefficient, and its failure is not necessarily proof that the project is not feasible.

Most of the areas of virgin ground remaining in the district are in flat, peat-covered meadows at the heads of the streams (fig. 8). These areas, obviously, were too low-grade and too flat to be worked by hand methods but might be workable with draglines or small dredges. There is also a large volume of unworked gravel, known to contain some gold, on Little Slate Creek about 3 miles northwest of Florence.

The town of Florence is virtually deserted; at present there is not even a post office. Grangeville, the nearest supply point, is reached by 42 miles of mountain road, most of which is both steep and rough; in good weather the trip may be made by passenger car in from 2 to 2-1/2 hours, but in winter the road is impassable. A winter trail about 6 miles long extends from Florence down the side of the canyon to the settlement at French Creek on the Salmon River.

Stream Gravels

Sand Creek. - The forks and tributaries of the upper end of Sand Creek comprise a total length of about 2 miles of meadow land averaging from 50 to 100 yards wide; all of this is overlain by several feet of soil and peat; at least part of it is underlain by gold-bearing gravels.

A strip about 600 yards long by 100 feet wide along the center of the main meadow was dredged in the early days. In 1935 and 1936 J. F. Jones of Florence operated a small dragline and floating washing plant above where the dredge stopped; he mined a strip about 1,000 feet long by 30 feet wide said to have been composed of 7 feet of gravel overlain by about 3 feet of peat; the recovery from this ground was slightly less than 40 cents per yard. Nothing definite is known regarding values in other parts of the deposit. Where worked, the gravel is loose and free from boulders. Bedrock was not exposed but is undoubtedly similar to that in other parts of the district. At low water, Sand Creek is practically dry.

This ground is held by Mrs. Eva L. Canfield, of Florence, and associates.

Meadow Creek. - The east fork, for about half a mile above the fork, and the west fork, for about 2 miles above the fork, contain virgin gravel deposits that may carry commercial gold values. The lower half mile of the west fork was worked extensively by hand methods in the early days, but there are some remaining areas of virgin ground along the edges of the old workings (see fig. 8). Above these old workings, on both the east and west forks, the stream bottoms are 100 to 300 feet wide and are generally flat and swampy. The ground on Meadow Creek apparently averages from 6 to 10 feet deep, of which 2 or 3 feet is topsoil of peat. At low water the main creek below the forks carried about 3 second-feet of water, most of which came from the east fork. Both forks of the creek are held by Mrs. Ada Cyr of Grangeville, Idaho.

Just above the old workings on the west fork, Frank J. Friedle, representing Oregon interests, was operating a movable dry land washing plant with caterpillar scraper for testing purposes, and was also sinking test pits on other parts of the creek. Evidently, some values were found, but when visited the results of the sampling were still indecisive.

Last Chance Gulch. - Small meadows that probably contain gold-bearing gravels extend along the lower half mile of Last Chance Gulch above its confluence with Meadow Creek. The meadows are from 50 to 200 feet wide and are probably about 6 to 10 feet deep to bedrock; the stream contains only a small trickle of water in the dry season. A couple of small tributary gulches have been worked by hand methods, and at one point (see fig. 8) a small hydraulic pit has been worked on some bench gravels; an acre or more of unworked ground of similar nature adjoins the pit. The ground is held by Mrs. Eva L. Canfield of Florence.

Little Slate Creek. - About 3 miles northwest of Florence, on Little Slate Creek, are extensive meadows that doubtless contain some gold. These meadows are virtually continuous from above the Seabury-Nut Basin road (see fig. 8) to the mouth of Van Buren Creek; it is improbable, however, that they contain gold in commercial quantities very far above the mouth of Turnbull Creek. That the several tributary gulches and streams have been worked indicates that the section from the mouth of Turnbull to and below the mouth of Van Buren Creek probably contains some gold especially along the western side of the meadows. Several rows of test pits have been dug across the Little Slate Creek meadows near the mouth of Van Buren Creek, but the results were unsatisfactory; the rest of the meadow has not been tested systematically. The pits indicated an average depth of from 8 to 10 feet, with few boulders; this section of the meadows is about 200 yards wide.

At low water Little Slate Creek above Van Buren carried about 3 to 4 second-feet of water on a gradient of not over 50 feet to the mile.

Van Buren Creek. - Van Buren Creek carries about the same volume of water as Little Slate Creek but has a gradient of nearly 100 feet to the mile. It flows in a valley bottom about 150 feet to 400 feet wide in the lower mile of its course. There were no evidences of placer workings or test pits on this stream.

Turnbull Creek. - Considerable placer mining has been done along the lower end of Turnbull Creek and its tributaries, especially Royal Creek. A small area of virgin ground, which might be suitable for "sniping" operations, remains on Royal Creek and at the confluence of Royal and Turnbull Creeks. At the upper end of the worked-out ground on Royal Creek is a recently worked hydraulic pit about 100 feet long by 20 feet wide by 8 feet deep (including 1 to 2 feet of topsoil); considerable 10-inch hydraulic pipe and a monitor were on the ground. Turnbull Creek carried about 1 second-foot of water near its mouth, but Royal Creek was practically dry (Sept. 5). Turnbull Creek has a gradient of about 200 feet to the mile; Royal Creek is steeper.

Most, if not all, of the placer ground along Little Slate Creek is owned by R. A. Rathbun of Freedom, Idaho.

Side Hill and Gulch Gravels

At many points in the Florence district residual gravel or side-hill wash was worked in the early days, but large parts of these deposits were left unworked. These unworked deposits doubtlessly contain some gold, and parts of them might be workable by draglines or by small-scale hydraulic methods if sufficient water could be obtained; however, they are not large enough to justify expensive plant installations or long ditches, consequently their workability appears to depend largely on the development of better methods or cheaper power. The largest unworked area lies on the southwest side of the west fork of Meadow Creek; no reliable estimate of the remaining volume of gravel or its value could be made in the time available.

Dixie District

The Dixie district and the nearby placer deposits on Big Creek (see fig. 9) are included in an area about 8 miles long from north to south by 5 miles wide from east to west lying a few miles north of the "breaks" of the main Salmon River; the streams draining this area all flow south into the Salmon. The district, although between 6,000 and 7,000 feet above sea level, is generally characterized by low relief and mature topography. The town of Dixie is about 28 miles by mountain road south of Elk City; this road crosses a 7,000-foot summit that usually is closed to wheeled motor transport from December to May; a much quicker route into the district will be available when connections are made with the new road now under construction up the Salmon.

At present the placers on Big Creek, although only about 3 miles in a straight line from Dixie, can be reached by road only by way of Dixie Ranger station (see fig. 9), a distance of 10 to 12 miles. The Big Creek placers, however, are connected with Orogrande by 7 to 8 miles of steep mountain road. The period of high water in the spring extends from about the middle of April to some time in June; by the middle of July many of the smaller streams are dry. Weather conditions suitable for outdoor operations such as dragline operation prevail from about the middle of April or first of May to the first or middle of October.

The volume of placer gravel in this district is small, compared with other important districts of central Idaho. Although Thomson and Ballard[22] have estimated that the total production was about $1,500,000, it is difficult at this time to understand where this amount of gold came from. Jellum[23] states that from 1861 to 1863, $270,500 was handled by the express company shipping out of Dixie. As this was undoubtedly the period of greatest production, it seems probable that the total was considerably less than a million dollars.

Practically all the gold was produced from about 5 miles of Crooked Creek and half a dozen streams and gulches that enter it from the west. Big Creek has produced very little gold to date but there is a possibility that the big meadows near the upper end may contain commercial values.

The Big Creek gravels are considered by Shenon and Reed[24] to be remnants of Tertiary deposits on an old erosion surface. It is probable that some of the Dixie gravels may be placed in the same class, although most of them have undoubtedly been resorted and reconcentrated in more recent times, some, obviously, are of recent origin. The Dixie deposits, apparently, are derived from the numerous small veins and other lode deposits that traverse the district; consequently, the gold is generally rough and is frequently embedded in quartz particles. The gold recovered at Dixie and on Big Creek is approximately 850 fine.

22/ Work cited.
23/ Work cited.
24/ Work cited.

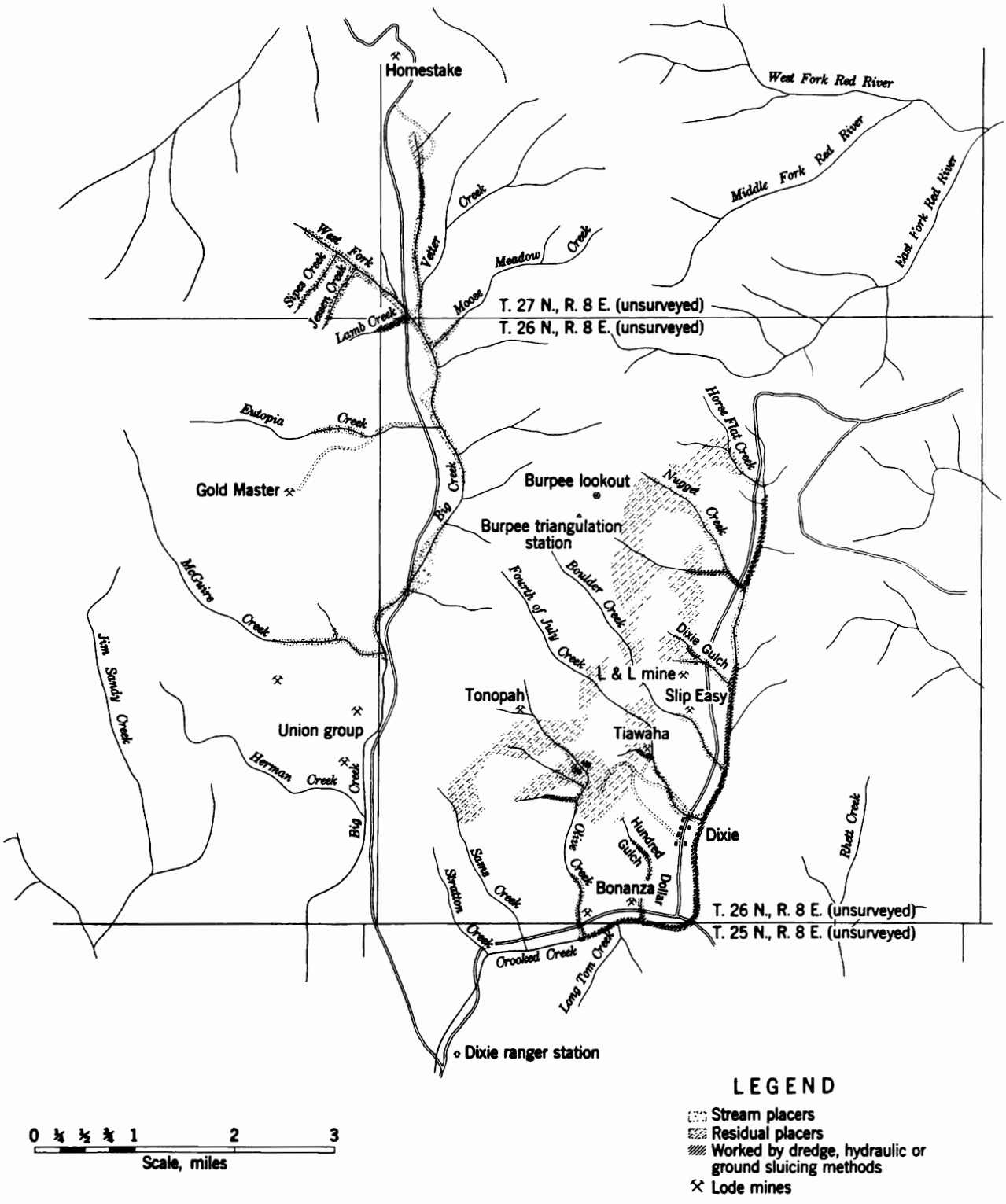


Figure 9.—Gravel deposits of the Dixie district, Idaho County, Idaho.

In addition to the stream deposits, there are large areas of comparatively flat, semiswampy ground near the headwaters of many of the creeks where gold is known to occur in spots. These areas are indicated in figure 9 as "residual" deposits but their commercial value, except where local concentrations occur, remains to be demonstrated.

In general, it may be said that the remaining ground at Dixie is suitable only for small-scale operations but that the meadows on Big Creek would be suitable for large-scale dredging operations if proved to contain commercial values.

Stream gravels

Crooked Creek. - This creek has contained the largest placer deposits in the Dixie district proper and has been mined from the mouth of Horse Flats Creek to the mouth of Olive Creek. In the early days it was mined by hand methods, more recently by draglines. Some of the earlier diggings are said to have been rich, but there are no authentic records of early production available; later operations have recovered about 20 cents per yard. With the possible exception of the small meadows just above Dixie Gulch, virtually no commercial gravel is left on this creek.

Olive Creek. - The lower part of Olive Creek flows through a canyon, but for about a mile above its mouth it contains gravel deposits 20 to 50 feet wide. Boulders are rather numerous near the surface, but the depth, character, and value of the gravels has not been determined by systematic testing; they probably contain some gold. The stream gradient is about 200 feet to the mile; the water flow on August 12 was estimated to be between 1 and 2 second-feet at the mouth of the creek.

About a mile and a half above its mouth the stream splits into three forks. The south fork has been worked by hand methods for one-quarter mile or more above the forks; these old diggings are 20 to 30 feet wide and about 4 feet deep to bedrock. The center and east forks are flat and swampy for some distance above the forks; the gravel deposits are about 50 feet wide and probably 4 or 5 feet deep. The gravel in both forks is generally small and angular; gold values are claimed to be between 10 and 30 cents a yard, but there is little evidence of systematic testing; some side gulches, however, have been worked by hand methods.

At some time in the recent past a ditch had been dug from the headwaters and a pipe line and monitor installed near the forks but never used.

Just below the forks, a pit about 180 feet long by 20 feet wide by 4 feet deep was excavated with a small gasoline shovel and the gravel washed in a portable washing plant in 1937. Evidently the operation was a failure.

Most of this ground is held by Miller and Powelson of Dixie. A. R. McInroy of Dixie is said to hold one claim on the south fork, and Wm. Randall of Waha, Idaho, is said to hold the ground near the mouth of Olive Creek.

Hundred Dollar Gulch. - Hundred Dollar Gulch is a short, narrow gulch said to have yielded $100 a day to some early workers. The old workings extend for about one-quarter mile along the upper part of the gulch; these workings are about 20 feet wide and only a few feet deep. In 1937 a pit about 25 feet wide by 30 feet long by 3 to 4 feet deep was worked at the lower end of the old workings; this ground was said to have yielded 63 cents a yard. When visited (August 12), the operation was inactive. From these old workings to the mouth of the creek the canyon is steep and narrow, but there may be sufficient pay gravel to repay individual operations by very small-scale methods. The ground is held by Miller and Powelson of Dixie.

Fourth of July Creek. - For about a mile above its mouth, Fourth of July Creek contains gravel deposits that are several hundred yards wide at the mouth but quickly narrow to about 100 yards; about half a mile above the mouth they again narrow to about 50 feet. A test hole sunk near the mouth of the creek was said to have gone through 20 feet of gravel to bedrock; the upper 6 feet of gravel was said to contain numerous large boulders; nothing could be learned of the values obtained. Old gulch diggings about half a mile above the mouth and near the Tiawaka lode mine prove that tributaries have carried payable gold values. The stream gradient is about 100 feet to the mile; the stream flow was estimated at about half a second-foot on August 12.

The ground below the lode locations of the Tiawaka mine is held by Lee Hida of Dixie.

Boulder Creek. - The lower half mile of Boulder Creek contains gravel deposits 100 to 200 feet wide; test pits in several places expose angular gravels to a depth of 4 to 5 feet, but not to bedrock. A number of large boulders are on the surface, but it is characteristic of the district that, except in narrow canyons, boulders usually are near the surface rather than near bedrock. The stream gradient is about 100 feet to the mile; the stream flow was estimated at about 1 second-foot at low water.

