93H 012
Wingdam

Report on

LIGHTNING CREEK GOLD PROPERTIES
IN BARKERVILLE DISTRICT OF BRITISH COLUMBIA

MADE FOR COL. J. A. MALLER

BY EARL K. NIXON
CONS. MINING GEOLOGIST

93H/4W

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Colonel J. A. Maller
60 East 42nd Street
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Dear Colonel Maller:

Attached hereto is my report following an examination, made at your request, of the Lightning Creek alluvial gold properties located in the Barkerville District of British Columbia.

My presence on the above properties, for the purpose of examination, was during the week of July 27 to August 2, 1941.

Respectfully yours,

Earl K. Nixon

Earl K. Nixon

Portland, Oregon
September 7, 1941

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II

BRIEF DESCRIPTION OF PROPERTY, PROBLEMS, AND SET-UP

This is an alluvial gold property occupying a narrow valley some eighteen miles long in a well-known gold-producing area, the Cariboo District of British Columbia. In the past, the property has been worked almost exclusively by bedrock drifting methods and wingdams in the early days. The gradient of the channel, depth of gravel, and boulder situation are believed to preclude the use of dredges or hydraulic methods for most of the length of the property.

Two types of deposits or gold concentrations have been worked in recent years on this property:

1. The "deep lead" or deep channel gravel
2. The shallower old rim or bench gravel (called 'Sanderson')

Only two or three short sections of gravel out of the entire eighteen-mile length have been mined, according to our information and belief.

Previous to 1934 various costly but unsuccessful attempts had been made to mine the deep channel gravel near Wingdam, a village one-third of the distance up from the lower limit of the property. Then in mid-year 1934, the company controlling the property brought Mr. D. Campbell Mackenzie onto the scene to install the Australian "deep lead" system. It was hoped that this system when installed would solve the difficulties of mining the spectacularly rich, deep channel gravels.

After the usual run of vicissitudes attending the installing of a new system of mining in a new country--and the spending of a half million dollars--the deep channel was successfully entered in February 1937 and values of one to two ounces of gold per cubic yard were encountered. Meantime a large section of old rim gravels had been opened up in a nearby operation--the Sanderson--and mining progressed there steadily, although in bedrock gravel averaging about $4.00 to $6.00 per cubic yard. Development work and drainage of the "deep lead" continued in preparation for substantial production.

The creek here flows near and in places over the workings in the deep channel, so water troubles and cave-ins had prevented successful mining of the deep channel gravel through the years. In addition, beds of "slum", a water-laden silt or mud, overlying the rich gravels had added to the troubles by breaking into the workings at times.

In late March, 1938, a raise in the deep workings broke into old, forgotten workings filled with "slum". The "slum", followed by water, flowed into and filled the entire lower workings; the old workings caved, and the creek came in. Water rose to the level of the nearby Sanderson level where it was halted and maintained. Mining at the

Sanderson continued a few months while an effort was made to finance unwatering of the "deep lead" workings.

Due to war conditions in England in 1938 and 1939, financing was not forthcoming, and the property has remained idle since, the machinery sold off to pay creditors.

III

GENERAL PHYSICAL CONDITIONS

Location and Accessibility - The Lightning Creek placer property is located one-half way between Quesnel and Barkerville in the Cariboo gold district of central British Columbia, approximately at 54° N. Latitude, and 122° W. Longitude. A good gravel road, open and maintained all year by the government, passes the length of the property. It is the main road from Quesnel to Barkerville. Quesnel is on the main government highway north from Vancouver to Prince George, a portion of the projected highway to Alaska. The writer drove his car from Vancouver to the property in a day and a half the last week in July, 1941. The distance by highway from Vancouver to Quesnel is 450 miles, and Wingdam, the village on the property, is thirty miles beyond Quesnel. A railroad with tri-weekly freight and passenger service runs from Squamish, which is twenty miles from Vancouver, to Quesnel.

Commercial flying and airmail service is maintained from Vancouver to Williams Lake and to Prince George, but not to Quesnel as yet. Flying time from Vancouver to Prince George is about ~~three~~ two hours, and from there back south to the mine by automobile would take at least 3 hours more.

Size - Sixty-nine placer mining claims and one special grant, forming altogether an unbroken length of eighteen miles along the valley of Lightning Creek, comprise the property under consideration. Acreage is not as important as continuous length of gravel channel. The claims reach for a considerable distance back onto the upland from the valley bottom which contains the minable gravel. The valley bottom is usually quite level between the toes of opposite slopes, and the valley flat averages from one thousand to two thousand feet in width, at least for the upper (or eastern) dozen miles of the property. Probably one-quarter mile would be a fair average width of the valley bottom for the entire length. At Wingdam, where the recent mine operation was carried out, the valley narrows to a matter of 1,000 feet or less. This is caused in part by the slump of a great mass of glacial debris lying against the south hillside.

Topography - (See photographs page 63, etc) The country in general is rough and rolling with a relief in the vicinity of Lightning Creek property of less than a thousand feet. Lightning Creek valley--almost a canyon at points in its lower reaches--has been cut down through the surrounding peneplained surface and outward to the west to the Fraser River drainage at Quesnel. The hill slopes on both sides of Lightning Creek flat are timber-covered, and measure from 20 to 35 degrees in grade.

Drainage - Lightning Creek, with minor gulch tributaries, flows westward the length of the property to a point just below, where it joins Cottonwood River. Most of the tributaries are short, not more than three or four miles long, and debouch into Lightning Creek drainage at points high on the valley sides. Ramos Creek, as an example, starts about two miles north of the town of Wingdam and furnishes water for fire protection and domestic use at the mine location from a dam where the creek passes over the north rim of the valley. At flood stage, May or June, Lightning Creek is estimated to have a maximum flow of 1500 cu. ft. per second. At the time of the writer's visit, about August 1st, it was a brook five or six yards wide and a foot deep, carrying not more than 100 second feet. (See photograph page 6B). Although the normal snowfall is heavy, the spring thaw is alleged to be perhaps a month along before rains come to augment flood conditions. Drift marks along the bed of Lightning Creek indicated its normal flood crest to be not more than four or five feet above present low-water stage. If the gradient for the eighteen miles ranges between 25 feet and 70 feet per mile, judging by map contours and statements by two engineers, there is sufficient stream velocity under flood stage conditions to carry off a tremendous volume of water without the creek spreading out very much over the pervious gravels beyond the limits of the silt-sealed creek bed proper. A water gauge was maintained at Wingdam for a number of years, but the records are not available.

Lightning Creek, as is commonly the case, seems to have silted or sealed its bed tightly so that under normal conditions there is a minimum of seepage into the underlying gravel. This has been the writer's experience in other parts of the country; and mine reports of the former operation at Wingdam bear out our prediction that, with the creek diverted or flumed, the channel gravels below, once drained, can be maintained in a relatively "dry" and safe state without undue expense for pumping. What the yearly saturation is from snow and rain water in terms of gallons at a given point in the channel cannot easily be calculated; but if a section of the valley gravels, say a mile at a time were flumed or drained or both, the resulting pumping rate after drainage should be of the order of 200 to 300 (U S) gallons per minute from the deeper part of the channel. The 'dry season' pumping rate at Wingdam was about 20 million (Imp.) gallons per month, or a little over 500 (U S) gallons per minute - when the channel was not nearly drained nor the creek flumed.

Climate - This inland part of British Columbia enjoys a quite satisfactory climate. Summer daily temperatures are in the 80's F; and nights are cool. In the winter, extreme lows of 35 below zero F. are not uncommon although surface work of some kinds can be maintained throughout the winter. The normal snowfall is about six feet and the total precipitation about 30 inches. Forage crops and vegetables are raised in relative plenty in the Fraser Valley around...

Quesnel. Cattle ranches are prevalent. The Quesnel area is referred to as a "good dairy country". The ground may or may not freeze before the snow comes in the fall. Winters are described as usually "open" until the first of the year, and the cold weather comes regularly in January and February. Spring thaw usually begins in April, and the run-off of water continues over a couple of months except when enhanced by rains. The writer experienced very warm sunny weather during the first week in August and was much relieved not to be bothered by mosquitos which infest much of the north country.

Timber - Almost the entire Cariboo District is covered with timber. There are some excellent stands of spruce of medium size and considerable pine and tamarack. Wood fuel costs around $3.50 per cord. Mine timbers 12 to 16 inches and peeled now cost around seven or eight cents per running foot we were advised. Dimension lumber costs about $20 or $21 per thousand board feet delivered on the property. We saw a medium sized sawmill operating a few miles below the lower end of the property. Tamarack commonly makes the best mine timber at least for caps and posts, but spruce is used here to a considerable extent. We saw dimension lumber up to 12 or 14 inches in size being trucked past Wingdam to the quartz mines near Barkerville. See photos pps 62-66.

Surface Improvements - (See photograph pp. 60) Except for two villages, Stanley at the very upper end of the property, and Wingdam some 12 or 13 miles below, there are only a half dozen houses (of miners or small farmers) in the 18-mile length of the property. At Wingdam, scene of the mining operation between 1934 and 1939, surface improvements consist of three large shaft houses, a four-story bunkhouse (100-man capacity), an office-engineering room-bunkhouse building, a recreation building, a fire-proof engine house, blacksmith shop-machine shop, warehouse, store and postoffice, a good 7-room manager's house, small hoist houses, mess houses, sundry machine sheds, sawmill building, and about 50 miner's houses and shacks scattered along the road up and down the highway.

Present occupants of the former village include the storekeeper and his wife, a caretaker, and a woodcutter. There is daily mail service, and a telephone connects with Quesnel and the outside.

Almost all machinery has been sold off the property to settle obligations for labor and taxes. There remain two churn drills, rather old but usable, a few mine cars, a good Pomona vertical shaft pump (probably about 1,000 gallon capacity), some 12-inch column line, odds and ends of machinery including shaft cages, car dumpers, rails, trommels and steel sluices for gold recovery, an assay balance, etc. Diesel engines, generators, hoists, etc. are gone; one might say the property has been stripped of mining equipment.

V

HISTORY OF PAST OPERATIONS

The property covered by this report, consisting of a continuous stretch of eighteen miles along Lightning Creek, was first consolidated into one group of leases in 1896. We have no detailed record of the earlier placer operations on the Creek, but brief notes on the history of operations from 1896 to 1934 are taken mainly from report of the Minister of Mines of British Columbia for 1935.

It appears that one of the earliest efforts to develop the property was to drive an adit up the channel for the purpose of draining the gravels. After driving a distance of some 1,500 feet, the work was abandoned, according to the British Columbia Department of Mines' annual report for 1899.

The La Fontaine Mine located on the present holdings a couple of miles down the valley from the village of Stanley was extensively mined between 1903 and 1907. Evidently the values were a little too low to make the operation pay at the then price of gold. That operation seems to have been carried out by the Lightning Creek Gold Gravels and Drainage Co., Ltd.

The history of the property from then on until about 1930 is obscure other than that some shaft sinking and churn drilling were carried on at various times in the interim, such as in 1904 and 1916. There seems to have been quite a period of exploration around 1917 and 1918. The name of the Lightning Creek Gold Gravels and Drainage Co. Ltd. was changed in 1929 to the "Lightning Creek Gold Mines, Ltd.", evidently in connection with a reorganization. In 1930 the Consolidated Gold Alluvials of British Columbia Ltd. was incorporated for the purpose of taking over and developing the leases of the Lightning Creek Gold Mines, Ltd.

Four shafts were sunk (the dates are not clear to us) and much Keystone churn drilling was carried out under the management of Mr. C. H. Unverzagt--who is at the present time president of the group that holds this property. These shafts were sunk at the village of Wingdam, in fact all operations described below are at Wingdam, also. Much difficulty was experienced by water breaking through into the mine workings when the channel was cut by a hard rock crosscut driven from No. 1 shaft. No actual mining of gravels took place until 1933 (the B. C. report states) when the No. 2 shaft at Wingdam was unwatered and the mining of pay gravels carried on for a time. In the fall of 1933 it was decided to resume the former attempt to mine bedrock gravels from No. 1 shaft. In order to do this a 26" diameter drainage hole was sunk through the gravel into bedrock and a large capactiy vertical shaft pump installed. Unfortunately this large hole was placed just beside the creek (see photograph on page ~~60~~). It is recorded that
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silt and "slum" came into the perforated casing to such an extent that the pump was choked and could not be removed from the hole.

On July 4, 1934, Mr. D. Campbell Mackenzie, a successful "deep lead" operator and engineer from Australia, took over charge of operations for the Consolidated Gold Alluvials group, and started immediately to install a proven system of mining deep leads as developed in Australia.

The history of operations from 1934 until their cessation in 1939 is clearly given in the annual reports of the company.

Since the experience gained during the Mackenzie operation has such definite and important bearing on decisions for any future operation of the property, we are outlining in considerable detail here the record of events that took place.

