PLACER MINING on LOWHEE CREEK
BARKERVILLE, B.C.

An essay submitted in partial fulfillment of the requirements of the course in Third Year Geological Engineering at the University of British Columbia

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4082 West 8th Avenue,
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November 15, 1947.

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Dear Sir:

It gives me great pleasure to submit the following essay, Placer Mining on Lowhee Creek, Barkerville, B.C., in partial fulfillment of the requirements of the course in the Third Year Geological Engineering at the University of British Columbia.

Yours truly,

(Sgd) W. H. Poole

Abstract

This essay deals with placer mining on Lowhee Creek, Barkerville, B.C., in the Cariboo District. A general survey of the history, geology, and present operations is contained herein.

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PLACER MINING on LOWHEE CREEK

BARKERVILLE, B. C.

Introduction

Lowhee Creek is a stream in central British Columbia, which has become noted as an important contribution to the placer gold production of the Cariboo Mining Division. The creek is fifty miles east of Quesnel and can be reached by stage or motor-car over an improved gravel road. The stream flows north and west, and empties in Jack of Clubs Lake at latitude N 53° 5.82' and longitude W 121°34.35'. Before it was mined by hydraulicking monitors, it was a small creek about two and a half miles long, perhaps three or four feet wide, with a moderate grade from its head at Stouts Gulch to where it dropped into the valley of Jack of Clubs Lake.

Lowhee Creek is and has been important not only as a gold producer but also as a spark which has kept placer mining continuously alive in the Cariboo. It has shown that deep-level drift-mining and hydraulicking of the same ground can both be profitable. It has been estimated that Lowhee Creek has produced about $3,500,000 in gold since its discovery in 1861.

History of Operations

Lowhee Creek was discovered to have gold-bearing gravels in 1861, a few months after the first Cariboo discoveries were made which precipitated the famous Cariboo Gold Rush of 1861-2. Howay reports, "Thus in making from Quesnel River and Keithley Creek to Williams the miners came upon Lightning Creek,...and Lowhee Creek."[1] Richard Willoughby, an Englishman, discovered the creek and was the first man to work on it. He named it in honour of the "Great Lowhee," a secret society in Yale, B.C., in which he was a prominent member. From July 27 to September 8, 1861, a period of 43 days, Willoughby and from four to seven

1. Howay, F.W., "British Columbia from the earliest times to the present," Vancouver, S.J. Clarke Publishing Co., 1914, vol. 2, p.77.

men worked the creek near the mouth with rockers, long-toms, or sluices, and from a strip 400 feet along the creek and 12 feet wide they recovered 3,037 ounces of gold amounting to $50,000. All the gold was found at or within four feet to bedrock which was reported as a "soft blue slate yielding readily to the pick."[1] Bancroft reports, "The gold in the Cariboo was found in the bluish clay which is on and in the slaty bottom sometimes as far as a foot deep; streaks of yellowish clay are also found which are sometimes very rich."[2] Willoughby's last week's work netted $2,032. Two weeks previous he netted $1,000 a week for each working hand on the claim. His largest day's return was 84 ounches of gold or approximately $1,600. Willoughby sold his claim in the same year and returned to Yale in the autumn of 1861 with $12,000 in gold dust.

A Mr. Patterson and a brother were reported to have recovered about $10,000 for five week's work shortly after Willoughby's departure. Their largest day's return was 33 ounces. The gold was rough and ragged, and had a fineness

1 Scholefield, E.O.S. and Gosnell, R.E., "British Columbia---Sixty Years of Progress," Vancouver and Victoria, British Columbia Historical Association, 1913, Part I, p.173.
2 Bancroft, H.H. "History of British Columbia,1792-1887," San Francisco, History Company, 1887, p.512.

of 930[1] (i.e. 930 parts of fine gold in 1000 parts of crude gold by weight). It is said that six-to ten-ounce nuggets were frequently found. A.Mr. Hodge, an American, held a claim on Lowhee Creek for six weeks and subsequently returned to Yale with $2100.

In 1862 the principal placers were on Williams, Lightning, and Lowhee Creeks. The winter population of 1864-5 was 400 to 500 on Williams Creek, 40 to 50 on Lowhee Creek, and an unknown number on Lightning Creek.