Above the Slip Easy lode mine the creek flows through a narrow canyon for about half a mile; above the canyon the valley widens to about 40 acres of swampy flats known locally as the "woodyard." Any gravels there may be on these flats must, obviously, be largely residual or very poorly sorted. The owners, however, claim that testing has shown values of 20 to 40 cents a yard distributed through 7 to 15 feet of gravel, with about 18 inches of topsoil.

The "woodyard" is held by J. E. Owens and the lower end of the creek by Van Arsdale, both of Dixie.

Dixie Gulch. - The first gold discovery at Dixie was said to have been made on Dixie gulch. This gulch has been worked for about one-quarter mile above the road crossing, but from the road to Crooked Creek, a distance of about one-quarter mile, there is a gravel deposit 50 to 100 feet wide, which apparently was too flat or too low-grade to be worked by the old timers. Above the old workings and on the small tributary gulch is some ground suitable for working on a very small scale by hand methods. Late in 1937, some hand workers on the upper part of the main gulch were said to be recovering about $1 per yard. Most of this gulch is owned by the Land L mine. The gulch is dry at low water.

Nugget Creek. - The south fork of Nugget Creek and the main creek below the fork were worked by hand methods in the early days; the north fork, however, has not been worked. Evidently some gold was left by the early miners, as a test hole in worked-over ground some distance below the road crossing was said to have yielded 50 cents per yard.

There is no record of production from the south fork, but the workings are said to have been rich. A strip about 20 feet wide and 4 or 5 feet deep was worked down the middle of the channel; narrow strips of unworked gravel remain on both sides of the old workings but are covered by old strippings.

The north fork is from 50 to 200 feet wide for about 2,000 feet above the forks; the stream gradient is about 60 feet to the mile. Above this point the valley widens to a large, swampy flat, which connects with the large flats at the head of Horse Flat Creek to the north. Here, as elsewhere in the district, it is claimed that the gravels on these flats carry values. However, it is apparent that these gravels must be poorly sorted and it would seem that values are likely to be spotty; the ground has never been properly tested.

Below the flats there is little doubt that the gravels contain commercial or near commercial values; the owners claim an average of 25 cents per yard. A small pit about 100 feet long by 20 feet wide by 4 to 7 feet deep near the intersection of the two forks is said to have yielded $500 in gold. Undoubtedly, this is a particularly rich spot; nevertheless, the owners have sufficient faith in the ground to have constructed a dragline shovel and washing plant from second-hand material and begun operations. The plant was not completed until near the end of the 1937 season, so had little chance to work. The plan was to work up from Crooked Creek through the old workings below the fork and then up the north fork. Another similar plant started work near the end of the season on a small section of the creek held by a lode location just above the road crossing.

There was said to be a good supply of water from May 1 to July 1; by low water the flow had dropped to a few gallons a minute.

With the exception of the lode claim (about 600 feet wide) mentioned above, this ground was held by Rudolph Lehman and C. L. Martz of Dixie.

Horse Flats Creek. - From the road crossing down to Crooked Creek, Horse Flats Creek follows a meandering course through a wide bottom land; for about 300 yards above the road the valley bottom narrows to 50 to 100 feet and then gradually widens to the large swampy basin that connects with the flats or swamps at the head of Nugget Creek. The gravel in the lower half mile of this valley was said to carry about 12 cents per yard; however, some testing done in the Fall of 1937 was evidently unsatisfactory.

The ground was held by Gusta Miller of Dixie.

Rhett Creek. - Some placer ground said to carry gold is held by J. E. Owens of Dixie on a branch of Rhett Creek a few miles southeast of the area mapped. The holdings were not visited but were said by the owner to consist of four claims from which tests of 15 cents per yard have been obtained.

Big Creek Meadows. - The meadows on Big Creek are about 6,400 feet above sea level, or about 500 feet higher than the town of Dixie. Below the junction of Big Creek with West Fork are some big meadows about one-quarter mile wide by three-quarters mile long; they are said to be 20 feet or more deep to bedrock; above and below here the meadows narrow to 100 yards or less. Below the mouth of Utopia Creek, Big Creek flows through a narrow canyon for about half a mile and then widens to another large meadow one-quarter mile or more wide; below McGuire Creek it again enters a canyon.

Up to late in 1937 these meadows had never been tested; however, the fact that some gold has been mined by hand methods from near the upper end of Big Creek, on West Fork, and on Lamb Creek indicates the possible existence of low values in the meadows. According to local reports, the Yuba Consolidated Gold Fields Co. had a test crew at work here in the late fall of 1937.

The ground appeared to be relatively free of boulders and generally well suited to dredging operations. Big Creek below the mouth of West Fork was estimated to contain 4 to 6 second feet of water on August 1; the gradient is about 50 feet to the mile.

The upper meadows were held by M. C. Jessen, of Orogrande, and Mrs. F. G. Roberts, Route 2, Lewiston, Idaho.

Upper Big Creek. - Above the confluence with Vetter Creek the valley of Big Creek narrows to about 100 feet or less; about three-quarters mile above Vetter Creek early-day miners worked a strip about 20 feet wide for about one-quarter to one-half mile along the center of the channel, leaving some virgin ground along both sides. In 1937 some itinerant miners were digging along the edges of these old workings and at one place recovered between $5 and $7 from 3 square yards of bedrock; adjoining areas, however, had frequently proved disappointing.

West Fork of Big Creek. - Meadows at the mouth of West Fork are about one-quarter mile wide but narrow quickly to 100 to 200 yards and retain this width for about 1-1/2 miles; the ground has not been tested but appears to be at least 10 feet deep and relatively free from boulders. On August 1 the stream flow was estimated at between 2 and 3 second-feet at the mouth; the gradient is about 100 feet to the mile.

Old hand workings on Lamb Creek and active hand workings on Jessen Creek and Sipes Creek demonstrate the occurrence of good pay on three tributaries of West Fork. Some itinerant miners were said to be recovering good values from shallow workings near the headwaters.

From about 1,000 feet above Sipes Creek to its mouth, West Fork is held by P. A. Sipes and M. C. Jessen of Orogrande.

Sipes Creek. - P. A. Sipes of Orogrande has been making a living for several years from one-man operations at the mouth of a small tributary of West Fork which, for want of another name, is here referred to as Sipes Creek.

Sipes operations were at the mouth of the creek where the channel was about 50 feet wide. A short distance above these operations the valley widened to about 200 yards of swampy flats. It was said that "snipers" had been recovering fair values from shallow ground above the flats.

The working pit at Sipes operation was about 20 feet wide and 5 to 8 feet deep. The gravel was handled by hand shoveling into a sluice box. The value per yard was not stated, but it was apparent that the ground contained fair values.

Jessen Creek. - M. C. Jessen, of Orogrande, had been operating for about two seasons on another unnamed tributary of West Fork. The gravel deposits on this tributary are 100 to 300 feet wide and extend upstream for half a mile or more; whether or not values are distributed over the entire width was not apparent - much of the ground consisted of the swampy flats so often found in this district near the headwaters of streams.

Jessen's operations had been confined to a small pit about 5 feet wide by 30 feet long by 8 or 9 feet deep (including 2 or 3 feet of top-soil); this pit was situated virtually at the mouth of the creek. Jessen had brought water in a 1-1/2-mile ditch from the upper end of West Fork. The flow on August 1 was sufficient to operate a 1-1/2-inch nozzle steadily under a low head. Water for "booming" material through the sluices had to be stored and used intermittently; about four "heads" a day were available at this time. It was said that sufficient water for steady operation was available from May 1 to the middle or end of June.

Jessen estimated that the ground averaged 25 to 30 cents to the yard; the gold was 854 fine. About 900 yards above the pit being worked, a test hole 6 feet deep was said to have yielded 15 to 20 colors to the pan. Bedrock at this hole was 72 feet higher than bedrock at the working pit.

Lamb Creek. - The old Lamb diggings, so called, are on a small tributary flowing north into West Fork close to its confluence with Big Creek. A strip about 20 feet wide and about 5 feet deep had been worked up this creek in the early days; a small amount of virgin ground remains along the edges of the old workings. According to some local reports, this ground yielded about $18,000; others estimate the yield at about 40 cents a yard.

Utopia Creek. - Some gravel deposits on Utopia Creek are held by the Goldmaster lode mine to provide room for mill-tailing disposal. So far as known, these gravels have not been tested for placer.

McGuire Creek. - The lower mile of McGuire contains gravel deposits from 20 to 200 feet wide, which contain some gold but have not been thoroughly tested. The ground appears to be 4 to 6 feet deep; boulders are numerous in the narrower sections. About three-quarters mile above the mouth a small amount of gravel has been washed, but when visited there was no activity. On August 15 the stream flow at the mouth of the creek was estimated at about 1 second-foot; the gradient is about 200 feet to the mile. This ground is owned by L. C. Puelz of Orogrande.

Operations of the Dixie District

Dixie Placers. - Dixie Placers, L. J. Burrows, manager, is operating a dragline placer plant on a deposit in Crooked Creek near the town of Dixie. Dixie is 80 miles by mountain road southeast of Grangeville, Idaho, at an elevation of 5,600 feet. The operating season opens between April 15 and May 1 and closes between October 1 and October 15 of each year. Mining has continued steadily during three seasons; a fourth season will be required to work out the deposit.

The deposit being worked is about 3-1/2 miles long and 50 to 150 feet wide. The average width is about 120 feet; the average depth about 13 feet. Bedrock is soft decomposed granite and schist cut by dikes of harder and more resistant rock. Bedrock gradient is about 50 feet to the mile. In the wider parts of the deposit boulders too large to go through the trommel are infrequent except near the surface, where they may be removed easily by the bulldozer. In places where the channel narrows, however, boulders from side-hill wash are so numerous that mining is impracticable; it has been necessary to "walk" the plant over these sections.

Equipment consists of a Northwest gasoline-powered shovel fitted with a 45-foot boom and a 3/4-yard dragline bucket; a 60-horsepower gasoline-powered bulldozer; a 4-inch centrifugal pumping unit; and a portable washing plant.

The washing plant is about 33 by 10 by 16 feet in over-all dimensions, exclusive of hopper. Its framework is steel; the outside lower members of the framework are 8-inch, 32-pound H beams; the rest of the frame is of proportionately lighter construction. The entire plant, weighing 25 tons, is mounted on eight (four front and four rear) 28- by 12-inch wheels grooved to fit round-timber skids or tracks.

Gravel is received in a small steel hopper and screened in a 4-foot-diameter trommel set on a grade of 1-1/4 inches to the foot and revolving at 20 rotations per minute. The first section of the trommel is a blank or scrubber section 5 feet long with one 3-inch retarding ring at the lower end; the second section is drilled with 1/4-inch round holes; the third and fourth sections with 3/8-inch round holes; and the fifth section with 3/4-inch round holes. The second to fourth sections are each 4 feet long; the fifth section is a blank 2 feet long. A 3-inch header pipe drilled with spray holes extends the length of the trommel.

Standard dredge tables are suspended in swinging cradles under the trommel. Tables are 18 inches wide, arranged in the usual manner. About 100 square feet of table area is provided. The last table sections discharge into a drag-type dewaterer, which delivers the dewatered sand and gravel to the tailing stacker. Yuba-type dredge riffles, 1-inch wide, spaced 1 inch apart, are used at the head of each table section and throughout the length of some tables. More than half the table area is riffled with 1/2-inch-mesh, no. 9, wire, smoke-stack screen over burlap.

Dewatered tailings and oversize from trommel are stacked by a 36-foot stacker equipped with a 24-inch by 1/2-inch belt traveling 200 feet per minute on a 22-degree angle.

Most of the ground to be worked is covered with a heavy growth of brush and small timber; windfalls are numerous. Clearing is performed by the bulldozer on day shift. An average of about 1 hour per day is required for this work.

Because of the concentration of gold near bedrock, it is possible to strip to an average depth of about 10 feet. This work is performed by the dragline shovel on night shift. Where possible, a cut with a maximum width of 70 feet is stripped at one operation; spoils are piled on both sides of the cut. If a second parallel cut is required, spoils from the first cut are pushed back into the worked-out cut by the bulldozer. It has been found cheaper to rehandle half of the spoils in this way than to take narrower cuts and pile all the spoil on one side only. The first cut is worked through to the beginning of the next "narrows" before the second cut is begun.

The washing plant is operated 10 hours a day. Only the bottom 2 or 3 feet of gravel and 6 inches to a foot of bedrock is washed. Gravel is dug and bedrock cleaned by the dragline shovel. The washing plant is moved ahead about 18 feet at a move; an average of 1/2 to 3/4 of an hour is required for each move.

About 85 percent of the gold is recovered on the first set of riffles, and about 10 percent on the next two; the rest is distributed through the other riffles. The first set of riffles is cleaned up daily; the others are cleaned up at about 10-day intervals.

The gold is fairly coarse and heavy. The chief loss is in gold particles, which contain sufficient quartz to lower their specific gravity materially.

The plant uses about 600 gallons of water per minute; this water is provided by the normal flow of Crooked Creek until midsummer. By low water the stream flow has usually fallen to about 300 gallons per minute; the additional 300 gallons per minute required for operation is obtained by recirculating half the water discharged from the plant. A small dam is built at the lower end of the cut being worked. The natural stream flow through the diversion ditch joins the plant discharge water in this dam, from which the required 600 gallons per minute is pumped to the washing plant under a pressure of 20 pounds to the square inch; the surplus water is permitted to overflow through an adjustable weir. At clean-up times, the dam is allowed to drain and only the clear water from the diversion ditch is used. A weighted wooden box, one side of which is covered with fly screen, serves as an intake box during operations and as a sump for the clear water during clean-up.

To prevent silting of the ditch from the washing plant to the pump intake, it is necessary to provide for additional clarification of the water after it leaves the plant. After each move, a small settling pond about 12 feet square is built behind the plant; the overflow from this pond is caused to flow over loosely piled rocks where most of the remaining silt is caught in the crevices.

No electric power is available in the district. All units are driven by gasoline engines. The total connected horsepower is as follows:

	Horsepower
Dragline shovel	66
Lighting plant (on shovel)	6
Caterpillar bulldozer	60
Washing plant	18
Tailing stacker1/	6
Pumping plant	10
	166

1/ The plant operated for 2-1/2 seasons with a 3-1/2-horsepower engine on the tailing stacker.