During 1934, Mackenzie, with ample funds provided, set about substantial preliminary development of the property leading to the installation of the Australian deep lead system of mining. He sunk No. 1 shaft a distance of 195 feet, No. 2 shaft 136 feet, and No. 3 shaft (mainly in rimrock to replace the shaft formerly sunk by Mr. Unverzagt) 161 feet. The costs of these were respectively $18,271, $8,078, and $11,420. He carried out rock-drifting from No. 1 shaft a distance of 328 feet ($4,050), and 3,758 feet of rock drifting from No. 2 shaft ($37,580). Mine buildings, shaft houses and dwellings were built costing respectively $24,351, $17,500 and $7,150. Machinery and equipment were purchased costing $98,891. In all, nearly $200,000 ($198,624 from the annual report) were spent in 1934. We note among other principal items of expense during 1934 those of payroll, $21,509; store and commissary, $11,846; exploration and pre-production expense, $50,412; and director's fees, $13,908. Much churn drilling was done to locate channels, bedrock elevations, and gravel values. During the six months, 126,799,910 imperial gallons of water were pumped from the three shafts at a cost varying from 2.83¢ to 14¢ per thousand gallons. A power plant, including three Crossley diesels of 565 combined h. p. was built at a cost of $30,866. The camp and all machinery were electrified and current was supplied by 440 volt A. C. generators. A total of $9,386.02 worth of gold was produced and sold during 1934. During the six months period after Mackenzie's taking over, the most important work was: (1) draining the gravels in the deep lead channel, (2) drifting under the channels in bedrock for installation of the new mining method, and (3) development of some of the shallower rim gravels (at the Sanderson workings) adjacent to the deep lead.

In 1935, the excellent progress toward installation of the new method of mining the deep lead was continued and actual mining of the shallower old rim gravels in the Sanderson workings developed into a separate mine operation. The Sanderson workings produced $74,296 in gold during 1935. The costs are so related to those of the deep lead workings and the general unwatering and development of the of the property, it was difficult to segregate those directly attributable to the Sanderson recoverings. However, it is believed that the Sanderson operation by itself would have considerably more than carried itself. During 1935, according to the auditor's report, the total amount spent was $258,995.88. Among the more important items of 1935 expenses are plant and machinery, $104,140; drifting, $43,602; building, $52,007; No. 2 shaft house, $14,032; No. 3 shaft house, $11,031; No. 3 shaft, $11,799. No. 3 shaft was sunk to a final depth of 273 feet, the work being hindered on two or three occasions by "runs of slum". On August 8th, a run of slum and water filled the lower workings and terminated all pumping for the rest of the year with the exception of the holding of water in the Sanderson shaft below the workings in the rim gravels. On August 10th, the power plant and new diesel engines burned. Nevertheless, the report for the year showed the following results:

Water pumped--248,000,000 imperial gallons
The sawmill on the property cut 1,336,479 board feet of lumber
A very necessary and well-carried-out surface survey of the property was made by the Surveying Department
6,410 feet of churn drilling was completed between June 30, 1934 to the end of 1935 (at a cost of $20,611)

It seems pertinent to quote a paragraph of Mr. Mackenzie's report where he states: "For over 20 years, periodic attempts have been made to enter these rich gravels from the Unverzagt level, which is practically on the same level as the bedrock. These many attempts have all failed owing to repeated bursts of high pressure slum. This slum was usually pumped to the surface, and further attempts made, with similar results. These repeated bursts of slum have causxd serious caves, three of which, under my own observation, have reached the surface a few feet away from the river. To make matters worse, the 26-inch Jennsen drill hole was sunk in the same vicinity.

"A large Layne and Bowler pump was installed in this hole and is reputed to have pumped large quantities of slum and sand before it became 'sanded up'. On the 18th of August, 1935, this hole caved to the surface, and a wing-dam had to be rushed in to the river to keep it away from the 'cave'. (See photograph page 61).

"We may take it as axiomatic that the only safe method of entering these gravels is by means of the main reef drive from the Melvin Shaft, and then only after the water pressure has been reduced to safe limits by means of drill holes bored up from the main reed drives. I cannot over-emphasize the importance of carrying out the above policy. Enough experimenting has been done and money spent over the last 20-odd years in this No. 1 Shaft to make it obvious that the progress of development of this property would have been considerably further advanced had we forgotten there ever was such a thing as the No. 1 Shaft."

During 1936, the installation of the Australian system at the

Wingdam workings was continued. Rock drifts called main reef drives were continued both up and down stream. On February 17th, a burst of water and slum flooded the Melvin shaft and lower reed drives. The break was brought under control by a good job of grouting through a hole promptly drilled from surface and the water shut off March 17th. The water was then pumped out and further progress work was carried on. Although holes had been drilled from the reef drives in bedrock into the old gutter channel at many points for the purpose of drainage, it was not deemed expedient actually to break into the channel with a drift until the pressure of water in the channel, constantly measured at various drainage holes, was lowered to a point of complete safety.

Several caves to surface in the vicinity of the large 26" drainage hole were noted during the year, so an area in the vicinity was reserved from any mining until some future time.

The Sanderson Mine workings in the rim gravels gave a good account of themselves during 1936. The annual report of that year shows that 42.717 cubic yards of pay gravel were mined and this production returned $210,482.37 in gold, (an average of $5.00 per cubic yard).

During the year a total of 338,900,000 Imperial gallons of water were pumped from the various mine workings. This corresponds to practically 800 U. S. gallons per minute continuous pumping during the twelve months. It seems desirable here to give the record in gallons per month pumped since the variation may be highly significant in any future operation. The pumping record for 1935 for both Sanderson (upstream gravel workings) and Melvin shafts (deep lead workings and reef drives) is as follows:

January	19,000,000
February	16,000,000
March	13,300,000
April	21,000,000
May	29,000,000
June	33,000,000
July	47,500,000
August	30,300,000
September	22,000,000
October	26,100,000
November	35,400,000
December	46,300,000
	338,900,000 gallons (Imperial)

During the year the extension of the lower reef drives in rimrock both upstream and down amounted to 1,227 feet. In the Sanderson Mine a total of 16,180 feet of close timbered gravel drives were carried out. The Survey Department again carried on a substantial amount of work in connection with lease surveys. The amount of churn drilling was diminished and only a little work was done in 1936.

The auditor's statement in the annual report shows "net charge to development of $162,338.78", which figure includes a credit of an operating profit of $25,540.84 on the Sanderson Mine or rim gravel workings and a charge of $53,854.75 for "Vancouver and London Administration and financial expenses including interest to date on advances guaranteed by stockholders."

It is interesting to note that a separate accounting for the operation of the Sanderson Mine showed total gold produced and shipped, 6,800,048 ounces returning $211,141.90 against which there was mining expenses of $181,172.43 and other charges against the gold such as insurance and taxes $4,428.63. This gave the profit mentioned above for the Sanderson workings of $25,540.84.

The accountant's "details of property improvements, plant, and equipment as at 31st of December, 1936" shows an expenditure during the year of $110,057.17 for the entire operation. The principal items making up this figure are: reef drives including drainage holes in the deep workings, $53,279; plant machinery and permanent equipment, $46,790.

Early in 1937 (February 8, 2:30 A.M., according to the record) a crosscut from one of the deep drives was first driven into the old deep lead channel gravel under satisfactory conditions and according to the Australian system. This must have been a great moment for Mr. Mackenzie. It is recorded in the annual report that "the first pan (of the deep lead gravel) washed contained .15 ounces of gold and from the second pan 1.47 ounces of gold were recovered." From the same crosscut the report further states that "on February 17th from a pan of soft bedrock containing no gravel 1.85 ounces were taken; and on February 18th 2.77 ounces were also recovered". It is also further stated that "in driving across the gutter from February 16th to February 28th, 27 cubic yards (place measurement) were mined for a recovery of 34.54 ounces of gold." This must indeed have been cause for rejoicing because it seemed plain that the Australian system of deep lead mining had been successfully applied by Mr. Mackenzie to the problem at Wingdam. After the successful entry into the deep lead in February, 1937, Mr. D. Campbell Mackenzie requested that he be relieved as his health under the long strain had begun to cause him concern. The operation was then turned over to his assistant, Mr. A. M. Richmond, as at the end of June, 1937, with Mr. Mackenzie being retained in an advisory capacity. In his supplementary report of the first quarter of 1937 Mackenzie rather proudly points out the following accomplishments during his encumbency from July 4, 1934 until the end of March, 1937:

"(1) Produced 11,075 ounces gold--$343,325.00.
(2) Driven 29,209 feet of close timbered gravel drives--over 5½ miles.
(3) Sunk Melvin Main Shaft in rock 276 feet.

(4) Driven 1,985 feet of rock drives.
(5) Pumped 807,000,000 Imperial gallons of water.
(6) Drilled 6,734 feet of Keystone holes from surface.
(7) Drilled and reamed 3,208 feet of underground drainage holes.
(8) Installed a modern power station of 550 h.p., which was unfortunately destroyed by fire on August 10th, 1935, necessitating the erection of a new station with an increased capacity of 1,000 h.p.
(9) Made a successful entry into the ancient "gutter" of Lightning Creek on February 8th, 1937."

It is my opinion that Mr. Mackenzie is indeed entitled to all credit for a tremendous amount of high quality work done in that intervening time. The writer's admiration for Mackenzie's capacity has increased progressively as he read through the very detailed reports of operations. Incidently there was no lack of energy or intelligence on Campbell's part. Final failure of the operation was failure in the policy toward a hazard, and Richmond "was credited with an 'error'". All operators, including Mackenzie, in the Lightning Creek deep gravels had followed the policy of "fighting the hazard rather than removing it". The writer's observation stated here is not the result of study of the history of the vicissitudes of the Wingdam operation but comes rather from his experience and association with much more costly and hazardous drainage problems in the Lake Superior iron region.

A summary of 1937 operations as given in the annual report by A. M. Richmond, General Manager, shows production of 1,822 cubic yards of deep lead channel gravel containing 663.89 ounces of gold valued at $20,561.80. (About $11.30 per yard average.) The direct cost of mining the above yardage during the first six months was $18.77 and $8.22 during the last six months.

The Sanderson workings during the year (317 days) produced 52,151 cubic yards of gravel containing 7,305.77 ounces of gold valued at $233,640. ($4.30 per yard and 165 cubic yards per day.) The direct cost of mining the Sanderson gravel, including all underground costs for mining, timbering, haulage, hoisting, treatment and tailings disposal, was $3.75 per yard for the first six months and $3.08 per yard for the second six months. A considerable amount of underground drifting, raising, and necessary development work was carried out. 1,954 feet of Keystone drilling was done during the last five months of 1937. Some geophysical work by Dr. Longacre and Dr. Hans Lundberg was done at two points on the property,--this to determine bedrock depths and profiles. The work apparently was not altogether successful.

During the latter part of 1937 various crosscuts to the deep lead from the reef drives were driven preparing and draining the deep channel for entry and mining at various points. Some work in the drive itself was carried on with varying results. In all, a lineal distance of 3,175 feet of the deep channel was considered as being under drainage control. Referring to these deep workings, Richmond states in his report that the channel appeared to have a width of perhaps 25 to 35 feet, that it would be quite crooked in its course, and that the best gold values would be found in the downstream section of the channel from No. 1 shaft. He stated that apparently the highest gold values would be deposited on and in bedrock over only a portion of the deep channel. He mentions that while the upstream part of the deep channel workings seemed to show an average of $10.93 per cubic yard in gold, the downstream workings, judging by the first 344 yards mined, showed $33.40 per yard. We learned, however, by discussing the matter recently with the engineer who was at the mine during the operation, that the deep channel came down to a width of 6 feet of barren gravel at one point and elsewhere widens to a greatest width of about 60 feet, and further that the average width seemed to be between 18 and 25 feet.

In 1938, operations and regular development in both the Sanderson workings and the deep lead or Melvin shaft workings were carried on as in 1937. Richmond, in his summary report for the first quarter of 1938, states "most encouraging results are being obtained from the working of the Melvin deep channel gravel (near No. 1 downstream raise), the gold values averaging from 1 to 2.3 ounces per cubic yard of gravel and bedrock mined". For the distance of 530 feet in the deep lead between the No. 1 upstream raise workings, and No. 1 upstream workings, Richmond estimated that for an average width of 30 feet and when mining a total width of 7½ feet, "we can safely expect to obtain gravels which will average 1½ to 2 ounces in gold per cubic yard." He states that for an additional distance of 250 to 300 feet of the downstream channel conditions should be about the same. "This means that in the 780 to 830 feet length of channel adjacent to the No. 1 downstream workings we have in possible reserve a total of between three hundred thousand and four hundred thousand dollars in placer gold in the 6,675 cubic yards of gravels in this section." Richmond further estimates that in the channel section controlled by No. 3 and No. 4 downstream raises that values of approximately half those mentioned above would give a possible additional reserve of between $150,000 and $250,000 in the 10,000 cubic yards of gravel in the section. He states that in the upstream section beyond No. 2 raise the deep lead gravels, the values have not been sufficiently encouraging to warrant estimates of reserves. Summarizing his figures, Richmond states "we therefore can estimate with reasonable assurance that in the Melvin deep channel so far developed we have between $450,000 and $550,000 in possible reserve gold gravels, the major portion of which is in the area adjacent to the No. 1 downstream raise-workings. This 16,675 cubic yards of gravel should be mined for approximately $250,000 including all expenses, possibly at somewhat lower costs, leaving a very substantial profit".

Then, on March 22, 1938 in three hours' time, all of this difficult and expensive preparation for mining the rich deep lead gutters was wiped out by the flooding of the workings with water and slum. One of the development raises off the deep lead broke through into old abandoned workings above which emptied their "lake" of slum into the new workings. Then with the old workings suddenly emptied, subsidence took place, fractures ran to surface, water of Lightning Creek came into the workings and flooded all of the deep drives and new Melvin shaft openings. It was two hours after the break below before Lightning Creek, at a point near the 26" bore hole, flooded into the caved ground. The water gradually came up to within 8 feet of the Sanderson workings and was there halted by emergency pumps. These, taking out 800 gallons per minute, kept the Sanderson workings dry and mining was continued there for several months in the so-called rim gravels while decision was being made as to what to do about, and how to finance, the unwatering of the main or deep part of the mine.