The ground was shallow near the mouth of the creek, but gradually deepened upstream making drift-mining necessary. "But a new lesson was to be learned by the gold miners. Hitherto, the surface had been skimmed with the aid of rocker and sluice, and a few insignificant hydraulic enterprises had been undertaken on the benches; but in the Cariboo, the mystery and art of deep-level mining in its true technical sense were to be practically studied and unravelled by means of shafts and drifts, pumps and hoisting machinery."[2] From the British Columbia Minister of Mines Annual Report of 1896 comes the quotation, "The production on Williams.... Lowhee, and other creeks of those early days has become

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1 Howay, F.W., "British Columbia from Earliest Times to the Present", Vancouver, S. J. Clarke Publishing Co., 1914, vol. 2, p.79.
2. Bancroft, H.H., "History of British Columbia, 1792-1887," San Francisco, History Company, 1887, p.476.

historic, since all these deposits have long since been exhausted leaving only such propositions as the deeper diggings that abundant capital, well expended, can alone grapple and make successful."

During the Seventies and Eighties the whole channel to within a few hundred feet of Watson's Gulch, a distance of about 8000 feet, was drift-mined.

In the Nineties, when the remaining ground was too poor to make drift-mining profitable, hydraulic plants were erected at the lower end of Lowhee Creek, and the hydraulicking of the old channel was started. Since then hydraulicking has been continuous to the present time and 10,000 feet of the channel have been mined.

In table 1 inserted below, the operations on Lowhee Creek[1] for the years 1874 to 1895, inclusive, are summarized.

In 1896 it was reported that most of the leases on the creek were under bond from Mr. Pinkerton to an English company represented by Mr. Rathbone. In 1899 the Cariboo Consolidated Limited, an English company formed to operate placer mines, acquired many leases on Lightning, Williams, Antler, French, and Lowhee Creeks. This Company operated the Lowhee placer until it was taken over by John Hopp in 1906.

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[1] Minister of Mines Annual Reports, 1874 to 1895 incl., British Columbia Department of Mines, Victoria, British Columbia.

In 1900 Mr. Melbourne Bailey, mining engineer on Lowhee Creek for the company, reported to the Department of Mines that a new hydraulic plant had been installed. The plant consisted of a double compartment sluice-flume, 732 feet long, and two pipe lines of 11 and 15 inches in diameter operating with 3- and 4- inch nozzles under a head of water of 250 and 180 feet respectively. Each compartment of the flume was 2 feet long and 3 feet deep, and was paved with spruce blocks 9 inches in length and from 10 to 12 inches in diameter. Bailey planned to use both compartments in the spring when the water was plentiful and only one when the water was low. In the first year of operations, 35,000 cubic yards were moved and 350 feet of the channel bedrock was uncovered. The hydraulic plant was enlarged and operations were continued until 1906 when Mr. John Hopp acquired the hydraulic leases on Lowhee as well as on many other creeks.

Under the efficient management of Laurent Muller, the leases were mined successfully until 1929, when they were sold. During those years the five miles of ditch from Stoney Creek was enlarged to carry 1500 miner's inches[1] of water and was extended to Jack of Clubs Creek and thence to Ella

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[1] A miner's inch according to British Columbia statute is a flow of water of 1.68 cubic feet per minute, or 1 cubic foot per second = 3.55 miner's inches.

Lake on a grade of 9 feet to the mile, at an approximate cost of $5200 per mile. In 1910 the Ella Lake dam, costing $56,000, was constructed with a storage head of 41 feet and capable of holding a capacity of approximately 80 acre-feet[1] of water. About 1250 feet of ditch was constructed from upper Lightning creek to the summit of Ella Lake in order to divert more water into the reservoir. A No. 6 Joshua Hendy monitor with 8- and 9-inch nozzles was used in the pit. In 1910 a storage dam measuring 320 feet in length and 20 feet in height was built on Lowhee Creek, about 100 feet below Watson's Gulch and above the pit to provide ground-sluice water, into which the water from 16 miles of the Gold Fields or Groundhog ditch was turned. These improvements and additions permitted the management to move approximately 150,000 cubic yards of gravel per season, an increase of about 200 per cent over the Cariboo Consolidated plant.