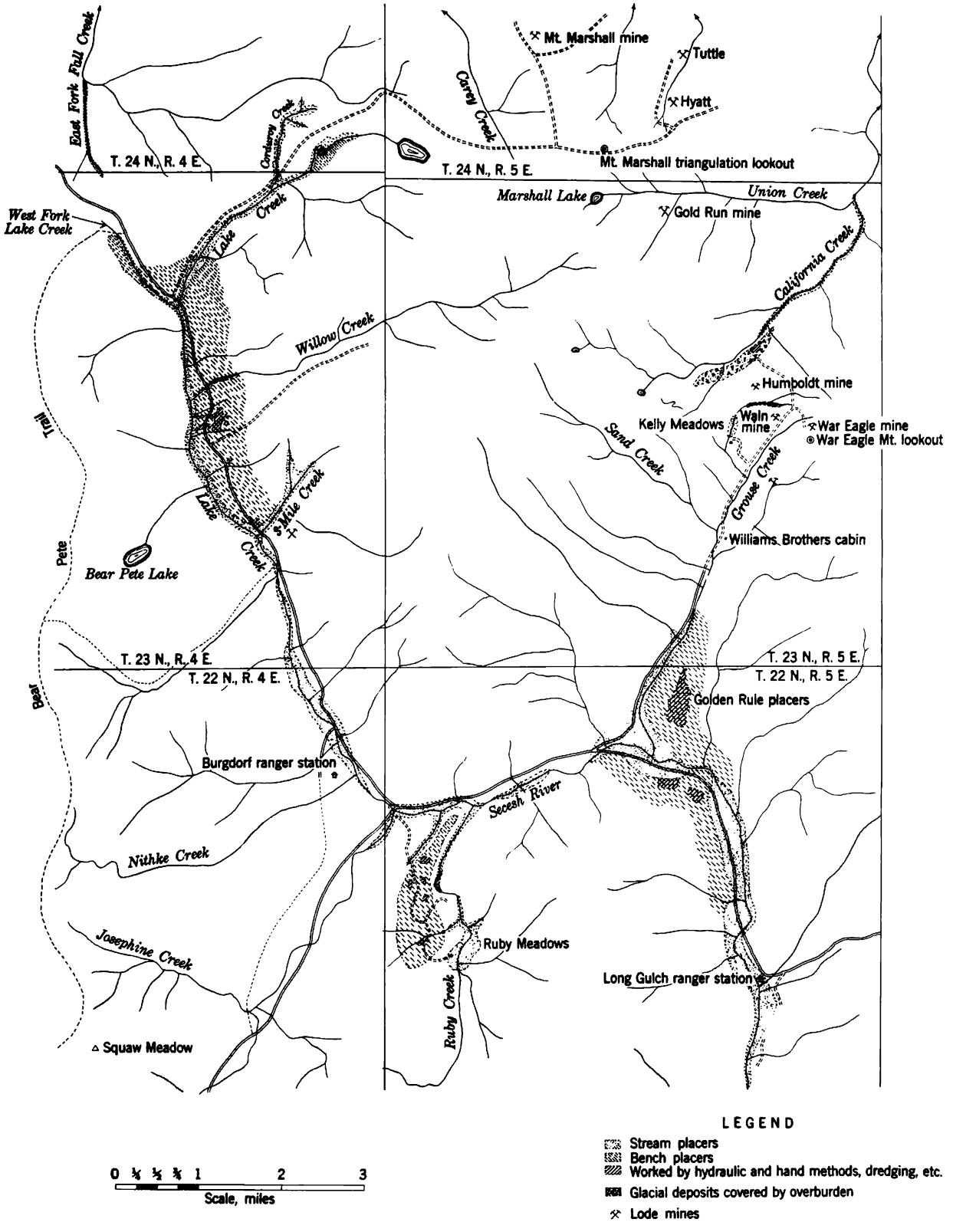


Figure 10.—Gravel deposits of the Burgdorf district, Idaho County, Idaho.

In 1937, gasoline delivered at Dixie cost 33 cents per gallon, retail, including the state tax of 5 cents per gallon.

Seven men, in addition to the manager, are employed regularly. These consist of 1 foreman, 2 shovel operators (1 each shift), 1 oiler (night shift), 1 bulldozer operator, 1 general laborer, and 1 plant operator. Most men are paid a monthly salary.

In addition to his other duties, the foreman pans bedrock behind the operations; on the night shift the oiler tests the gravel ahead of operations to determine the depth of gravel to be treated in the washing plant. The bulldozer operator operates the bulldozer about one-third of his time and works at odd jobs the remaining time.

Low costs for this type of operation have been made possible by the fact that the gold is concentrated near bedrock; it has been necessary to wash only a small part of the material handled. A steady working force and efficient team work have contributed materially to the results obtained.

The following table summarizesthe costs per yard in the operating season of 1936:

1936 operations, April 27 to October 30

(Total yardage, including stripping, 229,000)

Account	Amount	Per yard
Labor	$6,361.48	$0.028
Superintendent's salary	940.00	.004
Supplies and repairs	4,171.42	.018
Gas and oil, including freight	3,174.57	.014
Freight	291.86	.001
Insurance	319.58	.001
Taxes (except income)	114.68	.001
Office expenses	182.62	.001
Administrative expense	1,294.35	.006
Interest	331.65	.001
Total	17,182.21	0.075

Burgdorf District

The placer deposits for which Burgdorf is the natural supply point are found in a belt about 12 miles wide extending 17 miles south from the Salmon River (fig. 10). Nearly all the important placer deposits of this district are found in the drainage basins of Lake Creek and Secesh River, both of which flow south and east into the South Fork of the Salmon River. The streams flowing north into the main Salmon are generally too steep to have retained accumulations of gravel, although some deposits suitable for hydraulic mining are found on Fall Creek and California Creek.

There are two noteworthy centers of lode mineralization in this district; the most important is known locally as the Bear Creek district and officially as the Marshall Lake district; it includes the numerous high-grade gold veins along Bear Creek and Maxwell Creek. Most of the gold eroded from the Bear Creek veins undoubtedly has been washed into the Salmon River. The other center of lode mineralization is in the vicinity of War Eagle Mountain, where a number of high-grade gold veins are being worked; much of the gold of California Creek, Grouse Creek, and Secesh Meadows, as well as of Schissler Creek[25] and other creeks on the eastern slope, is obviously derived from these veins.

Although no producing lode mines have been developed in other parts of the district, the comparatively weak zones of mineralization lying around and between the two centers apparently have produced most of the gold now concentrated in Lake Creek and its tributaries. It is noteworthy that, with the exception of Ruby Creek, all the commercially valuable gold-bearing tributaries of Lake Creek and Secesh River head close to a line between the War Eagle and Bear Creek lode mines.

Except for a few small gulches on the slopes of War Eagle Mountain and on the slopes of the Salmon River canyon, the Burgdorf district is notably lacking in the rich "skim" diggings found in other camps of the region. Nor has any important production been derived from the stream gravels in this district; the stream gradients generally are too low to permit hydraulic mining, and the values have been too low to permit the use of other methods. There are, however, large areas of gold-bearing gravels on Lake Creek and Secesh River which probably could be dredged if gold prices were higher. Neither of these streams has been thoroughly tested throughout, and it may be that some parts of them are workable at present gold prices.

Large deposits of bench gravels occur along both Lake Creek and Secesh River. Parts of these deposits have been worked on a large scale by hydraulic methods, and there are probably other parts that could be worked profitably at the present price of gold. Very little information concerning the richness of these gravels could be obtained but there is little question that most of them are low grade. However, their situation on benches permits the easy disposal of hydraulic tailings. Water would have to be brought from considerable distances, usually from the headwaters of nearby tributaries. Inasmuch as these streams are small, water sufficient for hydraulicking is not available during the spring and early summer; the ditches used in former years are in disrepair and would have to be repaired or rebuilt. Lake Creek and Secesh River contain an adequate supply of water throughout the year, but the availability of this water for hydraulicking would depend on the development of very cheap power for pumping. Most of the bench gravels are between 50 and 200 feet above the bottom of the river valley.

25/ See description of Warren district, p. 70.

Burgdorf Post Office and the nearby stream valleys are all close to 6,000 feet above sea level. McCall, the nearest railroad point, is 5,000 feet above sea level. Therefore, the forest highway from McCall to Burgdorf is entirely in high country and, although free from excessive grades, is closed to winter travel except by tractor-drawn sleds. A brief description of the placer deposits of the district follows:

Stream Gravels

Lake Creek. - Except for a few short canyons, the gravels along Lake Creek are continuous from its confluence with Josephine Creek to within a mile of its source, a total distance of about 10 miles. From the upper end of the first canyon, near the lower end of the stream, to the beginning of the second canyon, about a mile and a half above Burgdorf, are meadows ranging in width from a minimum of 200 feet to a maximum of over 1,200 feet. Most of the meadows are patented as agricultural land and belong to James Harris of Burgdorf. From the lower end to about half a mile above Burgdorf there has been very little testing in recent years. What little information is available on early testing indicates very low-grade material. It is generally considered that the deposits are below commercial grade and in many places almost totally lacking in gold values. From the north property line of the Harris ranch to the second canyon, a distance of about 1 mile, several holes have been drilled in recent years. These are said to have shown a gold content of from 3 cents to 10 cents per yard, with an average of probably less than 6 cents a yard. Depths of 20 feet or more were recorded.

From the second canyon to Corduroy Creek, a distance of about 5-1/2 miles, the width of the stream placers ranges from 200 to about 500 feet. There are no records that this section has ever been tested. The occurrence of commercial values in the bench gravels on the east side of Lake Creek suggests that the stream gravels probably also are gold bearing; they are, however, undoubtedly low grade. All of the gravel deposits on Lake Creek below Corduroy are physically suitable for dredging. Practically all of Lake Creek from the Harris ranch to Corduroy Creek is held by Raymond Carrey, of Grangeville, Idaho, and associates.

From its confluence with Corduroy Creek to within a mile of its source, the gradient of Lake Creek is from 80 to 100 feet in a mile and the flow from 3 to 4 second-feet. This section has never been tested; it contains several boulder-filled narrows and is nowhere more than 300 feet wide; it is only suitable for small dragline operations. Bench gravels near the upper end of this section have been worked by hydraulic methods. A test pit 11 feet deep near the junction of Lake and Corduroy Creeks is said by the owner to have indicated values as high as 50 cents a yard.

Wm. Ritman, of Burgdorf, owns nearly all of Lake Creek above Corduroy Creek. One claim, just above the forks, is held by location. The rest of the land is patented.

Corduroy Creek. - Corduroy Creek has a gradient of about 100 feet in a mile and a flow of 3 to 4 second-feet. Stream gravel deposits extend from its junction with Lake Creek for about a mile upstream. The width of the gravel at the lower end ranges from 200 to 300 feet, but at the upper end, where small tributaries come in from the north and south, the width is nearly 1,000 feet. The depth to bedrock is from 10 to 12 feet, with about 3 feet of overburden. One test pit 6 feet deep, near the road crossing, yielded about $1.50 in gold from about 2 cubic yards of gravel. Other test holes have been sunk at intervals for about half a mile above the road; these holes indicate that the gravel is from 6 to 15 feet deep, with about 3 feet of topsoil. The holes are claimed to have indicated values of about 17 cents a yard. The gravels on Corduroy Creek are relatively free from boulders and are physically adapted to dragline or small dredge operations, especially if worked in conjunction with upper Lake Creek. Corduroy Creek above the road is held by Thomas Morgan of New Meadows; below the road it is held by Victor Paquet of Burgdorf.

West Fork of Lake Creek. - Stream gravels on the West Fork of Lake Creek extend upstream from its confluence with Lake Creek for a distance of about 1-1/4 miles. There are unworked and untested bench gravels along the east side of the creek adjacent to the stream gravels for a distance of about half a mile upstream from the junction, and on the west side from about half a mile above the junction to the end of the stream gravels. These bench gravels are 100 to 300 feet wide; bedrock is not more than 20 feet above the stream. The stream gravels range in width from 150 to 200 feet and are thought to be about 12 feet deep; however, they have not been tested; consequently, their commercial possibilities are not known. The ground is held by L. H. Muckensturm of Burgdorf.

Three Mile Creek. - Three Mile Creek enters Lake Creek from the east about 2 miles above Burgdorf. Stream gravels extend along the creek for about a mile above its junction with Lake Creek; they range in width from a few hundred feet at the lower end to nearly 1,300 feet at the upper end where two small tributaries come together. Very little is known of the gold values, but they are believed to be very low.

Willow Creek. - Willow Creek is a small tributary that enters Lake Creek from the east about 4 miles above Burgdorf. Practically all the stream gravels along this creek are where it flows through the bench placers that skirt the east side of Lake Creek. It is not probable, however, that they were formed entirely by the redeposition of bench gravels. Several veins in the upper drainage basin of the creek are probably the source of some of the gold in the stream gravels farther down.

The gravels extend from the lower end of the creek near where the road crosses for a distance of about half a mile upstream. The width is from 50 to 100 feet.

In the early summer of 1937, a pit about 15 feet wide by 100 feet long by 5 feet deep to bedrock was excavated by a small dragline scraper; however, the large number of boulders prevented the successful operation of such a plant. Late in the summer, a transient miner was recovering about 25 cents a yard from the same pit by selective mining by hand methods, but by this time the water flow had decreased to little more than a trickle; consequently, it was impossible to handle enough gravel to make wages.

Secesh River. - The Secesh River (fig. 10) is formed by the confluence of Lake Creek and Josephine Creeks. The gradient is from 25 to 35 feet in a mile and the flow about 100 second-feet during the dry season.

Extensive bench gravel deposits extend along the south and west sides of the valley from about a mile above Grouse Creek to about 2-1/4 miles below.

Stream gravels on the Secesh River extend from Lake and Josephine Creeks for about 8 miles downstream. They are not continuous, however, as the river flows through three short canyons in the first 4-1/2 miles of its course.

At the upper end are two deposits, one extending from the confluence of Lake and Josephine Creeks to the mouth of Ruby Creek and the other extending from about one-quarter mile below Ruby Creek for about three-quarters mile downstream. The first of these has a width of 500 to 800 feet. Large angular boulders from 1 to 5 feet in diameter are scattered over the whole surface. There is no record of testing ever having been done except probably right at the river channel, where a considerable thickness of the gravel is exposed. It is unsuitable for dredging because of the great number of large boulders, and the gradient is too low for hydraulicking. It is probably too low grade to be worked by other methods.

The deposit just below Ruby Creek is smaller, being about three-quarters mile long and ranging in width from 100 to about 400 feet. It is probably very low grade and has little, if any, value as placer ground.

At the confluence of the Secesh River and Grouse Creek is a gravel deposit of considerable size extending east and west along the Secesh River for about a mile, and north along Grouse Creek for about three-quarters mile. It is roughly triangular in shape, with its base parallel to the Secesh River and its apex on Grouse Creek, about

half a mile north of the river. It is known to contain an appreciable amount of gold. Its value as dredging ground, however, is not very definitely known. In the summer and fall of 1937, Fisher and Baumhoff did some test drilling just north of the river. The distance to bedrock was found to be about 32 feet. It is thought that there may be a channel containing commercially valuable gold somewhere in the deposit. The ground is owned mostly by Fred and Alfred Clark of New Meadows, Idaho.

Beginning about three-quarters mile below Grouse Creek, and extending along the Secesh River for nearly 3-1/2 miles downstream, are what is known as the Secesh Meadows. This is one of the largest stream gravel deposits in the Warren Burgdorf area, being exceeded in size only by the Warren Meadows on Warren Creek. The width ranges from 1,000 to 2,000 feet and probably averages around one-quarter mile. The total area is from 550 to 650 acres.

Porter Brothers of Helena, Mont., tested parts of these deposits in the summer of 1935. It is thought that the results of this testing indicated values much too low for the ground to be of use for dredging.

Ruby Creek. - Ruby Creek enters the Secesh River from the south about a mile below its source. The gradient through the narrows at the lower end is about 100 feet in a mile; through the flats near the upper end the gradient is about 50 feet in a mile. The flow at low water near the mouth is from 4 to 6 second-feet. Bench gravels occur along the west side, extending from 2 to 2-1/2 miles southward from the Secesh River. These deposits have been worked in many places by hydraulic methods.

Stream gravels occur along Ruby Creek in two sections for a total distance of about 2 miles. The lower section extends from the junction of Ruby Creek and the Secesh River for about a mile upstream. This part ranges in width from 50 to 125 feet. At the upper end, where the deposits have been worked by hand methods, the depth is from 4 to 6 feet with 1 to 2 feet of overburden. Parts of the creek bottom below these workings are very rocky. It is suitable only for hand methods, ground sluicing, or very small dragline equipment.

The upper section starts about 1-1/4 miles above the junction of the creek with the Secesh River and extends about a mile upstream. The lower half mile of this section ranges in width from 75 to 150 feet and in depth from 4 to 6 feet, with about 2 feet of overburden. In the summer of 1937, J. T. Jones, of Florence, started a small dragline operation along this part of the creek. The plant consisted of a 1-yard steam shovel and a floating washing plant. Operations continued for only five weeks, during which time a strip of ground 150 yards long and from 30 to 90 feet wide was worked. About 4,500 yards of material, averaging approximately 30 cents a yard, was handled. It is stated that the operation was stopped because the values decreased as the operations advanced upstream.