Mr. Richmond meantime carried on production in the Sanderson workings a few months until it could no longer be done at a profit. Then all operations ceased and all workings slowly filled with water. There has been no activity on the property--except the selling off of equipment, since that time.

We quite agree that financing of the reopening and unwatering of the mine (in accordance with certain restrictions imposed by the B. C. Mine Inspector) must have been a difficult task to attempt under the war conditions that prevailed in England in 1938 and 1939. It is stated that Mr. Mackenzie nevertheless, still having faith in the values and yardage classed as "reserve" in the deep lead, made a determined but unsuccessful effort to finance re-opening. Also, we understand, the British Government set up barriers against withdrawal of funds from England except for war purchases. These are now in effect.

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While in British Columbia recently, the writer spent an hour with Mr. Richmond, last operator of the mine at Wingdam. Richmond now has a substantial consulting mining engineering practice in Vancouver. He was pleased to answer the writer's questions about conditions and operating problems at Wingdam. Evidently he has had no reason to change his mind about the yardage and values contained in the deep lead in the Melvin Shaft workings, and he made no disparaging statements of any kind about the property.

ACCOUNTANT'S STATEMENT OF GOLD
PRODUCED DURING CONSOLIDATED GOLD ALLUVIALS OPERATION

	SANDERSON MINE		MELVIN MINE		TOTAL		
PERIOD	OUNCES	VALUE $	OUNCES	VALUE $	OUNCES	VALUE $	YEAR
July - Dec.	312.3	9,396.02	-	-	312.3	9,396.02	1934
Calendar Year	2,498.2	76,787.31	-	-	2,498.2	76,787.31	1935
Do	6,800.1	241,141.90	-	-	6,800.1	211,141.90	1936
Do	7,305.8	223,158.58	667.0	21,200.96	7,972.8	244,359.54	1937
Do	6,627.1	204,997.35	419.4	13,049.49	7,046.5	218,046.84	1938
To apl. 30	1,930.6	59,474.33	-	-	1,930.6	59,474.33	1939
Total	25,474.1	784,955.49	1,086.4	34,250.48	26,560.5	819,205.94	
Average per oz.		$30.61		$31.53		$30.84	

V.

GEOLOGY

As the geology of the Cariboo District has been covered in numerous published papers, a few pertinent details of the placer geology of the Lightning Creek drainage must suffice here.

Lightning Creek valley proper is a pre-glacial (quite likely late Tertiary) stream that cuts across the strike of old schists and argillites (said to belong to the Pre-Cambrian Cariboo Series as well as Mesozoic rocks) which are gold-bearing. The latter is proved by quartz lode mines and prospects of the district.

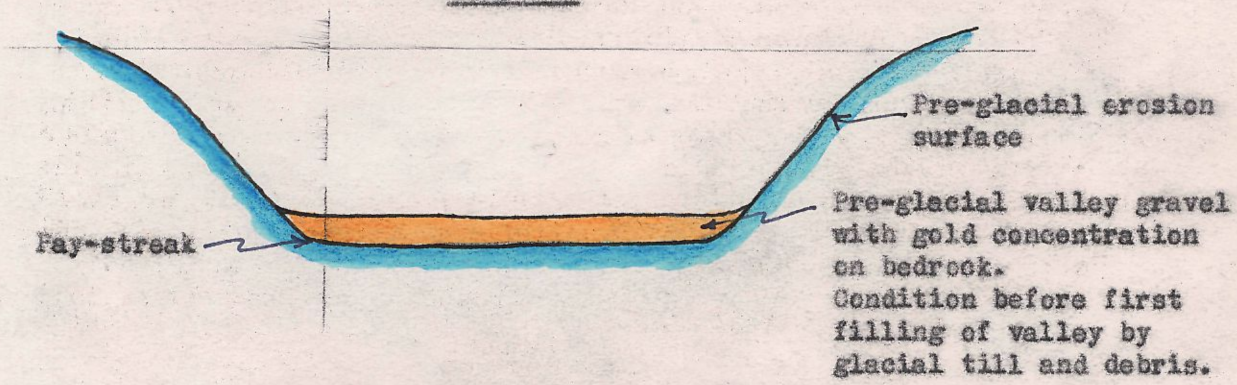
The valley was filled with gold-bearing glacial alluvium, much of the gold doubtless coming from reasonably nearby sources. This glacial debris was re-worked--perhaps several times--by glacial streams, and the gold concentrated in the lower or bedrock zone.

For clarity, we may divide the history of erosion and gravel deposition and consequent gold concentration in the valley into three stages.

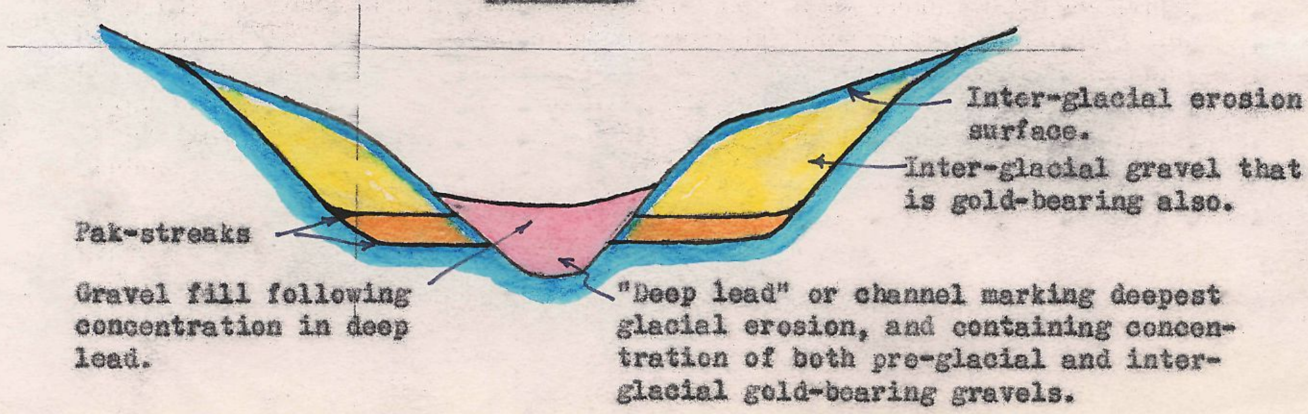
1. Pre-glacial erosion and early glacial deposition
2. Late glacial erosion and deep channel cutting
3. Recent partial filling of valley.

These may be depicted in idealized cross-section as follows:

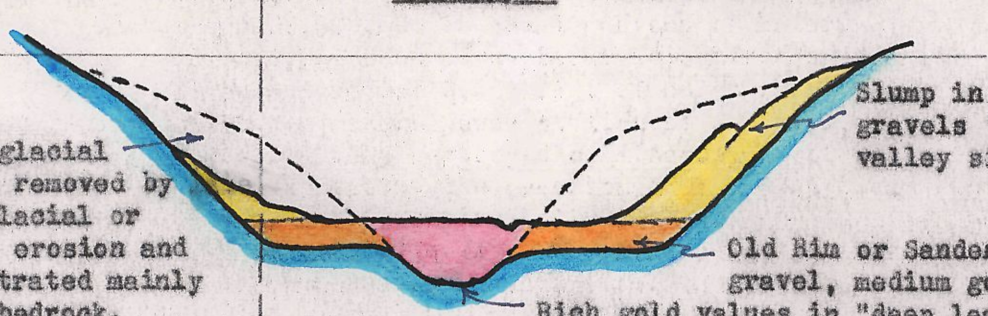
Stage I.



Stage II.



Stage III. - Present condition.



During Stage I, there was bedrock concentration of gold across much of the then bottom of the Lightning Creek valley. Some of the gold was from normal erosion of the nearby schist and argillite series and the concentration was mainly right on the bedrock. After the valley was filled in part by the first glacial debris and cutting down and reworking of this glacial till took place, erosion, judging by existing evidence, carried down to bedrock in someplaces but not so deep in others. Thus we may have (and do have) a bedrock gold concentration and (locally) another in the gravel some distance--20 or 30 feet--above. In such cases, the bedrock "pay" is apt to be pre-glacial and the upper "pay" glacial or interglacial,--or, obviously, both can be glacial, the upper pay representing a later period of erosion and re-working of a late glacial fill. In any event, the gold-bearing bedrock surface of Lightning Creek flat as represented by Stage I is a most important feature in the future economics of the property, and may easily produce more gold than the deep or subsequent channel.

Stage II, which consisted mainly of a rapid cutting down by a later glacial stream to a point 60 or 70 feet below the former bedrock level, shows the formation and gold concentration of the "deep lead" or deepest present channel. Into the deepest channel went most of the gold contained in all the sediments cut and re-worked above. Remnants, however, of the Stage 1 bedrock channel were left as "old rims" of this new and deeper channel. It would normally follow--and such probably is the case--that where the old rims are gone, the deep channel should be rich; and conversely, where the old rims remain as broad areas on either or both sides of a narrow, deep channel, the latter would be leaner in gold content.

The rapid erosion of Stage II must have had a definite cause, and of this there seems to be some acceptable evidence. It appears that Lightning Creek at one time flowed out to the north through a low divide called Beaver Meadows or Beaver Pass, a point five or six miles above Wingdam. This diversion was caused doubtless by glacial ice jamming the pre-glacial Lightning Creek channel just below Beaver Pass. Later, very likely because of another ice jam condition in what is now Beaver Meadows gap, the waters of Lightning

Creek began pouring over to the west into its former channel and began cutting down more rapidly (Stage II erosion). Another equally plausible cause of the Stage II erosion is that due to slight uplift and the increase of east-to-west gradient, Lightning Creek, starting at its confluence with Cottonwood River, may have cut down rapidly and, by head erosion, effected "capture" of the upper stream which at that time was being diverted to the north through Beaver Pass. The result below Beaver Pass is the same in either case.

Stage III is the present state of affairs wherein the entire valley has been filled (to an undetermined depth) subsequent to Stage II, and then eroded down by the meandering, back and forth cutting, of the present Lightning Creek. The latter now flows through the stream valley at an elevation of some 160 to 170 feet (at Wingdam) above the bottom of the deep lead or richest channel, and 100 to 120 feet above the "old rim" (Sanderson Mine) concentration.

During the deposition periods following both Stage I and Stage II erosion, there were deposited in the Lightning Creek channel, thick beds of very fine silt or mud. In our opinion they are deposits in eddies or backwaters formed by intermittent blocking of the channel by late ice or by slides of gravel into the channel from the valley slopes due to undercutting. These lenses of mud or fine silt and glacial clay are now called "slum" and have been responsible for many (perhaps most) of the mining difficulties on Lightning Creek. The "slum" when filled with water "runs" through a crack, crevice, drill hole, or almost any opening through which water will pass. It is necessary then to take great precaution against breaking into these "lakes" of slum. When drained of water, the material stands up well and is said to present no difficulty to mining. Only drilling can determine in advance the location of the lenses of slum.

Geologic processes have caused the gold-bearing metamorphic rocks of the district to be "mother lodes" of the first important gold concentration (Stage I). Further analogous processes aided by glaciation have converted that concentration in part into a mother lode for the "deep lead" concentration,--the last important one. The geologic pattern is now reasonably clear, at least in the portion of the valley below Beaver Pass, a section some eleven miles long. Above Beaver Pass it is uncertain that the late (Stage II) deep leads exist, but it <u>is</u> known for a certainty that very rich pay-streaks on bedrock (Stage I bedrock profile) have been mined. In fact, one is being mined now at a point a half mile above Stanley, just off the upper end of the Lightning Creek holdings.

It is not clear why the Wingdam section of Lightning Creek, a point some twelve miles below Stanley, was selected for attacking the deep channel concentration. Perhaps it was because at this point the valley narrows to a matter of a few hundred feet between the toes of opposite hill slopes, and the old operators expected a consequent enrichment of the constricted channel. Drilling shows that the valley constriction at Wingdam is mainly topographic and that the bedrock profile demonstrates a normal (1000 feet plus) width between back rim limits. Beginning about two miles below Wingdam, however, Lightning Creek goes virtually into a canyon for two or three miles.

At any rate, there does not appear to the writer to be any sound geologic reason why any particular point along the present holdings from their upper limit near Stanley, down to a point a couple of miles below Wingdam, should be outstandingly more favorable for gold concentration than any other point. Some of the broad "bays" * along the valley above Wingdam present alluring possibilities for old rim concentration of the Sanderson type, which may easily be shallow enough to allow stripping and mining from surface, rather than by underground methods. Also, we believe that in such broad widenings of the valley, geophysical methods (particularly 'resistivity') may be used to outline the bedrock profile and therefore the presence of old rim deposits and deep leads, in advance of actual drilling.

* (See photograph pages 65, 66, and 67)

VI

ECONOMIC FACTORS BEARING ON OPERATION AND PROFITS

Drainage Problem - This is a nightmare in the Lightning Creek district. Without it all of the pay gravels would have been mined many years ago. In the writer's opinion it has never been thoroughly understood by the former placer mine operators on Lightning Creek. This is probably because those operators, being placer operators without long experience in hard rock underground mining, fail to recognize that the deep channel mining on Lightning Creek essentially is standard underground mining plus a difficult water problem. It is virtually "a metal mine under a lake". In other mining regions in a similar setup the operator would first remove the lake--if possible. On Lightning Creek the operators always fought the lake with the latter literally hanging over their head at all times. The "lake" in this case is Lightning Creek; the slum problem will be taken up later.