In 1922 a new storage dam was built 200 yards below the summit of Lowhee Creek in order that the pit could be advanced beyond the old dam.

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1 The volume of the lake was calculated by the author by traversing the high-water mark with a Brunton Compass and pacing, by assuming the cross section of the lake to be regular, and by assuming a steady grade from the flume to the end of the lake (the lake was a shallow slough before it was dammed).

In 1924 the grade of the upper 1425 feet of the sluice-flume was lowered from a 6-inch (to the 12-foot box) to a 5-inch grade, and the wooden blocks were replaced by high carbon-manganese steel plates, 46 inches square and half an inch thick, made by the Bethlehem Steel Company. It was hoped that by using the plates the following advantages might be enjoyed:

1. Use of lower grade on the boxes.

2. Increase in water duty (water duty is defined as the number of cubic yards of gravel one miner's inch of water can break and move through the sluices in 24 hours).

3. Saving in time and money on upkeep of the sluice-flume.

4. Moving of larger boulders through the sluice-flume.

The steel-lined sluice did not come up to expectations. Within two years the steel plates, which were expected to last 10 to 12 years, were beginning to wear out and tear loose. Shortly after, the steel plates were replaced by the wooden blocks.

The gold was saved in Hopp's steel-lined sluice in 6-inch slots between each plate in the upper 150 feet of flume, in three boxes with wooden block riffles immediately below those plates, and in three boxes with block riffles near the lower end of the flume.

About 500 feet from the lower end of the flume was

a trap or undercurrent consisting of a grizzly in the bottom of the flume, which permitted the fine sand and gravel and part of the water to drop through to a compartment beneath. Water from a 6-inch pipe under a head of 115 feet entered the box below the grizzly causing an upward flow, which floated off the mud and allowed the coarse sand and gold to settle. It was found that this device did not pay for the time of one man to operate it and was subsequently dismantled.

For the period 1906 to 1924 Johnson[1] estimated that about 3,000,000 cubic yards of gravel were moved and between $400,000 and $500,000 in gold was recovered. The value of the gravel was, therefore, about 15 cents per cubic yard.

He estimated the average water duty to have been 1.2 cubic yards and operating expenses about $10,000 a season.

For the period 1901 to 1924 operating information supplied by W. G. McGowan[2] of Barkerville is as follows:

Lowhee Creek 1901-1924.

Gravel Moved	1,741,000 cu. yd.	
Gold Recovery	$318,000	$0.18 per cu.yd.
Cost of Improvements	$104,000	$0.06 " " "
Operating Costs	$176,000	$0.10 " " "
Profit	$38,000	$0.02 " " "

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1 Johnson, W.A. and Uglow, W.L., Placer Vein Gold Deposits of Barkerville, Cariboo District, British Columbia, Geological Survey of Canada, Memoir 149, 1926, p.107.

2 McGowan, W.G., mine manager, Canusa Cariboo Gold Mines Ltd., Barkerville, B.C.

Another set of figures from a report by John Hopp is as follows:

Period	Gravel washed cu. yd.	Yield oz. of crude gold	Production dollars	Value of gravel ¢ per cu. yd.
1900-1906	94,900	1986	34,358	36
1907	31,600	367	6,314	20
1908	66,000	602	10,804	18
1909	60,000	803	13,738	22.9
1910	95,000	713	12,300	12.9
1911	100,000	710	12,222	12.2
Totals 1900-1911	447,500	5181	89,736	20
1907-1911	352,600	3195	55,378	15.7

*Lowhee gold is worth about $17.25 per ounce at the price of $20.67 per ounce of fine gold.

1907-1911	Plant cost	$64,690	
	Operating expenses	44,557	-- 12.6 cents per cu. yd.
	Total expenses	109,247	
	Total recovery	55,378	-- 15.7 cents per cu. yd.
	Deficit	53,869	

Operating profit is 3.1 cents per cubic yard before the equipment is amortized over the life of the property.

Estimate of unworked ground in 1911 is 7,960,000 cu. yds.