The upper half mile of the upper section is known as the Ruby Meadows. It has an average width of about 1,200 feet and a depth to bedrock ranging from 5 to 20 feet, with about 3 feet of topsoil. It is said that drilling indicated values of about 4 cents a yard. This ground is said to be held by R. M. Carrey and associates, of Grangeville, Idaho.

Grouse Creek. - Grouse Creek enters the Secesh River from the north about 2-1/2 miles below Ruby Creek. The lower end, for about 3 miles, has a gradient of about 40 feet in a mile. The flow is about 5 second-feet during September.

The bench gravels along the east side of the valley and also the stream gravels at the lower end have been discussed already in connection with the Secesh River. The upper 1-1/4 miles of stream gravels range in width from 200 to 300 feet and in depth from 8 to 10 feet, including about 3 feet of overburden. The commercial possibilities of the gravels along this part of the creek are unknown, but they undoubtedly contain some gold.

Kelley Meadows are about 4 miles north of the Secesh River on a tributary that flows into Grouse Creek from the north. They were prospected to only a very limited extent, and very little is known about them aside from their size and location. They are too small for anything except very small dragline equipment. The gulch just above the Meadows to the northeast was placered for about half a mile by hand methods and ground sluicing.

Fall Creek. - The L. H. Muckensturm property is on a tributary of the east fork of Fall Creek. The source of the tributary is just east of the Burgdorf-French Creek highway near the summit between the Salmon River and the Secesh River. The placer is about 50 feet wide and extends from the source of the tributary for about a mile downstream. At the lower end of the placer the creek flows into a steep narrow canyon.

L. H. Muckensturm and son have six claims along the main tributary and one on a small gulch that comes in from the west. Hydraulic placering and ground sluicing have been carried on for about two seasons. The depth of the deposit is from 5 to 7 feet. The creek gradient is about 400 feet in a mile at the placer and considerably more just below the placer where the creek flows into the canyon. About 20 cents a yard was recovered from the small amount of preliminary work done in 1936.

A 3-inch nozzle is used with about a 20-foot head. The water supply is from the East Fork of Fall Creek and West Fork of Lake Creek. There is sufficient water for about 90 days of piping during the spring and early summer. The gravel is washed through an 18-inch sluice box and discharged into the steep canyon just below.

California Creek. - California Creek has its source just north of the War Eagle lode gold area. It flows north into Maxwell Creek, which is a tributary of the Salmon River. The gradient is from 200 to 250 feet in a mile. Along short stretches it is as much as 300 feet in a mile. At the upper end the flow is about 6 second-feet during September. Below Union Creek it is from 12 to 14 second-feet during September.

Stream gravels extend from the Idaho Klondike drift mine to Union Creek, a distance of about 2-1/2 miles. They range in width from 75 feet at the upper end to about 250 feet at the lower end. There is virtually no information available concerning the gold content as no testing has been done recently. Two or three test pits were excavated many years ago. It is reported that one of these was 30 feet deep and did not reach bedrock. There are many boulders up to 5 or 6 feet in diameter.

The ground is held, by location, by Wolf and Nugent of Wallace, Idaho.

Bench Gravels

Lake Creek. - A small area of bench gravel occurs at the upper end of Lake Creek, and a much larger area extends along the east side of Lake Creek from the forks south to Three Mile Creek. Three hydraulic pits were worked on these gravels many years ago, but no production records are available; buildings and other improvements have long since fallen to pieces. In the 20th annual report of the director of the Geological Survey, Waldemar Lindgren mentions that in 1897 operations had been begun on Lake Creek for the purpose of hydraulicking gravels estimated to average 15 cents a yard; the authority for the estimate is not stated.

The remaining areas of bench gravel on Lake Creek (fig. 10) appear to be similar in character to those already mined, but nothing is known regarding their value except that they are generally believed to be low grade.

Secesh River. - Deposits which for practical purposes may be classed as bench gravels occur at three places on the upper Secesh River. One area is near the mouth of Lake Creek, another near the mouth of Grouse Creek, the third extends along the west side of Secesh River for about 2 miles below the mouth of Grouse Creek. The first two deposits are being worked actively on a small scale at present; the third was worked on a large scale many years ago but is now inactive.

Placer Mines in the Bench Gravels of the Burgdorf District

Gilbert. - Near the upper end of Lake Creek, a pit about 200 feet wide by 300 feet long was worked by hydraulic methods in the early days.

The gravel in the face of the pit is 10 to 15 feet deep; it is uncemented and contains few large boulders. Granite bedrock is about 20 feet above Lake Creek, which at this point is about 6,500 feet above sea level. Water was taken from Lake Creek, which at this point carries about two second-feet at low water. The ground is owned by William Ritman, of Burgdorf.

Lake Creek. - Four miles by road north of Burgdorf a large pit on the east side of Lake Creek was mined by hydraulic methods in the early days. The main workings are about one-quarter mile east of Lake Creek at an altitude of 6,400 feet. Bedrock is decomposed granite; at the upper side of the pit this bedrock is 140 feet above Lake Creek; at the lower side of the pit it is 40 feet above the creek. The main pit has an over-all length of about one-quarter mile parallel to Lake Creek and an average width of 100 to 200 yards. The gravel is from 10 to 20 feet thick, is uncemented, and contains comparatively few boulders. The ground is held by R. M. Carrey of Grangeville, Idaho.

Three Mile. - At the mouth of Three Mile Creek, about 1-1/4 miles downstream from the Lake Creek placers, is an old hydraulic pit about 600 feet long, 300 feet wide, and 10 feet deep. The pit is close to the edge of the Lake Creek meadows; the creek itself is only about 20 feet lower than bedrock in the pit. Apparently, it had been necessary to elevate many of the tailings with an hydraulic elevator. The bedrock of decomposed granite slopes toward the confluence of Lake Creek and Three Mile Creek at a slope of about 2 or 3 feet to the hundred. The gravel is uncemented and generally free from boulders. This ground is also held by R. M. Carrey of Grangeville, Idaho.

Golden Rule. - A large deposit of bench gravel on the north side of Secesh River at the mouth of Grouse Creek was worked by hydraulic methods on a large scale during the early days and on a smaller scale up to the present time.

The old pit, which is from 50 to 200 feet above the Secesh River, extends along the hillside for about half a mile with an average width of about one-quarter mile. The gravel is from 10 to 20 feet deep. A rough estimate indicates that between one and two million yards of gravel have been moved, and it is probable that the best part of the deposit has been worked out. However, there is a large volume of gravel still in place, at least part of which carries commercial values. The owner, L. C. Winkler, of Council, Idaho, has been conducting small-scale operations in the northwestern corner of the pit for a number of years. The operations of L. E. Winkler at the Golden Rule placer in 1932 were described by Gardner and Johnson[26/] as follows:

26/ Gardner, E. D., and Johnson, C. H., Placer Mining in the Western United States. Part II: Inf. Circ. 6787, Bureau of Mines, 1934, p. 54.

The Golden Rule mine near Warren was operated by L. E. Winkler and two partners during 1932. Water for piping under a 200-foot head was conveyed to the pit through a 1,400-foot pipe line 13 to 9 inches in diameter. One giant with a 4-inch or a 3-1/2-inch nozzle was used for cutting and driving. A pit 200 feet long and 60 to 100 feet wide was washed during the season. The head of the sluice was at the lower end of the pit. The gravel and water were directed into the boxes by means of a fence built of posts and plank placed across the head of the pit washed the previous year. At the finish of the run the gravel from the upper end of the pit had to be swept 200 feet to the sluice. Although water was still available for piping, the maximum distance which the gravel could economically be driven had been reached. All the bywash water needed was taken from the creek. This water cascaded down over the upper face of the cut.

The boxes were 30 inches wide and were set on a grade of 9 inches in 12 feet. A grade of 6 inches to the box was used formerly, but better results were obtained with the steeper grade. Riffles in the first five boxes consisted of 2- by 6-inch timber 12 feet long, placed lengthwise in the boxes, seven to a box. Pole riffles in 12-foot sections were used in the lower end of the sluice. A set of pole riffles lasted about 10 days. Most of the boulders too large to be piped were broken by blasting and then run through the sluice. Stumps also were blasted. A total of 250 pounds of explosives was used during the 1932 season.

Most of the gold was caught in the first two boxes. Quicksilver was used in the sluice. After the bedrock was piped off at the end of the run, a string of 12-inch boxes was set in the pit and the bedrock cleaned.

A total of 63 days of one 12-hour shift each was worked by three men. This included setting the boxes for the run and cleaning up. An average of 110 cubic yards was washed daily.

The labor cost, allowing $3.50 per shift, was 9-1/2 cents per cubic yard. The explosives cost $125, or nearly 2 cents per cubic yard. Other supplies cost about 1 cent per cubic yard, making a total operating cost of 12-1/2 cents. No overhead or incidental costs were incurred. The pipe line was built some years ago of salvaged material, and an old ditch was utilized. The operating cost in this instance can be considered as the total cost, except for depreciation of the value of the mine.

It is apparent that lower costs were obtained in other years. For instance, it is reported that in 1936 three men working 48 shifts moved about 10,000 yards of gravel between April 20 and June 16. This would indicate that about 208 yards were moved per day, or about 69 to 70 yards per man shift. At $4 per shift, the labor cost would have been approximately 6 cents per yard.

Production records of the large-scale operations are not available, but it is known that from 1921 to 1930, inclusive, small-scale operations produced 1,595 fine ounces of gold and 269 fine ounces of silver. The exact yardage moved during this time is not known, but a rough estimate indicates that the gravel probably averaged about 12 cents a yard. The gold, as mined, is approximately 850 fine.

Ruby. - Near Secesh River, opposite the mouth of Lake Creek, is an area of over 500 acres of gold-bearing gravel, at least part of which is suitable for hydraulic mining. The exact origin of these gravels is somewhat obscure; they differ in many respects from the typical bench gravels of the district and possibly may be related to the "older gravels", described by Reed,27/ in the nearby Warren district. The deposit is on a low ridge between Ruby Creek and Secesh River. Bedrock is decomposed granite; at the lower workings it is about 60 feet higher than Secesh River and about 200 feet lower than the top of the ridge. A number of small pits have been worked at different places around the edges of the deposit (see fig. 10). The gravel is 6 to 12 feet deep in these pits but becomes much deeper toward the ridge; the deep ground has not been worked. In general, the gravel is tight but not cemented; it contains a large percentage of boulders from 1 to 2 feet in diameter. Although the highest values are on bedrock, there is in some places a "false" bedrock several feet higher, which also carries good values; much of the earlier work failed to reach the granite bedrock.

According to the owner, the ground worked during the early days averaged 50 to 75 cents a yard. Some recent work is said to have yielded $400 from a pit 36 feet long by 30 feet wide by 9 feet deep; the gold is said to be about 850 fine.

Plans have been made to bring water for large-scale hydraulic operations from a reservoir at the head of Ruby Creek. This will involve the construction of 2-1/2 miles of ditch and pipe line but, it is claimed, will make available a supply of 1,500 to 2,000 miner's inches of water under a 100-foot head during the season of high water.

The ground is owned by Dr. Don S. Numbers of McCall, Idaho. Recent work has been conducted by the Davis Mining Co., 304 Railway Exchange Building, Seattle, Wash.

27/ Reed, J. C., Geology and Ore Deposits of the Warren Mining District, Idaho County, Idaho: Pamphlet 45, Idaho Bureau of Mines and Geology, 1937.

Secesh. - Just below the Golden Rule placer, but on the opposite side of Secesh River, a wide, low bench extends for about 2 miles along the river; two large pits have been mined near the upper end of this deposit but have been abandoned for many years. These workings, which are irregular in shape, cover an area of approximately 40 acres. The gravel is from 10 to 15 or 20 feet deep, is uncemented, and generally free from large boulders. Bedrock, where exposed, consists of lignite and partly consolidated clay; at the face of the pit it is 65 feet higher than the river and slopes gradually to the river, a distance of one-quarter mile. Apparently, an hydraulic elevator was used to dispose of part of the tailings.

No record of past production is available, but it is generally believed that the gravels were low grade. The ground is held by Fred and Alfred Clark of New Meadows, Idaho.

Idaho Klondike. - The Idaho Klondike Mining Co., Mark Evans, manager, in 1937 was developing a buried channel on a high bench on the southwest side of California Creek, 13 miles by road from Burgdorf.

The deposit lies at an elevation of 7,000 feet above sea level on a bench 436 feet above California Creek. Apparently, this is an old stream channel that has been covered deeply with glacial or landslide material. That part of the deposit that lies close to the edge of the bench was mined by hydraulic methods a number of years ago; it is said to have yielded $60,000 from about 300 feet of channel. Farther back from the edge of the bench the covering has become too thick and the boulders too large to permit hydraulic mining; consequently, the present company has begun drift-mining operations. A couple of drifts have been lost by caving induced by the heavy flow of water in the spring; it is now thought, however, that this difficulty has been overcome.

The size of the pay channel has not been determined definitely; it appears to be at least 50 feet wide, 7 feet deep, and of undetermined length. Its course bears away from the channel of California Creek toward a low ridge composed of material similar to that covering the pay channel at the tunnel site. The gravel in the pay channel is uncemented and generally free from boulders. The gold is about 800 fine, is fairly coarse, and exceptionally heavy in the sense of being well rounded. The gravel so far worked has been high-grade; it is said to run as high as $10 to $20 to the yard.

Warren District

The district for which Warren is the natural supply point adjoins the Burgdorf district on the east; it is separated therefrom only by the height of land between the drainage basins of Secesh River and Warren Creek. The most productive part of the Warren district is included in a belt about 5 miles wide extending about 17 miles south from the Salmon River.

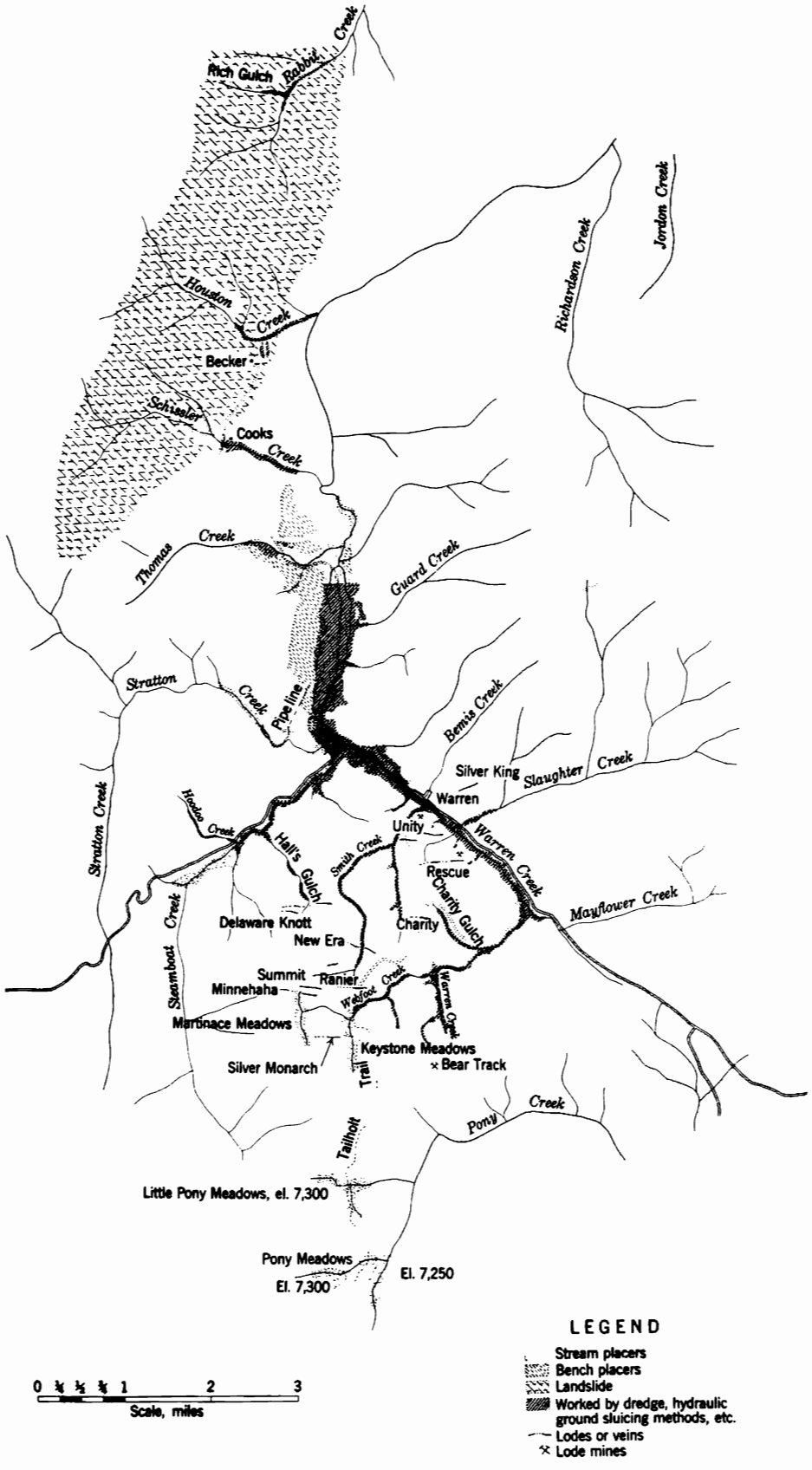


Figure 11.—Gravel deposits of the Warren district, Idaho County, Idaho (after Reed).