It should be perfectly plain mining logic that when unconsolidated gravels are mined from horizontal slices at a depth of no greater than 150 feet, some subsidence of the overlying ground is apt to occur as supporting timbers rot and refuse longer to hold the weight. Subsidence causes fractures that normally go to surface. If no water is present in the ground that subsides no harm will come. If water seals of various kinds between sedimentary formations of various types are present, these seals will be broken. If in an extreme case, as on Lightning Creek, the impervious bed or seal below a flowing stream is broken by the effects of subsidence, nothing but disaster can result.

Certain facts must be considered in forming a plan to cope with the drainage problem. The beds of streams normally are silted water tight. Let us assume that Lightning Creek is a normal stream. There is of course at all times some little seepage through the bottom of stream beds, but it is very slight indeed. When a stream--Lightning Creek--is at flood stage and its water spreads out beyond its normal compass, the seepage into the underlying gravels is very much increased because normally only the very stream bed itself is silted tight. In addition, water enters the gravels of the main channel by rain and by the soaking in of melted snow. Also, in a valley such as Lightning Creek, water flows into the top gravels to a certain extent from tributary streams and some comes in from the higher elevations along on the surface of bedrock and finally the bedrock itself almost invariably makes some water. It comes through crevices and faults in the country rock.

There are then two main sources of water that must be taken care of or guarded against in mining channel gravels: namely, (1) the water in the creek--or from the creek, and (2) the water of the "country", that is, the ground saturation from yearly and seasonal precipitation and all other sources.

In Lightning Creek Valley the "country" water is a continuous expense that will always have to be met as a part of the ordinary mining expense and technique. The water of Lightning Creek itself--except the above-mentioned excess which "spills over" into the valley gravels at flood stage, is a factor that always has been not only the source of great expense but a continuous hazard to mining safety. This need not be the case in the writer's opinion. We have licked the problem elsewhere,--as in the case of an underground mine where the workings were rendered unsafe by a lot of water coming in through the cave at ledge. By driving a drainage drift in country rock all the way around the surface cave, drilling "upper" holes through the ledge into the gravel and catching the surface water before it ran down into the mine workings, the hazard was removed. Also, many thousands of dollars in pumping charges were saved by catching the water before it reached the bottom of the mine. Where underground mine workings or ore bodies are near streams or the edge of lakes, it is standard practice where possible to divert the stream or drain the lake, and these expedients have been employed in numerous cases. Why it was not done on Lightning Creek is not clear to the writer.

In our opinion, no sound mining program can be planned in either the Rim gravels (Sanderson) or deep channel gravels without first making adequate and separate provision for handling both types of water sources mentioned above. We think that fluming is the only solution of the creek and that with the creek under complete control the channel gravel--that is, the "country"--can be drained and kept drained of its normal saturation without undue expense. No half-way job, however, can be made of the fluming of the creek. As the length of the Lightning Creek channel should be mined and the "country" drained by sections, the creek should be flumed in sections of equal or greater length, in this case one or two miles at a time. (See cost of fluming pp 37)

In our opinion it would not be feasible to re-enter and try to mine the half million dollars in gold estimated as lying in the deep channel of Lightning Creek at Wingdam in the vicinity of the old workings and reef drives of the last operators. Ultimately with a section of several thousand feet of the creek under control--in a flume--and the same section of "the country" drained, the deep lead might be mined--probably could be mined--with relative ease and comfort. However, to start at this time to mine the rich deep channel at Wingdam would require fluming the creek, draining "the country", then sinking a new shaft two or three thousand feet down the channel, and starting a "brand new" deep channel operation. Even then it would probably require a year of pumping to drain "the country". That apparently is justified.

Now, as to draining the "lakes" of slum that "hang" up in the gravels, we have a separate problem. Frankly, we cannot determine from the record of the former operations whether or not the slum lenses can be drained of their <u>water content</u> at all. Possibly they cannot. If they can, it will be through complete and systematic drainage of "the country" by sections preparatory to mining; if they cannot, it is possible that they can be "removed" in toto in some instances. Their position and elevation must be determined in advance by drilling. Then, when one is found to lie fairly close to the deep channel gravel, churn drill holes from surface may be drilled right down through the slum and on into a bedrock drift previously driven for the purpose. With sump in and sinking pump facilities ready at the collar of the shaft there should be no embarrassment from a self-induced run of slum. This, in fact, might be a good way of rapidly draining "the country" of moisture. The water level in the churn drill holes can be measured at all times, and they can be punched out and opened whenever they plug.

Where slum beds do not come down close to the pay gravels, it may be found unnecessary to drain out the slum; where they come right to the top of the pay, it may be deemed inadvisable to mine the ground in the immediate vicinity. Careful churn drilling and examination of the drill cuttings must at all times precede and be a guide to the mining operation.

Type of Gravel - Although the writer was unable to get underground into the workings of the former operations at Wingdam, considerable information is available from surface observations and from records as to the nature of the gravel from top to bottom along Lightning Creek.

Considering a vertical section of the deeper parts of the channel where bedrock is at a depth of 150 or 160 feet, one encounters at surface a few feet of soils, sand, and new alluvium, and then a series of thick, alternating beds consisting of sand, clay, gravel, boulder gravel, and "slum" to a depth of within ten or fifteen feet of bedrock as a rule. Sometimes the slum bed is absent. All of the above material would be classified as "light" and for the most part presents no special difficulties in shaft sinking or churn drilling, according to our information. One occasionally strikes in the above sediments a boulder the size of a bucket or tub, but usually nothing large enough seriously to hinder drilling. There is, of course, as a rule a nest of fairly heavy boulders along the present channel or bed of Lightning Creek representing removal of lighter alluvial wash by flood erosion in recent times. The material referred to as "slum"--not seen by the writer--is said, as previously stated, to be a water-laden silt or mud carrying fine sand which "runs" almost like quicksand and is one of the hazards in mining and shaft sinking.

The bottom gravel in the "deep lead" or rich pay ground is "heavy" and bouldery. Also in the Sanderson workings of the rim type of gravel, it is recorded that the miners took out 2.73 half-yard mine cars for each cubic yard of gravel in place, and in addition all boulders larger than a football were "gobbed", that is, left in the mined-out slice. It is said that in extreme cases a phase of the bedrock gravel would look like a cross-section of a pile of eggs with only the interstices filled with finer material, and it is said that in many cases boulders were gobbed back into the empty slice to a height of within a foot of the top lagging. So the swell of the ground is quite large indeed. The boulders themselves are of assorted types normally found in the glacial drift and are said to be mainly hard and unaltered. Boulders the size of a wash tub are common near bedrock, we gather. There is record of one that measured 22' long which apparently is the rare exception. No unusual difficulty in advancing the slices because of inordinate difficulties from boulders was experienced according to the descriptions of the last mining operation.

It is the writer's opinion that areas will probably be found in the shallower or rim type of deposit where it may be feasible to consider seriously a stripping operation wherein all top gravel and overburden would be cast with a long boom shovel or dragline, and the lower pay gravel loaded out into ten or twenty ton pneumatic-tired dump trucks to a washing plant. Drilling of any such areas would determine the feasibility of such an operation in advance of spending any considerable amount of money. It does not appear that the type of gravel or amount of boulders would preclude such a plan of mining.

Type of Gold - The gold recovered in the "deep lead" and Sanderson workings under the old operation at Wingdam would be described as "heavy", but not particularly "coarse" or nuggety. Pieces weighing more than one pennyweight are said to be fairly rare. A great deal of the gold comes in colors weighing of the order of 1/10 of a cent to one cent. The fineness is 910 to 915 judging by mint returns we saw covering more than one hundred thousand dollars in shipments.

The writer visited a new operation in charge of Mr. Alfred Brown which is located roughly fifteen hundred feet above the upper or eastern limit of the Lightning Creek property. Brown recently sank a shaft to bedrock and is drifting at the moment in a very high-grade gravel. A pan taken from one of the cars of the bedrock concentration showed wash gravel and sand mixed with angular fragments of the schist or argillite bedrock. Instead of panning down the gravel in the usual fashion, we fingered through the material picking out flakes and heavy colors that would weigh up to a quarter or half pennyweight.

Not much flour gold occurs on Lightning Creek. Although the gold is flaky and flattish, it is "heavy" and easily saved. It is bright in color and amalgamates readily with quicksilver. The latter is used only in the head section of riffles at Brown's operation. From tailings tests at the old Wingdam operation, the operator calculated that an unusually high percentage of gold--of the order of 98%--was being recovered. It is the writer's opinion that a recovery of probably 95% could be expected under the existing conditions, where daily yardage is relatively small and where recovery apperatus is stationary and can be built as elaborately as is desired.

Labor--Kind and Quantity - There is a scarcity of good mine labor in the Lightning Creek section at the moment due particularly to the exodus of younger men to the army and also to the loss of miners to the quartz operations at Barkerville and elsewhere. After talking to the last operator at Wingdam, Mr. Richmond, a competent engineer and smart operator in our opinion, and after making various local inquiries, it is our belief that a good nucleus of, say, twenty-five satisfactory miners could be obtained with no great difficulty. If a substantial operation gets under way, it is likely that additional good under-ground men would be attracted back to the property because of the satisfactory living, housing, and working conditions at Wingdam.

The miners are mainly native Canadians rather than foreign. This has been a mining district continuously for two generations so it would not be a question of importing miners from the outside and teaching them bedrock drifting methods. Miners in the Barkerville district receive \$5.50 to \$6.00 per day at present with muckers receiving 25 to 50 cents less.

Supplies and Machinery--Availability and Types, Custom Duty, Costs, Etc.-- At the present time due to war conditions, mining machinery of almost all kinds is scarce. Prices have increased at least 10% for the most part since a year ago.

Living expenses at Wingdam are reasonable at present. The cost of staple foods and vegetables seems to be slightly less than in the United States. The storekeeper will board and keep miners for \$1.25 per day.

Diesel oil in quantity costs 17¢ per Imperial gallon delivered at the property. Gasoline retails for 40¢ per Imperial gallon in Quesnel and doubtless would be a little less if purchased in bulk at Wingdam.

Wood for fuel costs about \$3.50 per cord. Round, peeled mine timbers 12 to 16 inches in diameter cost 8¢ per lineal foot.

Both American and Canadian or English brands of machinery and equipment are used in the district. The Canadian law exempts placer mining machinery from customs duty, but it is our suspicion that this regulation applies primarily to dredging equipment and might not apply to surface stationary equipment to be used in connection with under-ground workings.

At the present time, the rate of exchange is much in favor of the American dollar. One dollar in the United States money now brings \$1.10 in Canadian money. The costs mentioned above and in this report unless otherwise stated are all in Canadian money and must be reduced by 1/10 for comparison with United States costs of similar items.

Freight Rates - Freight rates on supplies and equipment from Vancouver to Quesnel by rail are 80¢ to \$1.50 per hundred weight or \$16 to

OUTLINE OF REPORT

I.

NATURE AND SCOPE OF REPORT

The purpose of the writer's examination and of this report was to determine for his client whether the property justifies serious further consideration as a probable future profit-maker, and if so, what steps are justified in the light of conditions found on the property.

This, then, is a rather detailed preliminary report, rather than a complete operating report. The latter will be required if favorable results attend the carrying out of the program recommended.

Minor details as to exploration, mining, and general operation - and any results of efforts to calculate the costs thereof down to a fine line - have been omitted for lack of point at the present stage. The estimates we include are believed to be sufficiently close.

Any really detailed cost calculations might be rendered absurd within a matter of months, or even weeks, by rapid changes in costs of supplies, labor, and machinery (and even the tax situation) due to the present war conditions and inflationary trends.

A program for development of the property is recommended - one that is sufficiently elastic to accomodate changes in outside costs and economic factors, as well as changes in mine operation and development made advisable by the encountering of unforseen circumstances and conditions.

Because of the large size of the property, the large gross gold content, the complexity of the operating problems, and the necessity of a rather comprehensive development program, the writer has felt obliged to go into much more than ordinary detail in presenting facts and comment in this report.

$30 per ton. From Quesnel to Wingdam by truck the rate is about $4.00 per ton. So, for the rank and file of mining material and supplies in less than carload lots, a rate of $30.00 per ton ($27.00 U.S. at present) is satisfactory for use in calculations. We were informed that one party with heavy diesel semi-trailer equipment is prepared to haul bulk items such as mining machinery from Vancouver direct to any mining property in the Cariboo for a substantial saving over the above mentioned figure.

Climate and Weather Conditions - To the statements made under "Climate" on page 5 , it may be said that the severe winter climate and six feet of snow at Wingdam would in no way prevent a year-around underground mining operation. It would be necessary, of course, to stock up in the fall with staple supplies such as wood, mine timbers, fuel oil, certain foods, etc. Surface drilling and exploration should by all means be done in the summer and fall seasons. The pumping problem is much simpler during the winter than at any other time of the year as the seepage from surface into the gravels is almost nil.

Shaft houses must be heated in winter as the gold recovery equipment is housed near the head frame. No unusual difficulties, except for short periods, should be experienced from ice and icy conditions if proper planning is carried out and precuations taken.

In the event it were found practical to mine some of the rim gravels by open pit methods, climatic and seasonal conditions would have to be taken very carefully into account. Stripping is difficult in winter and mining of the bottom gravel would be impossible because of the necessity of thawing.

Seasonal conditions in general will have to be carefully watched on account of their relation to the amount of water saturation above the gravels in the deep leads. After areas are mined, the timbers will cave most readily when the overhead weight is increased by water saturation. Subsidence of the ground brings cracks to surface and ground water funnels into the workings. Thus unless the creek is flumed, areas away from the present creek bed should be mined in the summer and fall seasons.