About the year 1929 John Hopp's holdings on Lowhee Creek were acquired by the Lowhee Mining company, Limited, an English company, with A. F. Eastman, managing director,, and T. A. Herman, mine superintendent.

In 1936 the Tacoma Land Company gained control of the company and the management was taken over by the following:

President:	C. W. Lea, Tacoma, Wash.
Vice President:	John Hopp*, Seattle, Wash.
Secretary-Treasurer:	Paul Barker, Tacoma, Wash.
Mine Manager:	Henry Lea, Tacoma, Wash.
Superintendent:	Joseph House, Barkerville, B.C.
Capital:	Authorized 750,000 shares at $1.00 par (by B.C. charter in 1929) issued, by Nov. 1936, 585,000 shares.

* Deceased.

Lowhee Creek is still operated by the same company under the management of Henry Lea and Joseph House.

Geology, Physiography, and Character and Origin of Gold

Geology

The whole of the channel of Lowhee Creek lies in rocks of the Barkerville Gold Belt (see Geological Survey of Canada Map No. 2394 enclosed). The Gold Belt rocks lie on the northeastern limb of a broad and relatively simple northwesterly plunging anticline. These rocks form the upper part of the Richfield Formation in the Cariboo Series, which is believed to be Precambrian. They strike northwesterly, and are composed mainly of quartzose sediments metamorphosed to fissile and non-fissile argillites, slates, quartzites, schists, and gradations of these rocks. The Richfield Formation is more than 8000 feet thick. The Gold Belt is about 1 mile wide and extends 10 miles along the strike of the strata from Grouse Creek northwesterly through Prosperine Mountain, Conklin Gulch, Stouts Gulch and Lowhee Creek to Island Mountain.

The rocks of the Gold Belt have been divided by Hanson

into five members, which mainly contain the following:

1. Baker Member, mainly fissile, grey calcareous quartzite.
2. Rainbow Member, partly fissile, interbedded argillite and quartzite.
3. B. C. Member, black argillite
4. Lowhee Member, mainly fissile, grey quartzite.
5. Basal Member, black argillite.

"The Baker Member caps the Gold Belt on the northeast and the Basal Member forms the base on the southwest."[1] The most important member is the Rainbow Member. It is cut by thousands of quartz veins some of which make ore. It is the most productive of the five members.

The Baker Member on Island Mountain contains a few discontinuous beds of limestone, some of which hold valuable ore of the replacement type. In 1947 a large bed of replacement ore in limestone was found in the Island Mountain Mine which assayed from 2 to 3 ounces of gold per ton. The deposit is used to "sweeten" the quartz-vein ore.

The rocks of the Gold Belt are cut by a number of post-mineral faults. The Lowhee fault is a north-striking

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1 Hanson, G., Barkerville Gold Belt, Cariboo District, British Columbia", Geological Survey of Canada, Memoir 181, 1926, p.4.

fault of tension which has offset the strata about 1200 feet. Two other main types are the reverse faults of compression, which occur along the crest of the minor folds, and the strike faults of tension the only one of which is the Willow River fault, which offsets the strata 6000 feet.

In 1933 Hanson divided the vein deposits "into four classes, each division being based on the relationship between the fracture and structure of the country rock:

1. Transverse veins strike northeasterly and dip nearly vertical or to the northwest.

2. Diagonal veins strike 70 degrees and dip approximately vertical or to the southeast.

3. Strike fault veins parallel the strike of and dip across the strata.

4. Bad veins parallel the strike and the dip of the strata."

The strike fault and bed veins form the "A" veins and the transverse and diagonal veins form the "B" veins as described by Uglow. The "A" veins tend to be poorly mineralized and to have no commercial value. The "B" veins are the commercial veins. They are younger than the "A" veins and form shoots of sulphide minerals at the intersections. The "B" veins range from a fraction of an inch up to 5 feet in width and are well mineralized, mainly with pyrite, smaller amounts of galena and arsenopyrite, and some sphalerite, barite,

and scheelite. The pyrite is belived to be thegold carrier. Selected samples of fine grained pyrite taken from a "B" vein on Island Mountain assayed as high as 20 ounces of gold per ton. On the average the "B" veins assay 2 to 3 ounces of gold per ton. Small amounts of tourmaline and pyrrhotite found in these veins suggest that the solutions which deposited the minerals were of intermediate to high temperature, owing their origin very likely to deep-seated, but unexplored, intrusive bodies, evidence of whose existence is given by the occurence of the quartz porphyry and aplite dykes and sills in the area.