Since the first discoveries, the Warren district has been one of the three most productive districts of Idaho County; in recent years it has forged ahead of the other districts, and since 1932 it has produced about three-quarters of the total gold of the county. Nearly all of this recent production has been by dredges on Warren and Steamboat Creeks. These dredging operations may be expected to continue, on a gradually diminishing scale, for several more years, but when the ground now being worked or developed is exhausted, only scattered deposits suitable for very small-scale operations will remain in the immediate vicinity of Warren. It is possible, however, that further discoveries of ground suitable for hydraulicking or drift mining may be made in the vicinity of War Eagle Mountain.

The town of Warren is 47 miles by forest highway from McCall at an altitude of slightly less than 6,000 feet. The road to McCall is closed to wheeled motor transport from about December to May, but winter communication is maintained by tractor-drawn sled and by airplane. Warren Creek and Steamboat Creek lie in steep-walled valleys; consequently, the upper parts of the smaller tributary streams may be reached only over steep and usually rough roads or trails.

Practically all the placer deposits of the Warren district (fig. 11) are associated with two areas of lode gold deposits. The first and most important lode mining area lies along both sides of Warren Creek from the town of Warren southeast to the divide between Warren Creek and the South Fork of the Salmon River; the other area is in the vicinity of War Eagle Mountain. Both these areas are traversed by numerous small and frequently high-grade gold veins, several of which have been intermittently productive for many years. The geology of lodes and placers in the immediate vicinity of Warren has been mapped recently and described in detail by Reed.[28]

Placer Deposits of the Warren District

The greater part of the Warren area slopes north into the drainage basin of Warren Creek. Part of it, however, slopes southeast into the South Fork of the Salmon River where the creek gradients are usually too steep to permit the formation of placers.

Stream gravels are found in practically every water course of the area that slopes into Warren Creek basin. The gradients of Warren Creek and its tributaries range from 40 or 50 feet in a mile at Warren Meadows to as high as 350 to 400 feet in a mile on some of the steepest tributaries. Warren Meadows contain the largest stream gravel deposits of the Warren-Burgdorf region. Along the steepest tributaries, where there is not a sufficient volume of water to wash the gold farther downstream, the placers are more in the nature of residual deposits, the gold values having been deposited near their source in the steepest gulches.

28/ Reed, J. C., Geology and Ore Deposits of the Warren Mining District, Idaho County, Idaho: Pamphlet 45, Idaho Bureau of Mines and Geology, Moscow, Idaho.

The extent to which the stream deposits of the upper Warren Creek basin have been worked is an important clue to their richness. The only deposits that have not been worked are some of the small ones at the sources of steep tributaries, and a number of flat grassy meadows near the summit between Warren Creek and the South Fork of the Salmon River.

Keystone and Martinace Meadows. - The Keystone and Martinace Meadows are at the source of Webfoot Creek, a tributary of Warren Creek. Some testing was done in about the center of the Keystone Meadows in October 1937 with not very encouraging results. Gold is present, but the deposit was found to consist mostly of topsoil with only a few inches to a foot or so of gold-bearing gravel on bedrock. At the lower end of the meadows, however, the gold-bearing gravel is thicker; Harold Adams, of Warren, worked a few hundred yards in the Spring of 1937 and reports values from 50 to 60 cents a yard. Very little is known of the Martinace Meadows, but they appear to be similar in character to the Keystone Meadows.

Pony Meadows. - Pony Meadows and Little Pony Meadows are on Pony Creek, which flows southwest into the South Fork of the Salmon River. C. H. Pickell of Warren put down a test pit on Pony Meadows but could not reach bedrock on account of water. He states that the gravel was pretty lean, but he got a few small colors at a depth of about 8 feet. Below these meadows, Pony Creek was worked extensively by hand methods in the early days.

Gulch deposits. - Some of the residual deposits in the steep gulches and tributaries of Warren Creek are very rich. Values of $1 a yard are not uncommon. They were worked to some extent in the early days but have been given very little attention in recent years, chiefly because of lack of an adequate water supply.

Upper Warren Creek and tributaries. - Halls Gulch, Smith Creek, Charity Gulch, upper Warren Creek, and Webfoot Creek have all been worked by the old timers by hand and hydraulic methods. Part of Warren Creek just above the town of Warren was worked many years ago by hand methods and recently was reworked by dredging.

Warren Creek and Steamboat Creek. - Steamboat Creek and most of Warren Creek below the town of Warren have been dredged in recent years. The Fisher and Baumhoff dredging operations on Warren Meadows are discussed in another chapter.

Bench gravels occur on each side of Warren Creek from the town of Warren to about a half mile below Thomas Creek. Many of these have been worked by hydraulic methods. The largest, however, has been left intact. It extends along the west side of Warren Creek valley from Stratton Creek on the south to Thomas Creek on the north. It has an

average width of about 1,000 feet and a depth of 30 to 45 feet. The bedrock is at about the same elevation as that of the stream deposits to the east. From 15 to 20 feet of the deposit consists of topsoil, the rest being gold-bearing sand and gravel. The ground is held under lease by Fisher and Baumhoff of Warren and is to be dredged sometime in the near future.

Placer Deposits in the Vicinity of War Eagle Mountain

The War Eagle Mountain area already has been mentioned in connection with the placers of the Burgdorf district, although streams on the west slope of War Eagle Mountain drain into California Creek and the Secesh River. Streams on the eastern slope drain into Warren Creek and the Salmon River. The stream gravels along Rabbit Creek, Houston Creek, and Schissler Creek, and, to a lesser extent, Thomas Creek and Stratton Creek have their origin in this part of the area. The deposits in many instances are redepositions and reconcentration of high-channel gravels, but the gold in the high-channel gravels must have been derived from the same general source as those in the more recent gravels.

Beginning at the summit between Thomas Creek and Schissler Creek and extending north to Rabbit Creek is a large area covered by a deposit of unsorted rock, gravel, and clay. The deposit ranges in depth from 50 or 60 feet at the creek channels to as much as 150 or 200 feet on the ridges between the creeks. The material that makes up the deposit ranges in size from small gravel to rocks 10 feet and more in diameter. Some of the smaller material is well rounded, but most of the larger pieces are angular.

The origin of the deposit is open to some controversy. According to Reed,[29] it is an accumulation of land slides from the large fault scarp that forms the eastern wall of the high rugged mountains to the west. It is very doubtful if the bulk of the deposit has any appreciable values. The rich gravels in Rabbit Creek and Houston Creek and the deposits in the Becker hydraulic pits on the hillside about 2,000 feet south of Houston Creek are thought to be high-level gravels that have been buried by the land slides. It is probable that other high-level gravels similar to those above mentioned and to that of the Idaho Klondike mine in California gulch are concealed by these landslides. With the possible exception of geophysical prospecting, there is at present no practical method of locating such deposits except where the creeks have cut through the landslide material and into the bedrock. If, however, geophysical methods could be applied successfully, this might be a fertile field for further prospecting.

29/ Work cited.

Rabbit Creek and Rich Gulch. - Rabbit Creek is about 2 miles north of Houston Creek and flows north into the Salmon River. Rich Gulch is a tributary from the north. The altitude at the junction of the streams is about 6,600 feet. The gradient of each is from 400 to 450 feet in a mile and the flow of each is from 1-1/2 to 2 second-feet during the dry season. The steep gradients and the large volume of water that must flow through the creek channels during the Spring run-off are rather unfavorable conditions for the formation of stream placers. This seems to be further evidence that the rich gravels of this vicinity are ancient high-level gravels or, at least, very recent redepositions of high-channel gravels in the present stream beds.

Rabbit Creek was hydraulicked for a distance of 1,500 to 2,000 feet each way from Rich Gulch. There are several hundred feet of iron pipe on the ground, and the ditch on the north side of the gulch is in fairly good condition. The width worked was from 30 to 50 feet, but it is possible that there is a considerable amount of unworked material that is buried by the heavy overburden of slide rock. The gold-bearing gravel is well rounded and ranges in size from a few inches up to 1 foot or more. The percentage of rocks larger than 1 foot is not very great except in the overburden. Rich Gulch was worked for a distance of about 1,500 feet above its junction with Rabbit Creek. Conditions here are very much the same as in Rabbit Creek, except that it is narrower.

Jack Wright, of Burgdorf, who owns the ground on both Rabbit Creek and Rich Gulch, states that one man working with a 2-1/2-inch hose and handling the boulders by hand can make from $2 to $3 a day. Conditions are favorable for hydraulic operations. High heads are possible with comparatively short ditches, and the steep creek gradients provide convenient means for disposing of tailings. There is a considerable amount of virgin ground in Rich Gulch and in Rabbit Creek about half a mile below Rich Gulch.

Houston Creek. - Houston Creek flows into Warren Creek from the west about 6-1/2 miles below the town of Warren. Its gradient is from 350 to 400 feet in a mile at the upper end but less at the lower end. The flow is from 1-1/2 to 2 second-feet in the dry season; in the early Spring it is from 10 to 15 second-feet. The altitude at the upper end, about a mile above its junction with Warren Creek, is around 6,100 feet. John Becker of Warren owns three claims on the creek and five on the hillside just south of the creek.

The gravels along the creek are very similar to those on Rabbit Creek. Mr. Becker worked about 2,500 feet of the upper end from about 1930 to 1934, by hydraulic methods and ground sluicing. About a half mile of the lower end remains unworked. In 1935 mining along the creek was discontinued and operations were begun on the hillside just south of Houston Creek.

Water is taken from Houston Creek through a 2-mile ditch and about 2,000 feet of 10- and 12-inch pipe. This provides a head of about 20 feet at the upper end of the pits and 200 feet at the lower ends. The water is impounded in a reservoir during the night and used during the day for piping. In the Spring of the year this provides a volume of about 2,000 miner's inches for 5 to 6 hours a day. In the late summer, there is enough water for only two to three days of piping a week. Mr. Becker works alone except when moving the pipe line. A considerable portion of the time is spent in blasting boulders.

The sluice boxes, 44 inches wide by 3 feet high, are placed at a grade of 8 to 10 inches in 12 feet. Block riffles 9 by 9 inches are placed at right angles to the boxes, and 12-inch poles are placed on top of the riffles parallel with the boxes. An undercurrent box with holes in the bottom, filled with mercury, is used for recovering the fine gold. About 50 percent of the total gold recovery is made in the undercurrent box.

The west pit was excavated in 1936 and 1937. Approximately 35,000 yards of material was excavated. In 1936 the top material was piped off and wasted, leaving from 6 to 8 feet of coarse unsorted material on bedrock. In 1937 this bedrock material was piped and sluiced, producing 52 fine ounces of gold. This indicates a value of about 5 cents a yard for all the material that was piped and from 25 to 35 cents a yard for the material that was sluiced.

Schissler Creek. - Schissler Creek flows from the northwest and enters Warren Creek about 2 miles above Houston Creek. The Creek gradient is from 200 to 300 feet in a mile and the flow from 6 to 8 second-feet in the dry season. The stream gravels extend from about 1,500 feet above its confluence with Warren Creek for about 1-1/2 miles upstream. They were worked from the lower end for about 1 mile upstream, leaving about half a mile of the upper end unworked. The worked-out portion ranges in width from about 200 feet at the lower end to nearly 500 feet at the upper end. Just above the upper end of the workings, the valley opens up into a basin about half a mile long and from 500 to 1,500 feet wide.

Conditions are favorable for hydraulicking. The bedrock slopes about 300 feet in a mile, or about 6 feet in a hundred. At the hydraulic pits at the lower end of the basin the gravel is from 10 to 30 feet deep, with an average of about 25 feet. There is very little clay and little, if any, cemented material. The most unfavorable feature is the large percentage of boulders from 1 foot to 3 feet in diameter.

The last operation on this creek was conducted by Fred Meyers, of Warren. One monitor, equipped with a 3-inch nozzle, was operated for about 45 days. A gin pole was used for hoisting and piling large

boulders. From 8 to 10 men were employed most of the time. About 4,000 yards of material was sluiced. The mint returns from this were $1,700, indicating a value of about 45 cents a yard. The value of the whole deposit, however, is probably less than this. The property is owned by Edna and Jim Hardesty of Warren.

Thomas Creek. - Thomas Creek is just south of the landslide area. The gradient is from 75 to 100 feet in a mile and the flow from 3 to 4 second-feet during August and September. Stream gravels extend from where Thomas Creek enters Warren Creek valley for about three-quarters mile upstream; they range in width from about 1,000 feet at the lower end to about 150 feet at the upper end. Bench deposits occur on each side of the stream from Warren Creek valley to within a short distance of its source.

The bench gravels at the upper part of the creek have been worked to a limited extent. They are comparatively shallow, ranging in depth from 8 to 15 feet. According to Chas. Curtis of Warren, some of the richest placers yielded values up to 75 cents a yard.

Very little is known about the stream gravels on Thomas Creek. The depth of the gravel is from 20 to 25 feet, but no information is available as to its value. The ground is held by location by Arthur Hollenbeck of Pollock, Idaho.

Stratton Creek. - Stratton Creek flows into Warren Creek from the west about one-quarter mile below Steamboat Creek. The lower half mile of the stream is in a narrow canyon. Gravels extend upstream about a mile from the upper end of this canyon; they range in width from 75 to 250 feet. About 1,100 feet of the lower end was worked by hand methods and ground sluicing. Aside from this, nothing is known about them.

Operations of the Warren District

Fisher and Baumhoff. - The property of Fisher and Baumhoff in the Warren district includes all of Warren Creek from the town of Warren to Thomas Creek and most of the bench gravel deposits on the west side of Warren Creek valley opposite Warren Meadows. Warren Creek above the town of Warren, Steamboat Creek, lower Stratton Creek, and lower Thomas Creek are held under lease. Upper Warren Creek and Steamboat Creek have been dredged already.

In September 1937 two dredges were in operation, one at the lower end of Stratton Creek and the other on Warren Meadows about a quarter of a mile above Thomas Creek. The dredge on lower Stratton Creek was built by the Warren Creek Dredging Co. in 1933. It was purchased by Fisher and Baumhoff and put into operation in February 1936. The dredge on Warren Meadows was built in 1931. It was operated by steam power until September 1936, when it was changed over to electric power.

Upper Warren Creek was dredged by a dredge smaller than the two operating at present. It was dismantled in the summer of 1936 and moved to Boise Basin, where it is now operating.