Taxes, Titles, and Regulations - Various fees, licenses, and taxes are charged by the Government in connection with mining operations. At the present time, while the property is idle, the fee for maintaining the claims of the company in good standing amount to about $6,000.00 per year in Canadian money.

The following fees are taken from Schedule A of the pamphlet presented to the writer by the Gold Commissioner in Barkerville and entitled "Regulations and Tariff of Fees, Rentals, and Charges Under the 'Water Act, 1939'":

Domestic Purpose

Application fee, payable on the quantity applied for:

1,000 gallons or less per day - - - - - - - - - - - - - 2.00

And for each additional 1,000 gallons or fraction thereof per day - - - - - - - - - - - - - - - - - - .50

Annual rental, payable on the quantity allowed:

1,000 gallons or less per day - - - - - - - - - - - - - 1.00

And for each additional 1,000 gallons or fraction thereof per day - - - - - - - - - - - - - - - - - - .25

Fluming Purpose

Application fee, payable on the quantity applied for:

10 cubic feet per second or less - - - - - - - - - - -10.00

And for each additional cubic foot or fraction thereof per second - - - - - - - - - - - - - - - - 1.00

Annual rental, payable on the quantity allowed:

10 cubic feet per second or less- - - - - - - - - - -10.00

And for each additional cubic foot or fraction thereof per second - - - - - - - - - - - - - - - - 1.00

Power Purpose

Application fee, payable on the horse-power estimated by the Comptroller:

For 1,000 horse-power or less, per horse-power - .50

And for each additional horse-power up to 5,000 .25

And for each additional horse-power over 5,000 - .10

Minimum application fee - - - - - - - - - - - - - - - - - 5.00

A further fee equal to one-fifth of the application fee shall be payable by every applicant six months after the filing of his application and a like fee every six months thereafter until the application is refused or the licence issued.

Annual rental prior to the operation period, payable on the horse-power estimated by the Comptroller:

For 1,000 horse-power or less, per horse-power - - 0.15

And for each additional horse-power up to 5,000 - .10

And for each additional horse-power over 5,000 - - .05

Annual rental during the operation period, the greater of the following:-

(1) A sum equal to the annual rental payable prior to the operation period.

(2) The aggregate of (a) the sum resulting from multiplying the estimated output of the power plant in horse-power years by the appropriate rate per horse-power year determined under clause 47 and (b), the sum resulting from multiplying the estimated quantity of undxveloped power in horse-power by 5 cents.

There is an additional fee understood to be 40¢ per thousand board feet for timber removed from Crown lands.

It is our understanding that when a mine operation is started in British Columbia with funds supplied from outside the country, all dividends that accrue from such operation may be withdrawn from Canada without restriction; that, however, the original capital investment brought in cannot be withdrawn; that a flat two percent tax on gross value of gold produced is collected by the Dominion Government; that when a mine operation is started in British Columbia, the operator is relieved from normal taxes during a development period of not to exceed three years; and that - as yet at least - there are no "excess profits" taxes in British Columbia comparable to those now current in the United States.

There are Corporation Taxes (with all of which we are not quite familiar) levied by the Provincial Government, but we are under the distinct impression, gained from talking with persons having mine operations both in the U. S. and in British Columbia, that in "B. C." the tax situation now is less onerous than in most mining states of the U. S.

A Gold Commissioner in B. C. has considerable latitude, and, according to the writer's observation, is a most respected individual. The present incumbent in Barkerville is highly regarded by mining people in the Cariboo District. The Provincial Government maintains a mines inspection service mainly for the purpose of compelling observance of safety regulations. This need not embarrass any sound operator.

Titles - Mr. Bryant, the Gold Commissioner, informed the writer that all payments have been made on the Lightning Creek holdings - grant #1077 and some 69 claims-, up to November 1st, nineteen forty-one; that lease on the claims runs for twenty-five years - if all regulations are met - from December, nineteen thirty-five. Work on the 69 claims is recorded to nineteen forty-two. Annual Dominion and Provincial taxes on the Lightning Creek property are understood to total about six thousand dollars.

While the writer assumes no responsibility legal or otherwise for the statement, it is his opinion from perusal of reports and documents, and discussion with the Gold Commissioner, that title to the so-called "Lightning Creek property" covered by this report, is vested in the Consolidated Gold Alluvials of B. C., Ltd., and that they can negotiate for and convey rights to the property. They have given an option, dated 20th September, 1940, to Col. G. S. Piper as lessee, whereby he agreed to develop the property, make certain payments, begin work on the premises by January 5, 1941, etc. This option was extended for ninety days as to the time of taking effect of each of the points in the original instrument, on 27th November, 1940. Col. Piper (judging by copy of document--not certified) on June 6th, 1941 gave an option to Col. J. Maller (the writer's client) conveying the right to assignment of the original option of 20th September, 1940. (That instrument was an operating lease agreement giving lessee exclusive operating control, he to furnish operating capital, ~~be reimbursed for same before profits~~, and profits divided 60% to lessee and 40% to lessor.)

We offer no opinion as to whether Col. Piper can or cannot deliver a satisfactory lease to Col. Maller, but since, as this is written, a con ference is planned between the Secretary of Consolidated Gold Alluvials and the two parties to the last option, for discussion and possible changes in certain details of agreement, the writer refers to his client the matter of security of option, stating merely that a doubt exists.

The writer feels that--omitting consideration of details, size, and schedule of payments under the lease--the original lease agreement of 20th September, 1940 is in general a fair working agreement.

Type of Bedrock - Schist and argillite both as a rule reasonably soft form the bedrock for most of the length of Lightning Creek. It is stated that the bedrock is more altered and oxidized in the deep lead or most recent channel than it is on the old rims such as in the Sanderson mine workings. In the latter place, bedrock could be picked by hand with only occasional use of powder. As a matter of fact, from 1 to 3 feet of bedrock was usually taken in the slices, partly because it was easier to handle than the gravel and boulders above, and partly because the gold carried into the bedrock that far.

In a considerable portion of the Sanderson mine workings in the rim deposits, a clay bed or other compacted layer was used for bedrock where the pay streak was off bottom.

It is stated that in the deep reef drives at Wingdam, even at a distance of 50 or 60 feet below ledge, the schist was soft enough to necessitate regular timbering.

For an open pit or even a dredge operation, the bedrock condition on Lightning Creek is favorable since it is soft.

VII

MINING METHODS

"Deep lead" Practice - It is well to describe briefly here the Australian deep lead system of mining as Mr. D. Campbell Mackenzie installed it at the mine at Wingdam.

The main hoisting and development shaft is sunk in the rimrock at some point opposite the known deep channel outlined by drilling. The elevation of the bottom of the shaft must be 70 or 80 feet at least below the elevation of the bottom of the deep lead channel opposite. A shaft station is cut and a slump for water storage prepared below the elevation at the station. Then a crosscut is driven at an elevation of some 40 feet under the deep lead itself; this crosscut, of course, is in hard bedrock. "Uppers" are drilled at frequent intervals from the advancing crosscut to outline the bedrock profile of the channel and at the same time to provide drainage of water from the channel itself. Then from this main crosscut a so-called "main reef drive" or rock drift is driven under but reasonably near the deep lead or channel. At intervals of one or two hundred feet raises are put up to a point a few feet under the elevation of the bottom of the channel and short crosscuts driven, keeping holes ahead at all times for drainage and safety. When the channel is definitely located, flat drainage holes are fanned out flatwise to accomplish additional drainage points. The reef drive itself may be continued a thousand or more feet in solid rock in this manner for the principal purpose of draining the deep channel which cannot be safely mined while it carries its "lake" of water. Pumping continues at the main shaft for a period of months while the hydrostatic pressure of the water in the channel is measured in the numerous drainage holes from the main reef raise crosscuts. As drainage continues the water pressure diminishes as the water table in the over-lying gravels settles lower and lower toward the bottom of the channel. When it is deemed safe to enter, the channel the crosscuts at the top of the raises off the main reef drives are continued into the channel and a lead drift in gravel is driven right up the channel. In actual practice where drainage of "the country" has been effected to a satisfactory extent, this leading gravel drive is kept in advance of the main reef drive (which is in bedrock) and serves as a pilot drift.

Obviously all of this development work is in wet ground and the work in the deep lead itself is difficult--the more so in proportion to the water in the channel.

In the main reef drives on Lightning Creek the bedrock is understood to be reasonably soft and oxidized so timbering and even double timbering is required. In the gravel drifts in the middle of the channel where the gravel is not cemented--and it usually is not at Wingdam, advance is accomplished frequently by brest-boarding or spiling, or both. Following the placing of each timber set, the caps are bridged, spiles are driven, a false set put in, spiles are driven again, a permanent set is placed, the false sets removed, and the process repeated. Obviously both top and sides must be close lagged. Permanent timber sets are placed at three or three and one-half foot centers.

The gravel is removed by slicing each way from the center gravel drift, the slices being continued to the rim or channel edge ("shoreline" in U. S. terminology). Where a deep channel is narrow as at Wingdam, say, 15 to 30 feet, it is likely that the Welch system (corresponding to our American Longwell system in coal mining) could be employed in some places. This would depend on two things: first, the water content of the gravels--the degree of drainage, and second, the nearness to the top timbers to which any overlying bed of slum approaches.

At any event the actual extraction of deep channel gravels is in no sense unorthodox mining practice. It may be difficult and expensive at times, but the operation is analogous to the extraction of underground metallic ores of analogous value with a soft gob overhead. In mining the channel gravels it is common practice to gob or leave in the slice all boulders larger than a football. These are piled up in the empty slices and help ultimately to reduce the subsidence of the overlying ground. Only the fines are taken out and hoisted, and it is standard practice in Wingdam to hoist the car of gravel rather than to use skips.

The writer is inclined to feel that the Australian system with its costly reef drives and double amount of development work may be unnecessary at Wingdam provided the drainage problem is properly taken care of. It is possible that development work could be halved at no loss in safety by making drainage of the channel by one thousand or two thousand-foot sections the first order of mining (rather than "breaking into the channel") in a "section-by-section" program.

Rim Gravels or Sanderson Type - As the pay ground in this type of deposit may have substantial width, three to five hundred feet, and considerable length, perhaps a thousand or more feet (28 acres are said to have been mined in the Sanderson workings), and since the water drain is in the deep channel on one side or other of this type of deposit, and since the pay gravel of this type is or may be many feet above bedrock, we have a new set of conditions rather unlike those described under the deep lead above. The contour of bedrock or false bedrock, whatever underlies the pay gravel, should be rather accurately known from churn drilling in advance of mine development. A shaft should then be sunk near the lower limit of the deposit to be mined and main haulage development drifts planned in such a fashion that drainage will be effected to the shaft at all times. Mr. Richmond followed some such scheme with the Sanderson workings and laid them out on a panel system with a main haulage through the center of each panel with laterals parallel and longitudinals parallel. Each panel was planned so that it could be mined by retreating from the outer panel limits. Thus a pillar is left as long as possible against the central haulage for protection, or maintained continuously to protect the haulage if the latter is to be used for extraction of gravel from more distant panels.

In other words, a modified panel slicing system not unlike those used in some of the flat-dipping tabular deposits of the Mesabi Iron Range or not unlike some of the panel systems used in flat coal vein mining in the United States is applicable to Sanderson's gravels on Lightning Creek. The details do not need attention here although it should be stated that actual mining in the slices and the advancing in the drifts is similar to that employed in the deep lead channel. Drifts must be advanced by spiling and false setting with timber sets at three or three and one-half foot centers. Boulders are gobbed in the slices. Miners are paid by contract at so much (about $1.50) per cubic yard of material removed, measurement being made of the empty slice at intervals.

The material called "slum", if saturated with water, is a menace in the Sanderson type workings just as it is in the deep lead type. The writer was unable to see this material as the workings were inaccessible at Wingdam, but Mr. Mackenzie states, however, "in the Bonanza tunnel, the gravels were overlain with slum which has the water drained out of it. Under these conditions it is one of the easiest and safest materials to mine I have ever seen. Loaded with water the slum becomes a menace and is the primary cause of the many abortive and expensive attempts to open up this property." The writer is inclined to agree thoroughly with the above statment of Mr. Mackenzie. The question then remains: 'How long does it take, when it exists in beds or "lakes" in the main channel, to drain this slum to such an extent that it will stand up and not run through drill holes or into the workings!' This would have to be determined as work progresses on the Lightning Creek property and would have considerable bearing on the overall economics of any future operation.

Modifications Suggested - As to the Australian deep lead method of mining, whether or not the reef drive method of development could be abandoned in favor of a simpler system must depend again on a solution of the drainage problem. More money spent in draining the channel thoroughly by sections of, say, 1,000 feet length might save many thousands of dollars in development cost per unit of length of channel.