Lowhee Creek, downstream from Watsons Gulch, follows and roughly parallels the north-striking Lowhee fault. (See Geological Survey of Canada Map No. 2394, enclosed. The corrections and improvements noted on the map have been made by Dr. S. S. Holland of the British Columbia Department of Mines and other men.) The north-striking faults, such as the Lowhee, produce fractures corresponding to the two "B" vein directions. When mineralized with quartz the fractures form the quartz veins such as are seen outcropping in the exposed channel of Lowhee Creek.

Physiography and Geological History[1]

The sediments laid down during the Carboniferous Period of the Palaeozoic Era on the eroded surface of the deformed Precambrian beds were intruded by the Mount Murray basic sills and dykes during the Mesozoic Era. Following this intrusion the country was faulted and compressed to reform the anticlinal structure that had previously existed. A long period of erosion which removed about 15,000 feet of strata succeeded the deformation and resulted in the peneplanation of the country in the late Cretaceous times. In early Tertiary time the whole country was uplifted to an elevation of about 6200 feet. Remnants of the ancient erosion plane are still evident. The mountains in the district are well-rounded and mantled with overburden and vegetation. Snowshoe Plateau at 6000 feet may be projected to meet the tops of many of these mountains.

Following the uplift in the Tertiary Period the streams cut their way down through the rocks to an elevation of about 4000 feet. (See Map of Lowhee Channel with cross sections, and figures 1 to 7.)

In the Pleistocene Epoch two periods of glaciation by valley glaciers resulted in the scouring of the

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1 Uglow and Johnson, pp. 38-42

valley walls to form hanging streams and U-shaped valleys. The hanging stream valley occupied by Lowhee Creek where it drops into Jack of Clubs Lake may be explained by a wide valley glacier deeply eroding the Jack of Clubs Lake basin. The placer deposits were only partly disturbed and in most cases the valleys were filled with glacial debris to a considerable depth. The average depth of glacial debris is 150 feet on Lowhee Creek.

Character and Origin of Placer Gold.

The gold in Lowhee Creek has an average fineness of 850 parts per thousand and is nuggety, ragged, hackly and crystalline. It is some times found in pebbles of quartz, galena, and pyrite.

It has been suggested and generally accepted as the best explanation that the concentration of the placer gold in the Tertiary channels was the result of a long period of deep erosion accompanied by chemical weathering. The growth of the crystals and the increase in the size of the gold particles is explained by assuming the gold-bearing veins below the surface in the vein zones were enriched by descending gold-bearing solutions.[1]

On Cow and Barkerville Mountains on either side of Lowhee Creek there are outcrops of a large number of

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[1] Uglow and Johnson, Memoir 149, pp. 215-225.

gold-bearing quartz veins from which the Lowhee placer gold probably was derived.

Present Operations.

During the summer of 1947, the Lowhee Mining Company, Limited, head office in Tacoma, Washington, operated the hydraulic plant on Lowhee Creek under the supervision of Henry Lea, mine manager.

The water system consists of twenty-six miles of ditch. The Gold Fields ditch is sixteen miles long, diverts the waters from upper Lightning and Jack of Clubs Creeks, and uses Groundhog Lake as a reservoir. The Lowhee ditch (see figures 8, 9, and 10) is 10 miles long, catches the water of Stoney and lower Jack of Clubs Creeks, and uses Ella Lake as a reservoir (see figures 11 and 12). On the Lowhee Ditch line there is a flume (see figures 13 and 14) 250 yards long carrying the water from the Ella Lake dam to the beginning of the ditch. Each ditch was built or enlarged to carry 2500 miner's inches of water. The ditches are provided with spillways (see figures 15) about every 1000 yards, depending on the creeks being diverted, which can be used to cut down the flow of water in the ditches. A telephone line extends along the ditches to the ditch-tenders' cabins, of which

there are about three along the Lowhee ditch.