In September 1937 the two dredges were operating under conditions that were nearly identical except for the width dredged. The width on Stratton Creek was from 300 to 500 feet and on Warren Creek from 1,500 to 2,000 feet. The depth of the gravel ranges from 18 to 22 feet, with most of the gold concentrated in the lower 5 to 6 feet. Some of the ground on Stratton Creek was worked by hand methods by the old timers, but Warren Creek, where the dredge was operating in 1937, was virgin. Most of the material ranges in size from coarse sand to boulders 6 to 8 inches in diameter. There are very few boulders 12 inches in diameter or larger.

Very little clearing is necessary on Warren Meadows. The bench gravel deposits on the west side of the valley, however, are covered with from 15 to 20 feet of topsoil, on which there is a heavy growth of lodge-pole pine ranging in size from small saplings to trees 10 inches in diameter. This is cleared off with a 60-horsepower Caterpillar tractor and pushed into windrows for burning. After the timber is cleared off, the topsoil is removed by hydraulicking. Water for this purpose is taken from Stratton Creek (fig. 11) through about 1,500 feet of ditch, 300 feet of tunnel, and about a mile of 18- to 11-inch pipe. The head is about 325 feet.

In September 1937 about 20 acres was cleared of timber and topsoil and made ready for dredging. Up to this time the dredges had been operated entirely in the creek gravels. All of the ground was tested by Keystone drills. The testing indicated a rather wide range of values. Dredge recoveries are about three times the values indicated by drilling. The value of the ground in the Warren Meadows and on Stratton Creek where the dredges are working is about 18 cents a cubic yard. Dredge recoveries from month to month may run from 1 to 10 cents above or below this, but the yearly average is very close to 18 cents per cubic yard. The value of the bench gravel deposits, as determined by drilling, is about the same as that of the creek gravels.

The two dredges are constructed of timber and have the same capacity. The bucket lines consist of 75 4-foot buckets and are operated at a speed of 26 buckets per minute. The actual dredging capacity, including shut-downs, is about 4,000 cubic yards a day. The trommels are 5 feet in diameter by 30 feet long and perforated with 3-inch holes. The tailings stackers are 90 feet long. A steel spud is used for dredging and a timber one for making the step ahead. Current practice is to take a 5-foot cut with about a 100-foot swing. In shallow ground a 6- or 7-foot cut can be taken. A 125-foot swing is the longest practicable.

The Stratton Creek dredge is equipped with riffles and tail sluices. There are six sets of 30- by 1-1/4-inch riffles and two tail sluices with sand traps on each side. Mercury is added to the head of the riffles at the rate of about 300 pounds a month. The connected power of this dredge is as follows:

One 10-inch pump	200
Bucket line	100
Wench	30
Stacker	15
Trommel	20
Total	365

Synchronous motors are used on the pumps for correcting the power factor.

The undersize from the trommel on the Warren Creek dredge runs over twelve 42- by 42-inch Pan-American jigs. The overflow from these jigs goes through two 16-inch by 42-foot sluices, and the concentrates over two 18- by 18-inch Pan-American jigs. The overflow from the 18- by 18-inch jigs goes to the riffles and the concentrates go to a 1-1/2- by 4-foot, continuous, Titan-type amalgamating barrel. The amalgamating barrel is operated in closed circuit with one 12- by 12-inch Pan-American jig. The overflow from the riffles goes over a sand trap and then into the dredge pond. The sand from the sand traps is elevated to the tailings stacker by a bucket elevator. Figure 12 is the flow sheet of the Warren Creek dredge.

The connected power is about the same as for the Stratton Creek dredge, except for about 20 horsepower extra that is used for operating the jigs.

The payroll for each dredge is as follows:

1 dredgemaster	Salary
3 winchmen	$6.00
3 oilers	5.00
1 mechanic	6.00
1 shoreman	5.00

Besides this, there is a general mechanic in the machine shop in Warren, an electrician, a truckdriver, a caterpillar operator, and a bookkeeper in the office in Warren for both dredges.

Normal operating time for both dredges averages about 90 percent. In the Spring of the year shut-downs are more frequent on account of power-line trouble.

Extra equipment consists of two caterpillar tractors and complete road-building equipment and a fully equipped machine shop in Warren.

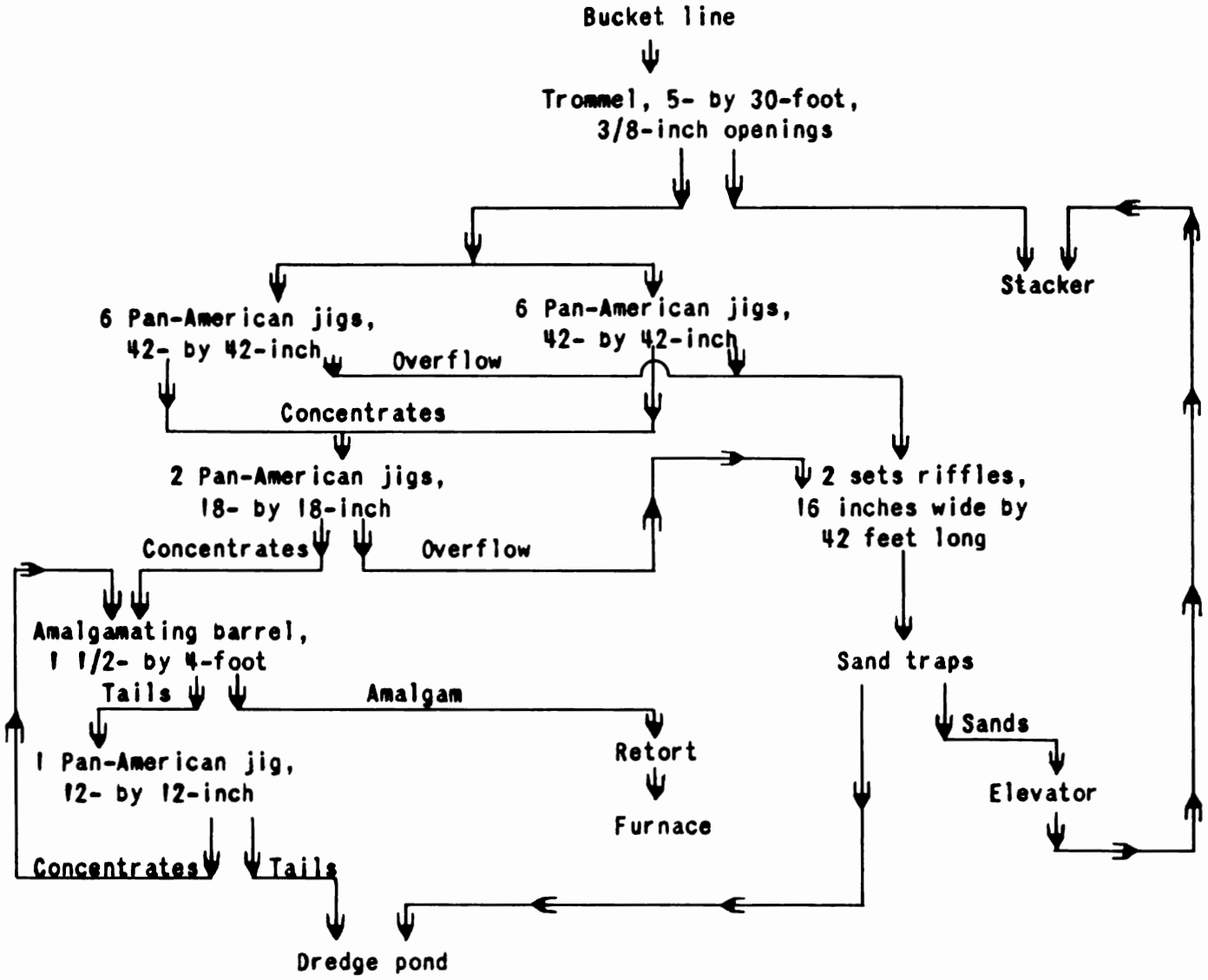


Figure 12.- Flow sheet of the Warren Creek dredge, Fisher & Baumhoff Co., Warren, Idaho.

Local operating costs are about as follows:

	Cents per cubic yard
Labor	1.37
Supplies	.55
Replacements and repairs	1.12
Power	.75
Transportation	.12
Compensation insurance	.04
Unemployment insurance	.02
General overhead including salaries and taxes	.50
Total	4.47

The above does not include depreciation and depletion. These two items will run from 2 to 2-1/2 cents a yard, making the total cost from 6-1/2 to 7 cents a yard.

Salmon River

General Situation

Productive gold-mining districts may be found at intervals along the entire course of the Salmon River, from its source in southwestern Custer County to its mouth in western Idaho County; many of its tributaries also drain well-mineralized gold-bearing regions. A certain amount of the gold eroded from these mineralized districts inevitably has found its way into the Salmon River and been concentrated where conditions were favorable.

The lower 200 miles of the Salmon are in Idaho County. From the border of Lemhi County to the town of Riggins, a distance of over 100 miles, the river passes through a deep V-shaped canyon, which offers very little opportunity for the accumulation of placer deposits. However, there are numerous small bars on the inner side of bends and at the mouths of the larger tributaries, where gravel deposits have been built up, in many cases to depths of 50 to 75 feet. The tributaries themselves usually are too steep to retain placer gold, but if they have cut through gold-bearing country the deltas at their mouths and the nearby river bars may contain commercially valuable gold deposits. Probably the largest deposits along this part of the Salmon occur at the mouth of its South Fork; bars along the Salmon, the delta at the mouth of the South Fork, and a bar a short distance up the South Fork are close enough together to be worked as one operation. In 1937 the Salmon River Placer Co., of Boise, Idaho, was building a hydroelectric power plant and installing equipment preparatory to working this ground on a large scale by dragline methods. The company owns about 640 acres of ground, parts of which are said to be 81 feet deep to bedrock. An

initial run of over 1,700 yards from the upper layer of one block of ground was said to have yielded approximately 49 cents per yard from an imcomplete clean-up. The gold is said to be about 870 fine. Men and supplies are brought in by airplane.

Other gold-bearing bars along this part of the river have been worked by pioneer miners and settlers for many years; however, the inaccessibility of the canyon above the roadhead at Carey Creek made it impossible to visit or map these deposits in the time available; there are many miles of the canyon which it is extremely difficult to traverse, even on foot, at the present time.

Between Riggins and White Bird the canyon is generally much wider than above Riggins. In places some bottom land is suitable for farming, and many large flat benches occur at various elevations above the river; many deposits have been worked on these benches and on the bars along the river. So far, the bench deposits along this section of the river have accounted for most of the total production.

History and Production of the Lower Salmon River

Very little is known of the early history of placer mining along the lower Salmon River between Riggins and White Bird. It is probable that the first discoveries followed shortly after the discovery of gold in Pierce City in 1860, as the Salmon River Valley from Riggins to White Bird has always been the natural route for gold-seekers traveling from the northern to the southern part of Idaho.

Three mining districts include all of the deposits along the main stream for French Creek to the Snake River. The Riggins district extends from French Creek to Lucile, the Lucile Sampson district from Lucile to Freedom, and the Camp Howard district from Freedom to the Snake River. Statistics on past production of these three districts are not complete and are far from reliable. As in most other placer mining areas, the greatest production was made in the early years following the first discoveries. By 1890 most of the rich and easily available deposits were worked out by hand and hydraulic methods; production declined rapidly. By 1900 the annual production had fallen to a few thousand dollars a year, and during many years of the period from 1900 to 1933 no production was reported. Production jumped from $8,435 in 1933 to $28,060 in 1934. In 1935 $40,740 was produced and in 1936, $42,210. The increase in 1934 and subsequent years can be attributed to a number of moderately large-scale mechanical and hydraulic operations that were begun as experimental testing plants shortly after the price of gold was advanced to $35 an ounce. None of these plants were successful, and in October 1937 only one was in operation.

Climate

The climate along the lower part of the river valley from Riggins to White Bird is mild and equitable and very favorable for all-year

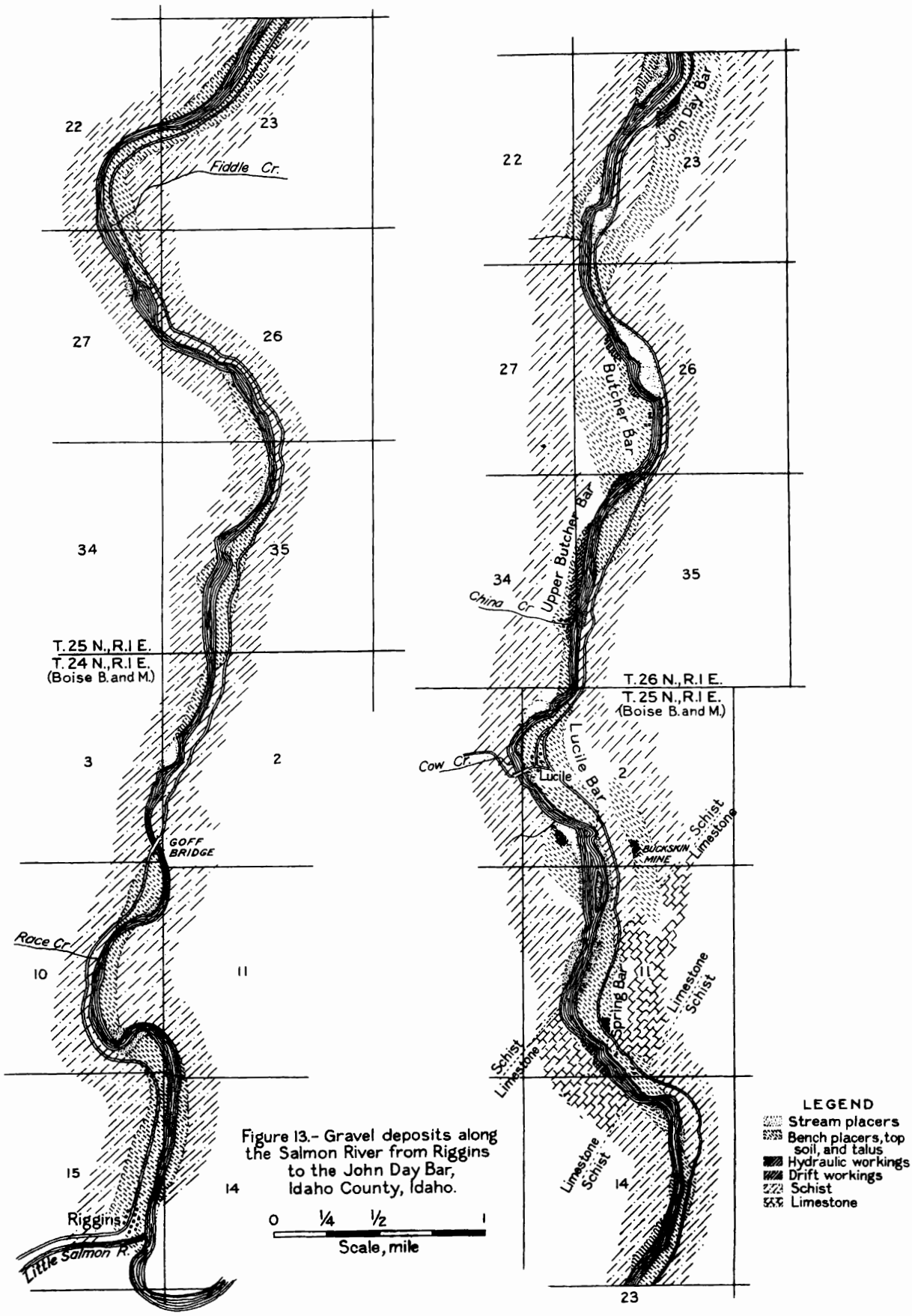
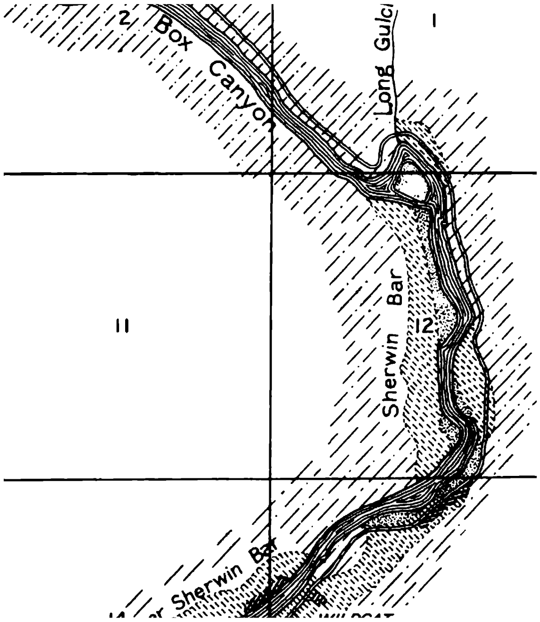


Figure 13.- Gravel deposits along the Salmon River from Riggins to the John Day Bar, Idaho County, Idaho.