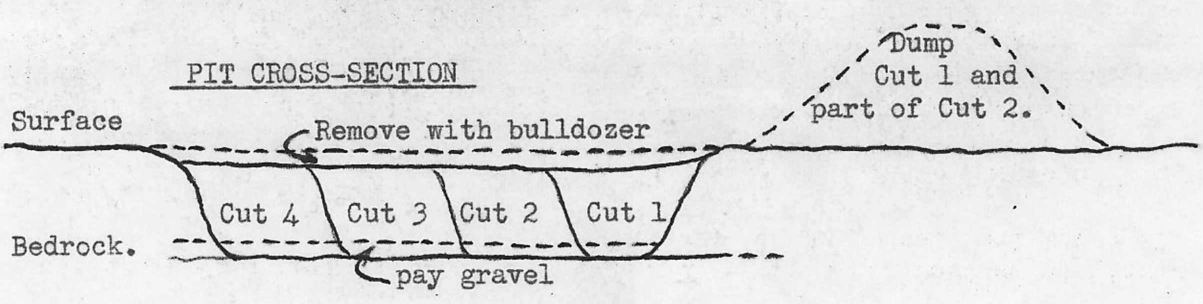
The writer has had experience draining an area underlain by about 100 feet of glacial till in the Lake Superior region where Layne and Bowler wells and vertical shaft pumps were used. Four to six thousand gallons per minute were pumped from such holes at times. The system was reasonably satisfactory but very expensive. In the Lightning Creek channel which is relatively narrow the writer is prone to suggest that, principally with the matter of timing in mind, drainage of sections of the channel by shafts might be supplemented by digging sump holes from surface with a long boom Caterpillar--mounted dragline shovel of five to eight yards capacity. With the creek in a flume such sump holes with some such dimension as 100 yards long by 20 yards wide could be dug across the channel. Using an arbitrary one-to-one slope for the sides, each hole thus planned would require the casting out of around 300,000 yards of gravel and take perhaps 60 days. The shovel, of course, would dig under water. However, after a hole had been started a centrifugal pump on a floating scow--as used to maintain the level in dredge ponds--could be used to lower the water level as the water drained from the surrounding country into the sump. The drawing or drainage area of such a sump obviously would be considerably larger than the drainage area of a shaft sunk for similar purposes, and the rate and volume of water pumped out into the nearby flume would be much larger. The draining of the channel would be much more rapid, since the space limitations in shaft sinking would not be present. Thereafter the sinking of the shaft for hoisting purposes should be greatly facilitated because of the relative dryness of the gravels penetrated. The current cost for making such sump holes would be between five and ten thousand dollars each, in other words, more or less equal to the cost of a shaft. There appear to be certain advantages, however, to the sump hole idea. After a sump had been finished to the ultimate depth desired, say, 100 feet, it would be a relatively simple matter to maintain a permanent pump station in the bottom.

No special modification need be suggested for the actual extraction of pay gravel from underground, although doubtless some modifications would be made from time to time in the light of conditions encountered.

Stripping and Open Pit Possibility - If it were not for the experience gained by many contractors and dirt movers in the United States in the last few years, it would be with some temerity that we offer the following suggestion. However, with the advent of bulldozers, 12 to 20 cubic yard "carry-alls" of the LeTorneau type and the development and current use of huge pneumatic-tired dump trucks carrying 30 to 40 tons at a load and served by power shovels of capacities up to 15 cubic yards (32 cubic yards in an extreme case)--costs of stripping and moving ground have been reduced to such an extent that the economics of mining superficial deposits has been changed.

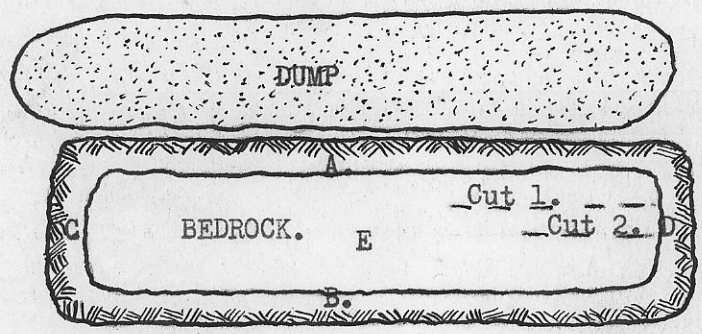
We are not recommending herewith that our client dive in to the mining of the shallow Lightning Creek gravels with this method in mind, but it is a distinct possibility, and we are prepared to prophesy that it may at some time in the future be used for the mining of the Sanderson type or shallow rim gravels on the property.

Let us take a theoretical case analogous to that actually experienced at the Sanderson mine workings.



STRIPPING PLAN

Scale 600' = 1"



Referring to the Pit Cross-Section on last page, it is common to take off the top 20 or 25 feet with bulldozer and "carry-all"; then the shovel cuts are made in sequence beginning at one side or other. All of the first cut is cast on the ground surface (marked 'dump') and as far away from the cut as possible. As much of cut 2 as is necessary is also cast on the dump. In this case a walking shovel or 'monigan' is better than one mounted on 'cat' treads. Part of the overburden from cut 2 is cast into open cut 1 after the bottom gravel pay has been loaded out and the gold recovered. In the above set-up it is definitely better to have two stripping shovels on the job, each served by a bulldozer and carry-all or "buggy". Cuts 3 and 4 are all cast back into the open cut on bedrock after the pay is removed. Thus, a large part of the overburden is merely cast, and a minimum has to be recast or overcast. In the above sketches, no approach ramps are shown. In actual practice, very likely a small shovel - about $1\frac{1}{2}$ yard would be used in the pit for handling the pay gravel into buggies for transfer to the washing plant. When catterpillars are used to haul carry-alls or buggies (pneumatic-tired dump carts carrying up to 10 or 15 cu. yds. of gravel), and the haul is not more than 1,000 or 1,200 feet, costs under favorable conditions are no more than 10¢ or 12¢ per yard. When the large 6 or 8-yard stripping shovels (draglines in this case) are used to fill the buggies, the shovels are slowed down materially. Thus, the stripping shovels should be allowed to carry on with their short swing casting, and a small dragline or stiff dipper-stick shovel (if boulders are bad) used for taking out the bottom pay gravel for washing.

Referring to the Stripping plan at the top of this page, it is idealized, of course, but is drawn to cover an area of 15 acres, corresponding closely with the area actually mined in the Sanderson workings. For estimate purposes a one-to-one slope is used for the pit sides, although the draglines prefer to dig to as steep a slope as the gravel will stand.

Estimated yardages and costs are given below:-

Yardages

	Stripping	Cu. Yds.	
Areas	A and B	735,000	
"	C and D	153,000	
Center area E		2,525,000	
Corners		43,000	
	Total.........	3,456,000	say 3,500,000

Pay gravel

3 yds. deep times E area 225,000

Costs

Stripping (3½ million yards @ 6¢ per yard).................	$ 210,000.
Mining and washing pay gravel (225,000 yds @ $1.00)........	225,000.
Keeping pit drained and misc. including clearing land, ditching, prospect drilling, etc................	50,000.
Total cost of recovering gold.	485,000.
Expected gross gold recovery - 225,000 @ $3.50 per yd.	$ 787,500
Profit indicated.............	$ 302,500.

Equipment

For the above type of operation the current cost of new equipment may be summarized as follows:

Two draglines - 6-8 yard size..............	$ 300,000.
Cats with blades and rooters, & power units for top stripping and to serve draglines, 2-	25,000.
Pit shovel - 1 or 1½ yard	20,000.
Gravel hauling equipment, cats with 15-yard buggies - two..................	28,000.
Washing plant for gold recovery	27,000.
Total	$ 400,000.

In considering the mining of rim gravels on Lightning Creek by stripping and open pit methods, one most important matter must be kept in mind: All of the pay can be mined and washed,- not merely the bedrock zone one slice (7½ feet) high that carries the principal enrichment.

In the Sanderson mine area, nine drill holes (all of those recently drilled that got "pay") showed an average thickness of the bottom pay gravel of 20.6 feet. We have estimated that only 9 feet of the bottom gravel would be loaded out and washed. We believe that the total gold recovered per acre of rim gravel would be substantially larger if mined by open pit methods than if bedrock drifted.

Obviously, the size and amount of boulders in both overburden and bottom pay will determine whether open pit mining can be done or not. In some places doubtless, it cannot. In others we are reasonably certain it can.

Stripping would have to start at the end of the spring thaw and run-off and should continue to or into the coldest weather, when freezing of the bottom gravels would make gold recovery difficult or impossible.

Mining by this method has the attraction of requiring a minimum of labor per unit of mining done; it has the objection of requiring a large initial capital outlay for equipment. Such outlay would not be made in any event unless several seasons work in advance were outlined by churn drilling - which must be done anyway. Where feasible, the method would materially increase the yearly output of gold and the profit, and reduce the number of years life of the property.

Such an operation as we outlined above would run about as follows: (Assuming ordinary conditions)

	per month	
Capacity 6-yd. dragline 175,000 yds/month......	350,000	(2 acres)
Pay gravel handled - at 3 yards deep	30,000	
Gross gold recovery - at $3.50/yd.	$ 105,000.	

	per season	
Using 6-month season for stripping..............	2,100,000.	
Pay gravel handled..............................	180,000	(12 acres)
Indicated cost..................................	$ 386,000.	
Indicated gross gold............................	630,000.	
Season Profit.		$ 244,000.

This operation would not have any connection with an operation being carried on at the same time in the deep channel gravels by bedrock drifting methods.

VIII

COST OF MINING

Slicing - Mr. Richmond, then General Manager at Wingdam, in his annual report for 1937, states that the Sanderson gravels were mined on a contract basis of $1.30 per cubic yard of gravel in place with the miner receiving a guaranteed minimum wage of $5 per shift and $4 for a helper. Richmond states--and we accept his figures--that the direct cost of mining Sanderson gravels, including all underground costs for mining, timbering, haulage, hoisting, gold recovery and tailings disposal, was $3.75 for the first half of 1937 and $3.08 for the last half of the year. The figure was $3.77 for the year 1936. These costs cover yardages of 47,781 in 1936 and 52,151 in 1937. They should therefore be representative for the extraction of this type of gravel. Richmond evidently was a good operator.

In the deep lead workings Richmond states the direct cost of mining in the Melvin gravels in the first half of 1937 was $18.75 per yard and $8.22 per yard for the last half of the year. During this period 1,822 yards of pay gravel were extracted. It should be noted that the costs of pumping water are not included in these figures. Mr. Richmond makes the further statement which is worth recording:

"The gross costs, including all mining expenses, mine and Vancouver overhead, taxes, and interest on advances from England, and including extensive and expensive repairs to your power plant, were reduced from $9,525 per cubic yard of gravel mined in the first half of 1937 to $8.082 per cubic yard of gravel mined in the second half of 1937; the costs for the month of December being $7.871 per cubic yard. The costs for the last half of 1937 included a charge of $2.053 for development as compared to $1.415 per cubic yard spent for development in the first half of the year, and $1.790 per cubic yard spent for development in 1936, when the gross costs were $9.474 per cubic yard of gravel mined."

The cost of pumping is doubtless included in the above figures.

Elsewhere in the reports a figure of $6.75 per cubic yard is estimated as applying to the mining and removal of the deep lead gravels. It is our feeling that $3 per cubic yard should cover the mining of gravel in the Sanderson type of deposit and $5 per yard in the deep lead type, that is, for slicing, exclusive of pumping costs.

Shaft Sinking - The cost of shaft sinking must vary considerably, the figure depending on whether the shaft is in hard rimrock or in gravel and on the water conditions and amount of pumping required. If one takes Mackenzie's costs, say in 1934, he would find No.1 shaft $90 per foot, No. 2 shaft $60 per foot, Melvin shaft $70 per foot. However, at that time, as we learned from direct inquiry of parties familiar with the operation and as we read in and between the lines of the annual report, Mackenzie's operation was a very expensive one indeed. There was a host of items of overhead which would not be permitted in most mine operations and there were costly delays due to natural conditions which in the light of Mr. Mackenzie's experience should be largely unnecessary in the future.

The cost of a shaft recently sunk by Mr. Alfred Brown near Stanley at a point less than half a mile beyond the eastern limit of the Lightning Creek property was about $36 per foot. We gather that the men doing the sinking were not typical old head men at the job and that appreciable savings could have been made. The cost of peeled round timbers for caps, posts and bearers, 12 to 16 inches in diameter, is currently 8¢ per running foot. The cost of rough lumber, delivered on the property, is $20 per thousand board feet. The planing of lumber usually costs an extra $2.00 per thousand.

We feel that a top figure of $40 per foot should be used for calculations for sinking in the Wingdam district at the present time, although the writer would expect to do the job actually for not to exceed $30.00. We refer to small shafts in the deep lead.

<u>Drifting</u> -- Judging by the record of operations during Mackenzie's and Richmond's time, the cost is about $10.00 per foot. This is not out of line with practice in the United States. One remembers that most of the drifting done during the former operation was in very wet ground which requires closer timbering and more attention to safety. It is believed that with a better job of draining in advance this cost of drifting and general development in gravel should be diminished somewhat.

<u>Drilling</u> -- The cost of drilling drainage holes from the reef workings between July, 1934, and the end of 1935 was a little more than $8.00 per foot. Some of this was Diamond drilling and some was done with post machines and jointed rods. All of it was done under rather critical conditions in wet workings. Thus the cost is very high indeed. However, Mackenzie's experience in this regard is worth noting.

For the drilling of churn drill holes on surface the cost under the Mackenzie operation from July, 1934, to December, 1935, ranged from $2.60 per foot to $3.42 per foot with an average of $3.20. We talked with Mr. Alfred Brown, allegedly the best-known driller in the Barkerville district, and he related his recent experience in doing a substantial amount of drill prospecting just above Stanley. The actual cost of the work apparently was under a $1.50 per foot. For contract drilling, however, we feel that one should use a figure of $2.50 per foot unless a program of, say, 5,000 feet, perhaps using two drills, is contemplated.

Pumping - In the latter stages of the Mackenzie-Richmond operation, cost of pumping water was reduced according to Mr. Haley, then engineer on the job (and with whom the writer recently talked) to around 1 3/4¢ per thousand gallons. The cost of diesel oil is now 17¢ per Imperial gallon delivered on the property. It was somewhat less during Richmond's operation. We calculate that during the period of "draining the country" pumping costs at the property would run of the order of $1,500 to $2,000 per month. To maintain the gravels thereafter and in condition of acceptable dryness the pumping costs should not be more than one or two hundred dollars per month, possibly even less. The above figures are based on an estimated volume of 3,500 gallons per minute during the first drainage stage and 200-300 gallons per minute during the "maintenance" stage.