The penstock (see figure 16) on the lower end of the Gold Fields ditch provides water for the monitor (see figure 17) at a head of 210 feet through a pipe line about 1000 feet long which starts with a 41-inch pipe, quickly tapers to an 18-inch and finally to a 14-inch pipe to connect with the No. 6 Joshua Hendy monitor operating with 6- and 8-inch nozzles. The water from the Lowhee ditch is used as by-wash. A No. 4 monitor with a 4-inch nozzle is lying idle in the pit. (See figures 18 and 19).

The sluice-flume is about 7500 feet long, 6 feet wide, 4 feet deep, and is paved with wooden blocks for the entire length. No undercurrents or traps are used to catch the very fine gold.

The disposal of tailings presents no difficulty. There is adequate grade from the end of the sluice down to the mouth of the creek. It is, however, necessary to build brush dams across the creek in order to catch the tailings and prevent the outlet of Jack of Clubs Lake from being blocked. (See figures 20, 21 and 22). Before 1943 the tailings were allowed to run to the lake. This has resulted in a large alluvial fan (see figure 23) which stretches to the Willow River, and on which a townsite of Wells, South Wells, is built.

The average season is started when, from April 1

to May 1, about 8 men are employed cleaning out and repairing ditches and flumes. As soon as the ditch "makes" water at the monitor (which is about May 1) hydraulicking is started for the summer and is carried on until late October. When water is plentiful two monitors are used. A No. 4 or a No. 6 monitor is used to undercut the banks and a No. 6 to move the gravel into the sluice.

During the season two cleanups are made, one near the end of July and the other near the middle of October. Before the plant is shut down for the winter the pipes and the wings of the sluices are lifted from the pit by a donkey engine so that they will not be damaged when the banks cave during the spring.

An average of 12 to 15 men are employed each summer. Operating costs amount to $12,000 to $15,000 per year. About 150,000 cubic yards of gravel are moved to produce about $51,000, or $0.34 per cubic yard.

Production for 1947 was very poor. An advance of about 150 feet was made along the channel and about 125,000 cubic yards were moved. Since that part of the channel is narrow the gold values were very low. The cleanup of the first few boxes netted 185 ounces. This year an additional 200 ounces of gold and 2 tons of concentrate valued at $600 per ton were taken from the upper 6000 feet of flume. Thus the total production for 1947 was in the neighbourhood of $11,700, which did not clear expenses.

Conclusions.

Lowhee Creek has been a remarkable placer creek. For more than 80 years it has been worked continuously, first the shallow ground by hand with rockers and sluice, then the deep ground by drift-mining, and finally by hydraulicking. It has provided work and produced abundant wealth through its life.

Its future, however, is uncertain in view of the poor cleanups of the past several years. At best its life will not be very long, for only 350 feet of the unworked channel remain at the summit between the head of Stouts Gulch and the head of the Lowhee pit.

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Appendix

Production Records of Placer Mining on Lowhee Creek, Barkerville, B.C.

Extracted from the files of the British Columbia Department of Mines.

Year	Production ounces of crude gold	Production dollars
1918	2352	40,000
1919	1764	30,000
1920	2060	35,000
1921	2060	35,000
1922	882	15,000
1923	530	9,000
1924	1500	25,500
1925	no return	no return
1926	386	6,720
1927	1101	19,280
1928	330	5,775
1929	1656	28,990
1930	1300	22,750
1931	1227	22,080
1932	731	13,350
1933	474	15,100
1934	339	10,330
1935	no return	no return
1936	350	10,800
1937	2782	81,500
1938	1530	46,250
1939	1742	55,600
1940	2573	87,500
1941	1536	52,200
1942	1389	47,700
1943	892	30,420
1944	1140	37,660
1945	520	17,300
1946	413	13,700

Note:- Figures for 1918 to 1924, inclusive, are estimations which may include gold production from Stouts Gulch and other properties operated by John Hopp at that time.

Figures for 1925 to 1946, inclusive, are actual weights of gold produced on Lowhee Creek.

Article from The Vancouver Sun, Vancouver, British Columbia, November 30, 1947.