2
Box Canyon
1
11
Sherwin Bar
12
Sherwin Bar

operating. Snowfalls are very light and never lie more than a few days, and in most cases only a few hours. Severe frosts are very uncommon, even in the winter. English walnuts are grown at Riggins with very little attention. Farming is practiced to some extent on the mesas between the river channel and the canyon walls and along tributary creeks where they enter the canyon. Agriculture is of little importance, however, because of the difficulty of building irrigation systems to utilize the water from the Salmon River.

Highways, Settlements, and Facilities

Highway No. 95 extends down the canyon from Riggins to White Bird. This is a graveled road that is maintained in good condition at all times. Another highway runs up the canyon from Riggins to French Creek, a distance of about 15 miles. This road is being extended on up the canyon from French Creek and eventually will be connected with route No. 61 at Salmon City in Lemhi County. The nearest railroad points are at Grangeville, 21 miles north of White Bird, and McCall, 39 miles south of Riggins.

Riggins, Lucile, Freedom, and White Bird, with a combined population of approximately 750 in 1930, are the only settlements along the highway. Below White Bird, and on the high mesas between the Salmon and Snake Rivers, is a small rural population. The total population along the river valley from Riggins to the Snake River is probably less than 1,000.

Water Supply

The water supply for early hydraulic mining operations was entirely from tributary creeks. These creeks are still the only practical source of supply for irrigation. Ditches for all-year use from the Salmon River are impracticable because of the great vertical range between high- and low-water mark. This range is from 15 to 20 feet, while the river gradient is around 15 feet in a mile. From this it is apparent that from 2 to 3 miles of a ditch would be under water during the flood period and would have to be rebuilt each year. This difficulty could be overcome by taking the water through tunnels where the river flows along vertical cliffs; but so far there have been no operations of any kind along the river that would justify the expense of building a water tunnel of any kind. In recent years, water for hydraulic operations was pumped by centrifugal pumps powered by Diesel engines or electric motors.

Geology

The rocks of the lower Salmon River (figs. 13, 14, and 15) from about 10 miles above Riggins to Slate Creek consist largely of schists and slates. The laminations of the schist strike roughly N. 30° E. and dip to the southeast at about 45° to 55°. About a mile south of Lucile is a strata of limestone several hundred feet thick. Both

contacts of this limestone with the schist are parallel with the lamination of the schist in dip and strike. Crevices or depressions formed by erosion in the lamination of the schist have acted as natural riffles for catching gold at the bottoms of recent and ancient river channels.

From Slate Creek to the Snake River the country rock is basalt. In places where it forms the bedrock of gravel deposits, it has eroded very unevenly. Drill holes in the stream gravels indicate a difference of 10 to 20 feet in the depth to bedrock in a distance of 40 to 50 feet laterally. This has been the source of some difficulty in mining operations where draglines or power shovels were used.

There are many quartz veins and stringers in the schist formation from Riggins to Freedom. Few, if any, of these veins contain gold, however. Placer gold from Riggins to the Snake River is associated almost entirely with gravel, consisting essentially of well-rounded granite and quartzite material. The contact between the schist and the granite formations is about 10 miles above Riggins. Many of the veins in this granite formation are gold-bearing. Wash consisting of soil and angular fragments from the granite canyon walls, often contains appreciable quantities of placer gold.

Bench gravels. - Very extensive deposits of gold-bearing gravels of commercial grade occur in the old river channels from 15 or 20 feet up to over 200 feet above the present stream level. The Buckskin mine (figs. 13 and 16) is on the bedrock of a channel 210 feet above the stream level, and the bedrock of the Wild Cat hydraulic mines (fig. 14) is 100 feet above the stream level. It is probable, however, that channels occur at much greater elevation than this, as gravel of stream origin was observed at an elevation of nearly 400 feet above the river. Gold is largely concentrated on or near bedrock, although values occur to some extent through the entire mass of gravel. At the Spring Bar, where the bedrock is limestone, the best pay streak is in a small seam of mud and gravel about 6 inches thick and from 12 to 18 inches above the bedrock. In the deposit just across the river from the Spring Bar the pay streak consists of a narrow seam of very fine silt from 4 to 6 inches thick and about 2 feet above bedrock. At the Butcher Bar is a concentration of values in natural riffles formed in the laminations in the schist bedrock. At the north end of this bar appreciable gold was recovered by hydraulicking ground that previously had been drift-mined, indicating values other than those concentrated on bedrock.

The gravel in the old stream channels is often 100 feet or more thick. At the Buckskin mine (fig. 16) apparently it is nearly 200 feet thick. It does not seem probable, however, that the original depth of any of the old channel deposits was this great. Present depths of 100 feet or more may be due to gravel having been eroded from higher channels and redeposited on lower ones.

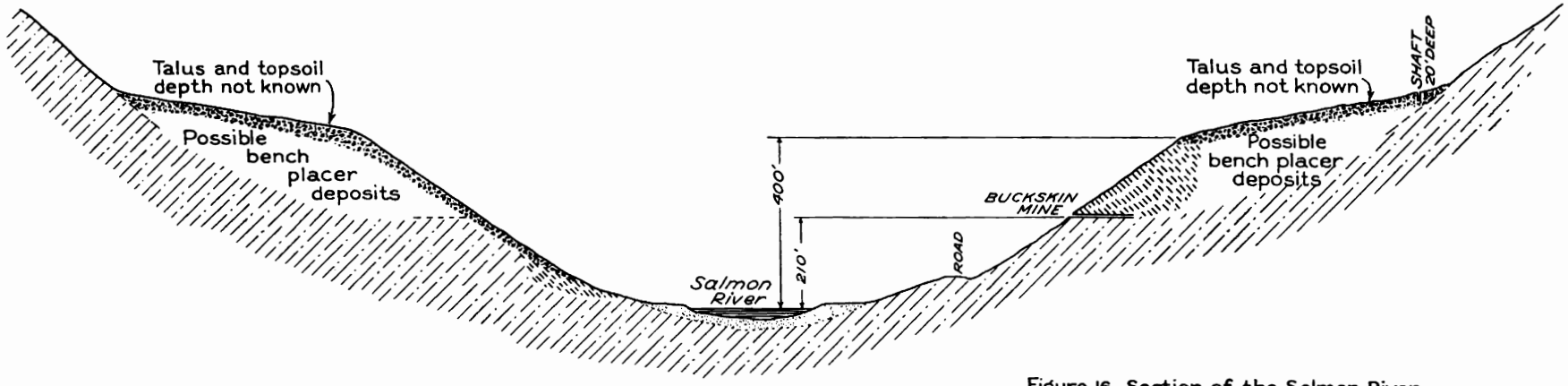


Figure 16.-Section of the Salmon River Valley at the Buckskin mine, looking north (downstream) Idaho County, Idaho.

Boulders from 1 to 3 feet in diameter are very common in most of the deposits down the river to the town of Freedom (fig. 14). In drift mines where there is a very large percentage of such material, indicating a narrow channel and swift water, the gold values apparently are just as good as where more placid conditions for deposition are indicated. The large rocks appear to have acted as riffles for catching the gold. Much of the large material consists of well rounded granite and quartzite boulders; other material consists of angular pieces of schist from the canyon walls. Angular schist material of all sizes occurs mixed with the gravel of stream origin in all of the deposits, and in some places it forms a heavy overburden over the gold-bearing deposits of stream origin.

A very interesting and important geologic feature of the lower Salmon River is the benches that occur on each side of the valley from Riggins to the Snake River. They are very prominent in the vicinity of Lucile and the Butcher Bar and also just below the White Bird bridge. In places where the river flows through narrow box canyons they are entirely lacking. One such place occurs about 2 miles north of the White Bird bridge (fig. 15) where the river flows through a canyon for about a mile. Along this section there are no gravel deposits of any kind on either side of the river.

The lower edge of these benches is from 400 to 425 feet above the stream level (fig. 16). From the edge they slope upward to the schist canyon walls at a grade of 18 to 20 feet in a hundred. This slope is due, in part at least, to the accumulation of topsoil and schist talus from the canyon walls. In most cases the sides of the benches as well as the tops are covered with this capping of topsoil and talus. There is a small exposure of well-rounded gravel near the edge of a mesa just west of the Butcher Bar; and at the Buckskin mine, gravel of stream origin is exposed from the mine workings nearly all the way to the top of the mesa. This gravel consists almost entirely of granite and quartzite, indicating that it was derived from the granite and quartzite formations above Riggins and transported and deposited by the main Salmon River during a period when the stream was at a much higher geological horizon than at present.

A matter of great importance is the probable extent of the gold-bearing gravels concealed by the capping of topsoil and talus that covers the benches. The only places where these gravels have been exploited are at the drift workings of the Buckskin mine (figs. 13 and 16) and at the Wild Cat hydraulic mine (fig. 14). Nearly all of the other workings along the river are at an elevation of 50 feet or less above the stream. The occurrence of river gravel at an elevation of nearly 400 feet above the stream level indicates the possibility of old channels on bedrock much higher than the Buckskin mine. That such channels have not been discovered is not odd. Prospecting at the higher levels has been retarded, first because of the lack of a water supply, and second because of the heavy overburden that covers

nearly all of the deposits at elevations of 100 feet or more above the river. The discovery of the Buckskin mine can be attributed to the comparatively small exposure of river gravels at that point. This exposure extends from the mine workings to nearly the top of the hill, but it is only from 25 to 40 feet wide.

From figure 16 it appears that the gravel deposits might extend from the edge of the benches back to schist mountain sides. Although this is a perfectly logical assumption, it has never been proved. That a number of practical placer miners suspected it is evident from their attempts to find placer deposits far back from the edge of the benches. A 20-foot shaft was sunk on the mesa above the Buckskin mine and a 35-foot shaft on the one just west of the Butcher Bar. Neither of these shafts is deep enough to have gone through the overburden, as they are back near the mountain sides where the overburden is thickest.

Stream gravels. - On the maps (figs. 13, 14, and 15), all deposits on bedrock above the present stream level are shown as bench deposits, and those on bedrock at or below the stream level are shown as stream deposits. The classification is more of an economic than a geologic one. The deposits above the river level are well-adapted to drift mining, as there is no water problem to contend with; they are favorably situated for hydraulic mining because of the head room available for tailings disposal. From the geological point of view, however, the present stream channel is merely the lowest and most recent of the many that were formed through the ages. It differs from all higher channels only in that it is free of overburden and is occupied by a permanent running stream.

Much of the production from these deposits was made by "skim diggers", who operate along the inside curves of the river and shovel and sluice the thin accumulations of fine gravel that are deposited annually during floods. Such accumulations generally are only a few inches thick. In places where conditions are favorable, however, and where the process has been permitted to take place for a number of years, they may be much thicker. Deposits of gravel of commercial grade from 6 to 8 feet thick that occur at many places along the river just above the low-water line were probably formed over a period of many years by the same process that causes thin deposits to form in a few years.

Except in places of local enrichment, such as those just mentioned, few if any successful attempts have been made at working the stream gravels for quite obvious reasons. Gold concentrated on bedrock cannot be reached by hand methods because of seepage water. Suction dredges and dragline systems met with little success at working the stream bottom because of the rapid current. Bucket dredges would probably be impracticable because of the great vertical range between high and low water, in many places more than 20 feet.

From Riggins to Freedom (figs. 13 and 14) the stream gravel deposits, exclusive of the river bed, are quite limited in extent. They consist mostly of small bars along the inside curves of the river. From Freedom on down, the bars are larger, the largest being about two miles long and from 300 to 600 feet wide (fig. 15).

If the gravel in the bed of the river can be considered as a potential economic placer deposit, the stream gravel deposits are very much greater than is apparent from the maps. Assuming an average width of 200 feet for the river, there would be 650 acres of river bottom from Riggins to the White Bird bridge, a distance of 27 miles.

In 1937 the Idaho State Legislature passed a law providing for the exploitation of the placer gold in the beds of navigable streams.30/

In accordance with this act, individuals or corporations can lease the river bottoms of navigable streams in Idaho for mining purposes. The location of placer mining claims below the high-water marks and the filing of leasing rights are carried out in much the same manner as locating and filing on mineral land according to the Federal mining laws of 1872. Royalties are determined by the State Land Commission. The maximum royalty that can be charged is 12-1/2 percent and the minimum 2-1/2 percent of the gross production. Claims not in production can be held two years without royalty or rental payments. After the 2-year period has expired, lessees must have their claims in production or pay a minimum annual rental of 25 cents an acre.

Character of gold. - Because of the great distance from its source, the placer gold of the lower Salmon River occurs mostly in very fine grains. Nuggets worth from $2.50 to $3 are reported to have been found in the vicinity of Lucile. Such occurrences, however, are very rare. Most of the gold is so fine that the placer miners along the river must practice the greatest caution to save it on the riffles. Gold from bench deposits at different elevations differs greatly in size and appearance. At the Buckskin mine it is tarnished and occurs in very thin flakes, some of which are from 1/32 to 1/16 inch in diameter. At other mines in the same vicinity, but at an elevation of only 50 feet above the river, it is bright and occurs in very fine particles, many of which will pass a 100-mesh screen and some a 200-mesh screen.

The grade of the gold from the lower Salmon River is quite high, ranging from 825 to 865 fine. The following table shows the grade (fineness) and location of a number of shipments to the U. S. Assay Office and the U. S. Mint. These figures were furnished by gold buyers of the lower Salmon River.

30/ Campbell, Arthur, and Bresnahan, Leo, Mining Laws of the State of Idaho: Published in July 1937.

Location	Fineness
Fall Creek, 5 miles northwest of Burgdorf.....	556
Florence, 15 miles north of the Salmon River.....	683
Salmon River, 25 miles above French Creek.....	769
Salmon River, near French Creek.....	825
Salmon River, 5 miles below Riggins.....	850
Salmon River, near White Bird.....	865

Individual Deposits

In the following paragraphs a number of the more important individual deposits or bars are described as to location, size, gold values, ownership, and past and present operations. Much of this information was supplied by operators, miners, and ranchers in the vicinity of Riggins, Lucile, and White Bird. Costs and other pertinent operating data were available for only a few operations. Gold values per yard of material are only approximate in most cases, as very few operators take the trouble to make accurate yardage measurements. All of the deposits described are shown on the maps (figs. 13, 14, and 15).

Squaw Bar and Soldier Bar. - From Riggins to Lime Point the deposits are comparatively narrow. The two most important deposits along this section of the river are Squaw Bar and Soldier Bar. Workings on these two deposits consist of drift mines in an ancient river channel about 50 feet above the river level. In October 1937, two or three men were working single handed in the old drift workings.

Spring Bar. - Spring Bar is at Lime Point about a mile south of Lucile on the east side of the river. Bedrock consists of limestone about 50 feet above the low-water mark of the river. The pay streak consists of 3 to 5 feet of clay and gravel on bedrock. According to James McFarnsworth of Lucile, who worked in the old drift workings in the winter of 1936 and 1937, the better parts of the pay streak run from $1 to $3 a yard. The higher-grade material has been almost completely mined out, leaving only enough pillars to support the roof. The greater part of the bar belongs to the Wakely Brothers of Lucile. The southern end belongs to Fred Ballard of Burgdorf.