In the event that it seemed feasible to make power using a low head turbine and generators from the water discharged from the flume into which Lightning Creek is placed, the cost for electricity for pumping, hoisting and other uses would be diminished considerably.

Fluming the Creek - We estimate the cost of fluming Lightning Creek for a distance of 1 mile as about $70,000. Against the gravel in the deep channel, assuming its average width to be 10 yards and depth to be 2½ yards, the flume cost would amount to $1.60 per cubic yard of pay gravel mined. How much this figure should be credited by the amount of pumping charges saved by elimination of loss by seepage through the bottom of the creek cannot now be told, but we would suspect that it would amount to 25¢ per yard. Thus, if one of the greatest hazards that has been experienced in mining the Wingdam gravels in the past can be eliminated by spending $1.60 for "insurance" on each yard of the rich deep lead gravels, that certainly would be a satisfactory and profitable investment.

Our estimate of fluming Lightning Creek for a distance of 1 mile is as follows: (Box to be of 2-inch, 3-inch and 4-inch plank; battens, 1 x 4's; yokes, 6 x 8's placed at 4-foot centers; yoke caps to be 6 x 4's; braces, 6 x 8's; stringers, 8 x 10's or round timber. Box to be 12 x 14 feet or equivalent cross section.)

Lumber for Flume

Item	F.B.M.
Box 14x4, 6x3, 9x2"	92
Bats	12
Yokes, 50 x 4÷4	50
Yoke Caps, 16 x 2 ÷ 4	8
Braces, 24x4 ÷ 4	24
Stringers, 5 x 6.6	33
TOTAL	220 per lineal foot of flume

Flume Cost

1,161,600 board feet of lumber @ $19 per thousand...	$ 22,000
Spikes and bolts....................................	2,100
Labor cost at $3 per foot, say,.....................	16,000
Trestles..	1,500
Preparing berm with power shovel....................	3,500
Contingencies and misc. 10%.........................	4,110
Flume Total............	$ 49,210
Diversion Dam, spill way, and headgate..............	15,000
Contingencies, 10% total estimate...................	6,400
Total Cost of Fluming Creek...	$ 70,610

If the box lumber in this flume is planned on the side next to the water to reduce its co-efficient of roughness to about .01 and the flume given a grade of 1 foot per thousand feet, its carrying capacity would be about 1700 second feet of water. The water would have a velocity of about 10 feet per second. We think this would be satisfactory for carrying Lightning Creek at flood stage.

As such a flume would only lose a head of about 5 feet per mile, and it would gain 54 feet on the fall of Lightning Creek in the mile to be flumed. This head of water with a flow of only 100 second feet would give roughly 450 h.p. output, when the low head turbine and generator is each figured at 80% efficiency. There would thus be nearly 400-500 h.p. available at low water stage. The savings in power cost for one year with Diesel fuel at 17¢ per Imperial gallon would be of the order of $20000. A 450 h.p. turbine-electric generator installation would cost about $23,000.00.

It would be simpler and cheaper, of course, to put the flume at approximately the grade of Lightning Creek because of less trestle work and less cuts and fills. Decision on the feasibility of using the flume for power would have to be made after a preliminary survey on the ground.

During the period of coldest weather, some difficulty would be encountered with ice and freezing in the flume. It would probably be less, however, than in the case of small flumes. Even if it were necessary to turn the water out of the flume for a short period in the coldest weather, such action should not jeopardize mine work since the creek flow is then the smallest of any period of the year and the seepage least due to frozen surface.

Without going into details here, it should be noted that any plan of creek diversion to include utilization of the water, should include consideration of a wood-stove pipe line instead of an open flume.

Power - The cost of diesel plant installation is normally stated as in the neighborhood of $60 for h.p. of capacity for engine and generator. The cost of producing electricity, using diesel power, runs from a minimum of about 1¢ to a maximum of 3 or 4 cents per kilowatt hour, depending on the size of the plant, cost of fuel, etc. For an installation on Lightning Creek of standard diesel and generators with a capacity of, say, 500 h.p. and using the present cost of diesel oil as 17¢ per Imperial gallon, the cost of generated power should be about 2¢. Regardless of the possible development of a water turbine-electric generating plant, a diesel plant would have to be installed for beginning work and retained for emergency and standby. We estimate the total cost for installation of a 500 h.p. diesel-electric plant under present conditions as about $34,000.

Should a dredge field be developed on the Fraser River or the Cariboo Mining District become a more important user of electricity, there is always the chance that power might be available from the transmission lines of an independent power company.

Cost of Getting Started - The following estimate of the cost of getting up for bedrock drifting at Wingdam is based on cost of equipment at present and mainly new or good used equipment. Very likely by 1942 it may be impossible to obtain many items of new equipment, and used material at lower prices may have to be purchased and shipped from isolated points.

Fluming the creek for one mile......round figures......			$70,000
Shaft sinking--2 shafts, 1000ft. apart			
200' @ $30.00	6,000		
160' @ $40.00	6,400		12,400
Cutting sump, shaft station, cross-cutting, and raising into channel..........			6,500
Head frames and trestles. One with sheet metal housing..........			2,800
Change house, gravel house (gold recovery), tool house, hoist house, compressor and timber shed..........			9,000
Heating equipment for change house, etc..........			1,000
Fire protection..........			900
Compressor, hoses, drills, air line, etc..........		$3,500	
Hoists (2), motors, cable, sheaves, etc..........		6,000	
Pumps - 2 1000 g.p.m. with motor @	$2,000		
2 300 " " " @	900		
Columnline, connections	1,200	7,000	
Cars, cages, switches, rails, tools, etc..........		4,700	
Diesel - electric generating plant			
2 - 200 h.p. direct connected to generator @..........	$13,000		
1 - 100 h.p. direct connected to generator @..........	8,000	34,000	
Switch boards, 4500 ft. of transmission line, connections to pump, hoists, etc..........		2,500	
Bulldozer with blade and hoist, one 2-ton truck, and 1 "pick-up" truck..........		13,500	
Misc. tools and gear, warehouse supplies, etc......		8,000	
Machine shop tools and equipment (drill			

sharpener, lathe, drill press, welders, small tools, dies, etc......................	7,000	
Add 35% duties and excise taxes..................	30,170	
		$116,370
Freight on equipment to mine - est........................		3,600
Supply of diesel oil, lubricants, timber, etc............		5,000
Labor on construction and installation, 20 men - 2 mos. and compensation insurance.........................		7,700
Supervision, engineering and current labor, 8 months, while shaft sinking and draining.....................		18,100
Misc. overhead, travelling expense, etc..................		1,500
Contingencies 15% of $243,470............................		37,270
		292,140
Add operating capital to carry labor and supplies to profit stage after draining.......................		30,000
Out of pocket............		$322,140

It will probably be found advisable to install a hydro-electric plant at the end of the flume, where an effective head of 50' is available. The cost would be approximately as follows:

42-inch encased reaction turbine horizontal shaft, such as a Christiana wheel, 500 h.p. at 212 r.p.m. using 100 sec. ft. of water.............	$4,425
Automatic-electric governor for speed control.....	1,200
300 K.W. A.C. generator, used, switch board, etc..	7,000
V-belt drive and pulleys..........................	550
Penstock and pipe line............................	800
Add for duties and excise taxes 35%...............	4,891
Installation, footings, building, spillway, etc...	4,000
	$22,866

The above equipment would utilize 100 second feet of water which is approximately the minimum flow during the year. It would produce about 300 K.W. of power, - sufficient to carry the operation normally.

The sequence of activities - and of spending - would be about as follows: Flume construction and shaft sinking would start at the same time and be carried on concurrently. The lower shaft mainly in rim rock would go faster (and have less water) than the upper shaft, which probably would be sunk in gravel, fairly near the deep lead. It would be for gravel drainage first - later for hoisting gravel and mining. Drifting, draining and pumping would be pursued most vigorously from the lower (west) shaft. After cross-cutting to the channel started, it would hasten, and cheapen the cost, probably, to install a mechanical mucking machine ($2500). During the several months of development, mainly from the west shaft, the channel (the "country") would be draining and no mining could be carried on. Mining would be started with a few crews and more added as working places were made available. Development, however, would have to go on in the channel to keep well ahead of mining and for drainage.

Before the first 1000-section is drained and mined, the next 1000' east toward Wingdam would be partially developed and another shaft started. About this time it would be necessary to start unwatering the Melvin shaft as a part of draining the one-mile section. By the time mining had advanced east to drill section "C", the downstream end of the Mackenzie deep lead development, the entire Wingdam flumed section should be ready to mine, - and the $500,000 estimated by Richmond should be ready to take out. With the section drained and all facilities in, that next section east - of 2000 ft. of channel, should be a very profitable operation.

IX

GOLD VALUES EXPECTED

In the Deep Lead--Evidence from Past Recoveries - There are numerous records of very high values that have been obtained from time to time from sampling and mining in the deep lead. Some of these are worthy of record here. Mr. Mackenzie, in his supplemental report of March 31, 1937, records obtaining single pans carrying .15, 1.47, .85, and 2.77 ounces of gold in gravel cut when the deep lead was first entered in February. Twenty-seven cubic yards (place measurement) from crosscutting the deep lead channel gave 34.54 ounces of gold, Mackenzie states.

In the above figure, "12 square yards of 3 square fathoms were uncovered for a recovery of almost 12 ounces per square fathom". (A square fathom is calculated as containing 8 to 10 cubic yards.) In this case the value would be between 1 1/4 ounces and 1 1/2 ounces per cubic yard. Richmond, in his summary report for the first quarter of 1938, states, referring to the deep lead gravel in the No. 1 downstream raise workings, "the gold values average from 1 to 2.3 ounces of gold per cubic yard of gravel and bedrock mined". Farther along Richmond estimates 10,000 cubic yards in the No. 3 and No. 4 downstream raise workings to contain $150,000 to $200,000 or between $15.00 and $25.00 per yard. He estimates another section in the upstream area between No. 1 and No. 2 raises has not been sufficiently encouraging to warrant estimates of profitable gravel. These are only "moderately encouraging" he says. He records "washing 20 yards of gravel in one of the downstream crosscuts and recovering .95 ounces of gold per cubic yard, and another test on 34.25 cubic yards of gravel that yielded 2.17 ounces of gold per yard. In the No. 1 upstream raise workings he records "yielded 1.13 ounces gold per cubic yard for the first 344 cubic yards mined in this section". His statement follows:

"We therefore can estimate with reasonable assurance that in the Melvin deep channel so far developed we have between $450,000 and $550,000 in possible reserve gold gravels, the major portion of which is in the area adjacent to the No. 1 Downstream Raise workings. This 16,675 cubic yards of gravel should be mined for approximately $250,000 including all expenses, possibly at somewhat lower costs, leaving a very substantial profit." ($500,000 from 16,675 yards would be at the rate of $30 per yard.)

The best evidence we have, however, (for which we have mint returns or records or both) is the total yardage of deep lead gravel mined during the operation. The following table gives this:

Year	Cubic Yards Mined	Ounces of Gold	Gold Value
1937	1821.8	663.89	$ 20,056.80
1938	1050.	419.37	12,581.25
TOTAL	2871.8	1083.26	33,143.05
1938	(Average)	.374 penny weight	$11.54 cu. yd.

 (No pages 41 and 42) [illegible]

It is apparent that the value per cubic yard in the deep lead varies from point to point as mining progresses along the channel. There are rich spots and lean spots. It seems best to tabulate Richmond's estimates for a continuous 2,000-foot section along the deep lead where we have more information than at any other point on the property. This is as follows:

Area	Horizontal Distance	Cubic Yards	Gross Gold (Per Richmond)
1D-1U	530 feet	4425)	$300,000 - $400,000
1D-2D	350 "	2250)	
3D-4D	1150 "	10000	150,000 - 250,000
TOTAL	2030 feet	16,075	$500,000

The essence of this estimate is that in this 2,000-foot strip of channel, one may expect to mine 25 cubic yards for each yard of length of channel, and that each cubic yard thus mined will carry about $30 worth of gold (practically one ounce).

To reconcile the above with the actual mining of nearly 3,000 cubic yards, say, 100 lineal yards of channel would seem difficult. As a matter of fact, it seems plain from a perusal of the detailed map of the deep lead workings that 100 yards of the deep lead was not cleaned out. The deep lead was nibbled at near the No. 1 raise workings and quite a bit of development work done, part of which was evidently regular mining and part of which obviously was for the purpose of drainage. We are inclined to feel that the actual result of mining the deep lead during 1937 and 1938 does not reflect the true average condition of affairs in the channel.

We are prone then to suggest an arbitrary basis for calculation which is as follows: Use an average width of 10 yards, a mining thickness of 2½ yards, an average value of ½ ounce of gold per cubic yard worth $15.50.

Sanderson Type Gravels--evidence from past recoveries.

Here we have much greater evidence to go on. In 1936, 47,780.8 yards yielded $211,141.90; in 1937, 52,151.2 yards yielded $223,640.26; and in the first quarter of 1938, 21,364.6 yards yielded $103,000 (3,328.31 ounces) or an average of 3.12 penny weights per cubic yards. Therefore for this type of deposit an average yield of 2.86 penny weights, or .143 ounces of gold ($4.43 at present price) per yard may reasonably be expected.

Thus, each acre mined should yield a bit more than $50,000 in gold. This checks quite well with actual recovery in the Sanderson area which measures roughly 15 acres on the map and from which, according to the auditor's report, dated October 2, 1940, a atotal of $784,955.49 were recovered between 1934 and 1939.