The Buckskin mine is just north of the Spring Bar. The bedrock consists of schist at an elevation of 210 feet above the river level. The deposit appears to be about 200 feet thick. The pay streak consists of 18 inches of gravel on bedrock. Material was mined that ran as high as $1.50 to $2.50 per wheelbarrow load; the average, however, is much lower-grade than this. Considerable unmined material is exposed in the old drift workings, although most of the better-grade material has been removed. Very few of the deposits at this elevation have been explored for lack of water. Most of the deposit is on property belonging to the Wakely Brothers of Lucile.

Lucile Bar. - The Lucile Bar is on the east side of the river at Lucile. The productive part of this deposit consists of an ancient channel corresponding in elevation to the bedrock at Squaw Bar, Soldier Bar, and Spring Bar. Considerable gold was produced from it by drift-mining methods. Most of old drift mine workings are caved. The property belongs to the Wakely Brothers of Lucile.

Upper and Lower Butcher Bars. - Upper Butcher Bar is about a mile north of Lucile on the west side of the river. The pay streak on the bedrock of the old channel has been completely mined out by drift mining. Butcher Bar is about half a mile farther north on the same side of the river. Some drift and hydraulic mining was done just north of the buildings indicated on the map (fig. 13), but the greater part of the deposit remains intact. One drift that cuts across the channel at about right angles is 240 feet long from the portal to the face. The bedrock at the face slopes up quite sharply, indicating the approximate location of the west side of the old channel. Originally, the channel must have been wider than 240 feet, as part of the east side undoubtedly was cut away by the present stream.

The bedrock is schist. The formation of natural riffles in the laminations of this rock seems to be more pronounced in this deposit than in others that were examined.

In 1928 and 1929 a small part of the south end of the bar was hydraulicked by the Irbs Placer Mining Co. of Casper, Wyo. Water was pumped with an 8-inch centrifugal pump powered by an electric motor. The current used was generated in a hydroelectric plant on John Day Creek. One giant with a 3-inch nozzle was used for undercutting. For sweeping, the 3-inch nozzle was taken off and a 4-inch nozzle was substituted. The pump delivered 3,000 gallons of water per minute when the 3-inch nozzle was used, and a little more when the 4-inch one was used. A 5-ton derrick was used for piling boulders.

The thickness of the deposit at the hydraulic pit ranges from 50 to 75 feet. The bedrock is about 35 feet above the river level and slopes slightly to the north at about the gradient of the river. From 15 to 20 percent of the aggregate deposit consists of large boulders weighing from 500 pounds to two or three tons.

About 30,000 yards of gravel and boulders was handled. Figures on gold recoveries are not available. Some of the rich gravel on bedrock was mined out in former years by drift mining, making the average grade of the material handled by hydraulicking lower than it would have been had the deposit been virgin. It is said that an average value of 32 cents per yard was indicated for the original material after making the proper adjustment for what was taken out by drift mining.

The operation was not successful, mostly, perhaps, because of the cost of handling large boulders.

John Day Bar. - The John Day bar is on the east side of the river at John Day Creek. Most of it belongs to the Tony Gordon Estate of Freedom, Idaho. A small hydraulic pit about 1/4 mile south of John Day Creek and a larger one just north of the Creek are the only evidence of any mining ever having been done on the deposit. The greater part of it is covered by 50 to 60 feet of topsoil. It is being used for agricultural purposes.

The Wild Cat hydraulic pits are on a bench placer deposit just north of the John Day bar. The bedrock consists of schist 100 feet above the bed of the river. The thickness of the gravel is from 15 to 20 feet at the lower or west end of the pit and from 150 to 160 feet at the east end. There are comparatively few boulders over 1 foot in diameter and practically none that would cause serious difficulty for a hydraulic operation. From 6 to 8 feet of the bottom gravel is cemented with iron oxides. This material was left in place except where channels were cut down to bedrock to provide grade for sluiceways. From 750,000 to 850,000 yards of gravel was removed from the larger of the two pits and from 500,000 to 600,000 yards from the smaller.

Upper and Lower Sherwin Bars. - Upper Sherwin bar is on the west side of the river just north of John Day Creek. It is owned by Aylshyer, Sherwin, and Hardy, attorneys at Grangeville, Idaho. A small amount of the north end adjacent to the river was mined by the old timers by hydraulicking. It is said that bedrock material ran from $1.50 to $2.00 a yard, with exceptional samples running as high as $6 a yard. The greater part of the bar is covered by a heavy overburden of topsoil and schist talus from 60 to 80 feet deep. Drift mining probably is the only practical means by which most of the bar can be worked.

Lower Sherwin bar is about half a mile north of upper Sherwin bar. The upper part of it was staked by some prospectors a few years ago but later it was relinquished. The lower part belongs to the Circle C Cattle Co. of New Meadows, Idaho. Conditions here are very much the same as at upper Sherwin bar. There are no available records of mining operations on this deposit.

Deposits in the vicinity of Freedom. - The deposits at Freedom are quite extensive, but little is known of their possibilities for placer mining purposes. Adjacent to the east side of the river is a stream deposit about a mile long and having an average width of 450 to 500 feet. The north end is strewn with large basalt boulders, some of which weigh many tons. In the vicinity of Freedom it is used as agricultural land. The south end is very low and is under water during the flood season.

The Slicker bar is just across the river from Slate Creek. There are some old tunnels on bedrock that show good values, but it is rocky and difficult to work except by drift mining.

Large Bar. - The Large Bar is about a mile north of Freedom on the east side of the river. Hydraulic methods were used quite extensively on this deposit in the early days. Water was taken from Slate Creek through a long flume (parts of which still remain) extending from Freedom to the hydraulic pits at the north end of the bar. More recently, mechanical methods were tried, but with little success.

The bedrock consists of basalt. On the west side of the road, it is about 25 feet above the river. The gravel at the hydraulic pits is from 20 to 30 feet thick and has very little overburden. On the east side of the road it is thicker, but the overburden is also heavier. Very little information is available concerning gold values. The property belongs to the Large family of Freedom.

Horse Shoe Bar. - The Horse Shoe bar is just north of the Large bar on the west side of the river. It occupies the inside of a large horseshoe bend of the river. Most of it belongs to Frank Bedford of White Bird.

Basalt terraces indicate the vertical position of a number of ancient channels that the river occupied through the ages. At least three of these terraces can be recognized from the road on the opposite side of the river. The thickness of the gravel ranges from a minimum of 15 or 20 feet at the outside near the river to perhaps more than a hundred feet near the center. Nearly all of the deposit is covered by overburden of sand and silt ranging in thickness from 10 to 50 feet.

In 1935, 1936, and part of 1937 a washing plant was operated on the northwest part of the bar. The plant was stationary and consisted of a grizzly and sluice boxes. The gravel was loaded into trucks by a 3/4-yard steam shovel and hauled to the plant. Tailings were hauled from the plant by trucks and dumped into the Salmon River. Four trucks were required, two for hauling untreated material to the plant and two for hauling tailings from the plant. Overburden consisting of fine sand and silt was removed by hydraulicking. A 1-inch nozzle was used for undercutting, and a stream of water from a small wooden launder was used for carrying the material away. Water for hydraulicking and washing was supplied by a Diesel-powered centrifugal pump that delivered 900 gallons of water per minute.

A crew of 12 men, consisting of 4 truck drivers, a fireman and a shovel operator, a grizzly man, 2 pipers for removing overburden, a carpenter, a foreman, and a roustabout, were required to operate the plant. About 60 percent of the total yardage handled was overburden and 40 percent was gravel that was run through the washing plant.

According to L. J. Thomson, of White Bird, who acted as foreman, the material that was washed netted around 45 cents a yard, or an equivalent of 18 cents a yard for all material including overburden. Mr. Thomson states that one of the reasons for the failure of the venture was the many shut-downs caused by the failure of old, partly worn out, second-hand machinery.

Roby Bar. - Roby bar is just north of Horse Shoe bar. It is composed mostly of an immense bench deposit, the extent of which is not known very accurately. Most of the eastern part of it is covered with a heavy overburden of topsoil and is being used for agricultural

purposes. Some hydraulicking was done along the edge near the river where the overburden is comparatively thin. Part of this bar consists of a stream deposit extending along the river from the Frank Taylor farm house to the Ralph Russel farm house (fig. 15), nearly 2 miles. The width during low water ranges from 250 to 600 feet. During flood periods it is probably half submerged. It is one of the largest stream deposits on the lower Salmon River. It is stated that it was tested twice for dredging ground, but no further attempts were made to utilize it for placer mining purposes. The depth to bedrock is said to range from 15 to 40 feet and average around 30 feet. The bedrock is very uneven, which accounts for the great range in the depth of the gravel in comparatively short distances. The whole deposit, including bench and stream placers, is on agricultural claims belonging to Ralph Russel and Frank Taylor of White Bird.

Taylor Bar. - The Taylor bar, formerly known as the Gold bar, is just north of the Roby bar. It was homesteaded recently by John Taylor of White Bird but later came to be owned by the Holland Land Bank of Spokane. Very little information is available concerning past mining operations on the property.

The Cooper bar is on the west side of the river about half a mile south of the White Bird bridge. It consists mostly of a moderately large bench deposit. Some ground sluicing and hydraulicking was done near the river edge by the Chinese a great many years ago. At the north end is a small stream deposit about 1,500 feet long by about 350 feet wide.

In October 1937 John Doland of Boise operated a small washing plant on the stream deposit. Gravel was loaded into the hopper of the washer by a 3/8-yard steam shovel. The tailings from the sluice box and the reject from the grizzly were moved by a 30-caterpillar tractor. Water was pumped from the river by two 3-inch centrifugal pumps, one powered by a truck motor that burned distillate and the other by a gasoline engine.

The washing plant consisted of a hopper of about 1-yard capacity, a grizzly for rejecting coarse material, and a sluice box. The grizzly was 4 feet wide by about 6 feet long and was set at an angle of about 45°. It consisted of 1-inch horizontal bars spaced to provide 1/2- to 3/4-inch openings. The sluice box was 4 feet wide by 25 feet long and sat at a slope of about 8°. Riffles consisted of 3/8-inch metal lath on heavy burlap.

Three men - a shovel operator, a tractor operator, and a foreman - were required to operate the plants and make moves. From two to three moves were made each shift, each requiring about 1 hour.

At the time of the visit the plant had been operating for only a few days and very little pertinent data concerning recoveries were available. L. J. Thomson, the foreman, thought that recoveries might run as high as 30 cents per yard. From 150 to 200 yards a shift was run through the washer, but Mr. Thomson thought that this could be increased to 300 or 350 yards a shift after the operation got under way.

Local operating expenses consisted of about $15 a day for labor and $10 a day for gasoline, fuel oil, hauling, and other incidentals.

Ramey Ridge District

Geographically and geologically, the Ramey Ridge district is more closely related to the Edwardsburg district and other mining districts of Valley County than to the gold belt of Idaho County. However, as the mineral deposits are in Idaho County, they will be mentioned in this paper.

The Ramey Ridge mining district lies in the drainage basin of Big Creek, a tributary of the Middle Fork of the Salmon River, just north of the southern boundary of Idaho County. At present the district can be reached most conveniently from the railhead at Cascade, Idaho, by way of Yellow Pine and Big Creek Post Office. Big Creek PostOffice, which is the supply point for the Ramey Ridge district, is in Valley County, 88 miles by road from Cascade; this road crosses several high ridges and is impassable from December to May, inclusive. Big Creek may also be reached by road from Warren, Idaho, a distance of 43 miles; however, there are many long, steep grades on this road and it is closed by snow from November to June, inclusive. Ultimately, the Ramey Ridge district probably will be connected with the new road now under construction up the Salmon River.

Although there is some placer mining along Big Creek in Valley County, the placer gold production of the Ramey Ridge district has been negligible; that part of the district that lies in Idaho County is extremely rugged and generally unsuited to the accumulation of workable placer deposits. Furthermore, the lode mineralization is generally more "base" than in other parts of Idaho County; the oxidized zones are generally shallower, and post mineral erosion has been less than in the more highly productive placer districts of Idaho County. However, there are many rich gold veins in this district and it is probable that small commercial concentrations of placer gold may be found.

When visited in the Fall of 1937, there was no placer mining activity in the district, but some prospecting had been done on a gold-bearing gravel deposit on Beaver Creek near the Golden Hand lode mine.

Beaver Creek. - The country in the vicinity of the Golden Hand mine is traversed by a number of high-grade gold veins, many of which are cut by one or more of the numerous small streams that plunge steeply

into Beaver Creek valley. For about a mile above the confluence of Beaver Creek, Hand Creek, and Cash Creek, the valley of Beaver Creek contains gravel deposits 100 to 300 feet wide; these deposits appear to be suitable for small dredge or dragline operation if proved to contain commercially valuable gold. It is claimed that several holes 30 to 40 feet deep were sunk in this deposit and that gold was found from top to bottom; the actual value per yard was not stated. The ground appeared to be generally free from large boulders. The stream gradient is about 100 feet to the mile; the water flow was at least 4 second-feet.

Alongside the stream gravels is a large deposit of low bench gravel containing many large boulders, apparently wash from the steep mountain sides; nothing is known regarding the gold content of this deposit.

The deposit is reached by road from Big Creek Post Office, 14 miles to the Golden Hand mine, thence about 2 miles by trail down Cash Creek. The elevation at Beaver Creek is approximately 6,000 feet above sea level; the road from Big Creek crosses an 8,000-foot summit. The Golden Hand, Inc., owns four placer claims along this part of Beaver Creek.

Other Districts

Although the preceding descriptions include virtually all of the important placer deposits of Idaho County, there are a number of small deposits in other parts of the county, which may have some present or potential value. For instance, placer gold is known to occur along the Selway River and many of its tributaries. Although the combined production from all these scattered deposits has been negligible, it is probable that some of them are suitable for small-scale operations. The entire county, however, has been thoroughly prospected for placer gold, and it is doubtful if any large or rich deposits have been overlooked, unless they were buried by later accumulations, as were some of the ancient high channels near Warren.

SUMMARY

In reviewing the results of this reconnaissance, several outstanding facts become apparent.

1. Nearly all deposits of proved value, suitable for large-scale dredging operations, are worked out or in the hands of strong operating companies. However, there are a number of large gravel deposits known to contain gold but that have, so far, been considered to be too low grade to be workable under present economic conditions; further testing may reveal commercial concentrations in some of these deposits, or an increase in the purchasing power of gold may render them workable.

2. High-grade deposits suitable for small-scale operation by hand methods are practically exhausted. There are a number of deposits that will yield some gold by hand-mining methods, but the returns usually are so low that they will be worked only for prospectors grub stakes or for subsistence purposes in time of temporary unemployment.

3. The largest volume of unworked stream gravels containing good values in gold consists of deposits that are individually too small or that are otherwise unsuited for large-scale mining by standard bucket dredges, and that are also too low grade or too flat lying to permit mining by hand or hydraulicking. The recent development of small bucket dredges and of dragline plants has brought several of these deposits into production; however, the equipment is still too cumbersome and too expensive to be used on any but the largest deposits of this type, that is, those that are just under the lower limit for the old-style dredge. There are many other small, flat lying deposits that can be worked successfully only with equipment that is cheaper, more compact, and more portable than any yet developed.

4. The largest reserves of placer gold in Idaho County are probably contained in the ancient high gravels that cover large areas in several of the mining districts. Small parts of these deposits have been hydraulicked with good results; further successful exploitation, however, will depend upon more scientific and systematic prospecting and probably upon the introduction of new mining methods.

5. Mining operations in the past have been handicapped severely by poor transportation facilities; in recent years, however, roads have been built and improved to such an extent that transportation no longer is an insurmountable handicap in the principal mining districts.

6. Placer-mining operations are handicapped by the severe winter climate, but from May to November operations may be conducted at costs that compare favorably with those obtained by operators in other parts of the United States.

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