Normally $2\frac{1}{2}$ yards of bottom material are mined in the rim gravels. One to three feet of the bedrock are taken and the remainder of the gravel above bedrock.

Values from Churn Drilling

It should be stated that the drilling on the Lightning Creek property during the Mackenzie and Richmond operation was with standard Keystone type of equipment using 6" inside diameter casing and $7\frac{1}{2}$ shoe. The common Radford factor in which 100 feet of vertical hole drilled are assumed to equal one cubic yard of material taken out was used in calculations according to Mr. Haley, engineer on the ground for most of the period.

The writer talked recently with Mr. Alfred Brown, a long experienced placer churn driller now working in the area, and found that the technique is standard for placer deposits. Brown stated that occasionally they would strike a big boulder and lose a hole. But on the whole no unusual troubles were experienced except when drilling through the slum. At such times the sludge would run into the casing. By pouring water into the top of the casing to offset the pressure at the bottom this "running" could be prevented fairly well. Since no good values were obtained or expected in the slum the matter is not serious. Brown stated that sometimes they would hit into a nest of boulders. At such times they would pull back the casing, blast and then drive if the boulder could not be chopped out. If this failed at one attempt they would pull the casing and drill an offset rather than take a chance on breaking the casing by excessive driving. A pump-type of bailer was used at all times. The difficulty here is that in the case of heavy gold as at Wingdam, it is necessary to come up fast with the bailer line in order to suck the large colors into the bailer. Doing this has a tendency to draw in gravel and therefore values from outside of the bottom of the casing. No effort was made, Brown stated, to extract any gold from the bottom of the hole after it had been drilled a few feet in bedrock. It is our impression that the drilling during the Mackenzie-Richmond regime was properly done and gave as good results as could ordinarily be expected. Evidently the work had very close supervision. The old drilling done previous to Mackenzie's arrival and as far back as 1903, however, is questionable. The records were not too well kept. Mr. Haley, with whom the writer conferred, and Mr. Richmond went over all of the old records very carefully, making their best interpretations and used the latter in drawing up the drill cross sections, copies of which accompany this report. We would say that in the future when the drill location is known to be in the channel, holes should be spaced quite closely, probably not more than 10 feet apart. This is somewhat costly, but the end would justify the means, we believe. If the deep channel is rich, close drilling will almost certainly give evidence of it, although the values of the pay gravel as determined by drilling may, on actual mining, vary many dollars per yard above or below the drilling result. We would say that gravel values determined by drilling are perfectly acceptable to establish "quality", that is, "probably minable" or "probably not minable" but could not be used for "quantity" within 20 or 30% unless a large enough number of holes is drilled so that the law of averages has a chance to get in its work.

The following calculation is quoted directly from Mr. Mackenzie's report:

"Following are the arithmetical averages on "gutter" values on each line taken from the E line upstream to the A line at No. 1 shaft:

"E	line	74	penny weights per square fathom
H	"	324	"
D		493	"
C		225	"
I		49	"
A		528	"

Giving a mean for this section of 282 penny weights per square fathom."

Using a mining thickness of the pay gravel of 2½ yards or 10 cubic yards per square fathom, the calculation, using a penny weight as $1.50, will be reduced to the following:

E	line	$10.10	per cubic yard
H	"	48.60	"
D	"	73.95	"
C	"	33.75	"
I	"	7.35	"
A	"	79.20	"

Giving a mean value for this section of $39.30 per cubic yard.

This is probably considerably higher than the actual value of the gravel. Taking a more direct comparison, the A line, I line and C lines have an arithmetical average of $43.27 per cubic yard as against actual recoveries for part of this length of deep lead of about $11.00 per cubic yard.

In the Sanderson type of deposit, however, the picture is substantially as follows: Weighted averages of drill hole results on Sections J and BB (holes on Section B are omitted as they were drilled in 1906 and show too high values) show a value per cubic yard for the entire thickness of pay zone of $3.98. Recovery values for the entire yardage mined in the area are $4.43 per yard.

The weighted averages are arrived at as follows:

Cross Section J

Hole	Pay	Drill Value	Product
2a	15'	5.75	86.25
3	27'	5.50	148.50
4	16'	5.50	88.00
5	13'	2.97	38.61
6	12'	8.60	103.20
7	26'	5.75	149.50

Cross Section B-B

Hole	Pay	Drill Value	Product
1	38'	2.21	83.98
2	32½'	1.65	53.62
3	12'	1.00	12.00
	191.5'		763.66

763.66 divided by 191.5 gives a weighted average of $3.98 per cubic yard.

In the above calculation, correction was made in two instances for extremely high values recorded. On Section J, Hole 3 had a 6-foot thickness, running $39.42 per yard and Hole 4, a 6-foot thickness running $80.22 per yard. These were recalculated in weighting.

On the whole, the record of recent drilling in the Sanderson gravels brings out three points.

1. The drill values obtained in these lower grade gravels are reasonably acceptable if used with discretion.

2. Especially high values in the bedrock zone or in the pay streak must be regarded with suspicion.

3. With the thickness of gold-bearing gravel indicated in the above drill results, it is obvious that the bedrock drifting method of mining recovers only a portion, indeed, of all the gold in the enriched zone.

We note from the old records that a good many holes drilled between 1900 and 1910 were put down with a so-called "jetting-type" of drill. We are unable to develop any yardstick for comparing the values obtained by this method, and we suspect that, using it, there was just as good a chance of condemning an area by inaccurate sampling as of proving its worth.

X

YARDAGE OF PAY GRAVELS - RESERVES

Deep Lead

Proved

Location	Length on Channel	Cu. Yds.	Contained Gold
At Wingdam No. 1 Ra. upstream to No. 2 Ra. downstream	880'	3,333*	$175,000*

* (We are classifying as "proved", one-half of the yardage and values listed in Richmond's estimate of 1938.)

Highly Probable

Location	Length on Channel	Cu. Yds.	Contained Gold
At Wingdam Same as that above under "Proved".	880'	3,333	$175,000
No. 3 to No. 4 downstream raise area.	1150'	10,000 @ 20.00	200,000
No. 4 Ra. downstream, on west to "E" Section.	3000'	25,000 @ 15.50	387,500
	5030'	38,333	$762,500

Possible - purely prospective

Location	Length on Channel	Cu. Yds.	Contained Gold
Five miles of Lightning Creek	26,400'**	220,000**	$3,410,000**

** This is a quite arbitrary assumption. It is arrived at by taking about one-third of the remaining 18-mile length of the property (eliminating the mile at Wingdam). The presence of a deep lead or rich channel for a matter of a mile and a half has been demonstrated near Wingdam. There is evidence of a deep lead on No. 2 cross section at La Fontaine. There is proof of the presence of a very rich bedrock pay streak at the Alfred Brown operation near Stanley that is justifying bedrock drifting whether it is a deep lead or not. Deep erosion channels are commonly consistant in longitudinal profile. Channels do not start, stop, and start again, although values in such channels may do just that. Anyway the weight of geologic evidence that our assumption is sound is probably stronger than the weight of contrary evidence that the channel is not present to the extent that has been assumed.

but no values

there were no values proven below the Costello's shaft at Stanley.

In the Rim Gravels (Sanderson)

Proved

None

Probable

Area

A percentage of 18 miles - see below.	100 acres @ $50,000 per acre	$5,000,000

Possible

A similar percentage as above.	200 acres @ $50,000 per acre	$10,000,000

No account is taken of pillars of pay gravel that may remain and might some day be robbed if the Sanderson mine workings are drained, nor is any account taken of various bars of rim gravel mentioned in the reports as existing at several points on the property particularly where tributary streams debouch into the Lightning Creek drainage. For this reason, we cannot classify any of the rim gravels as "proved".

In arriving at a figure for "probable" and "possible" reserve yardage of the old rim or Sanderson type, we feel justified in again resorting to arbitrary calculation. There cannot be any question in anyone's mind that "there probably is" a very substantial area within the Lightning Creek valley flat that is underlain by the old rim gravels such as were mined in the Sanderson workings at Wingdam.

Estimating the area within the valley flat on the Lightning Creek property as 3,000 acres (an average width of around 1,400 feet for the 18 miles or more of length) we feel justified in assuming that 1/10 of this area may reasonably be expected to be underlain by rim gravels similar to those mined in the Sanderson workings. We are taking 300 acres then for the estimated area of rim gravels on the property. It has been shown elsewhere in this report on the basis of gold recoveries that the gold production per acre from the Sanderson mine was at least $50,000.

This 300 acres or 1/10 of the valley flat would contain, then, $15,000,000.

It is the writer's opinion that conditions justify classifying 1/3 of this area as "probable" pay gravel reserve, and the remaining 2/3 as "possible" or "prospective".

If open pit mining is found to be feasible at various points where the rim gravels exist on Lightning Creek, it is our opinion that due to lowered cost of mining by this method, thus allowing larger areas to be mined, a much larger gross gold recovery will be obtained from the property. On the basis of this expectation, we could, with reasonable propriety, add a few million dollars in the "possible" column. This has not been done.

Probable Gross in Gold Per Unit Length of the Property - Referring to the deep lead, and accepting Richmond's estimate of $500,000 as being present in the 2,000 feet of channel at Wingdam, there would be a gold content of $250.00 per running foot of deep channel.

Taking the gold recovered from the Sanderson workings as $785,000 in a length along Lightning Creek which measures 2,000 feet, the value per lineal foot of channel is $392.00 for the rim type of gravel. This happens to cover only one rim, of course, and there may be a similar deposit opposite on the other rim.

At any rate, for the one mile length of channel at Wingdam between the upper limit of the Sanderson workings and the lower limit of the deep reef drive, there is an apparent total of $1,319,250. This is as follows:

Recovery from Sanderson	$ 785,000
Recovery from deep lead	34,250
Estimated reserve, deep lead.	500,000
Total - 1 mile of Lightning Creek	$ 1,319,250

So far as we know, no one has any facts on the condition or content of the deep lead opposite the Sanderson mine workings. If it were rich enough to mine there - as it is just below - considerable would be added to the gross gold content of this particular mile of Lightning Creek.

The mile of channel at Wingdam above referred to is not known to be richer than any other mile along Lightning Creek: we simply have more facts about the deep lead and rim gravels at Wingdam than elsewhere. If the gold content in the Wingdam mile were applied to the total length of the present holdings, a figure of nearly $24,000,000 would result. It is our opinion that the bed of Lightning Creek from Stanley to the lower end of the holdings will ultimately be proved to contain not less than $1,000,000 in gold per mile in length.

XI

ESTIMATED PROFITS
(On yardages used.)

Ultimate Gross Profit *	Profit per Yd.	Yards		Total
Deep Lead "Proved" gravel	$22.00	3,333		$ 73,326
"Probable"	22.00	3,333	$ 73,326	
	14.00	10,000	140,000	
	8.00	25,000	200,000	413,326
"Possible"	8.00	220,000		1,760,000
Rim Gravels				
"Probable"	1.43	1,250,000		1,787,500
"Possible"	1.43	2,500,000		3,575,000
		GRAND TOTAL..........		$ 7,609,152

Yearly Profits (After operation is under way)

	Profit per Yd.	Profit per Day	Profit per Mo.	Year
Deep Lead				
Mining rate 100 cu. yds. per day				
50 yds. per day in $30 gravel	$22.00	$1100	$33,000	$396,000
50 yds. per day in $15 gravel	8.00	400	12,000	144,000
		$1500	$45,000	$540,000
Rim Gravels: **				
Mining rate 500 yds. per day (bedrock drifting)				
500 yds.	$ 1.43	$ 715	$21,450	$257,400
GRAND TOTAL.......		$2215	$66,450	$797,400

* It goes almost without saying that any estimate of "ultimate gross profit" given in a report on a property such as the Lightning Creek, is given primarily for the purpose of classifying its profit possibilities. Solution of operating problems and adoption of low-cost, large-scale methods of mining might multiply the figure given.

** If open-pit methods (or dredging) is found applicable to some of the rim gravel areas this mining rate, and consequently the profit factor, would be upped several times.

The profit in the deep lead mining might be upped by having four or five shaft operations in one drainage section, the gravel from all being hauled to one central washing plant for gold recovery. Faster deep lead mining will allow lower pumping and drainage time, and a more profitable operation.

XII

ECONOMIC ASPECTS

Lode Possibilities - Mackenzie, in his annual reports of the Wingdam operation, mentions that in his deep lead rock drifts, gold-bearing quartz veins and mineralized zones in the schist were encountered at several points. Assay values ran up to $8.00 per ton, Mackenzie states. He further refers to a "big vein series" in the Melvin schist and expresses the belief that it favors development with depth.

The possibility of developing lode mines on the Lightning Creek property is one to be kept constantly in mind.

Varying Channel Values - Wingdam is some 12 miles below Stanley. Gold values in placer channels usually decrease with distance from the source of the gold. It is known that the upper reaches of Lightning Creek above Stanley were very rich. Williams Creek, near Barkerville, is commonly understood to have produced about $11,000,000 in 2 miles of length. Lightning Creek heads near Williams Creek and is similar geologically. It is rated by the old timers as second in richness to Williams Creek--judging evidently by recoveries above Stanley.

The content of gold per mile of channel should increase as one follows up Lightning Creek from Wingdam to Stanley. This is further suggested by the fact that the gold is more coarse at Stanley than it is (according to report) at Wingdam.

A small dredge tract was drilled out near the lower end of the present holdings on Lightning Creek. It is possible that Lightning could be mined from the lower end where commercial values first begin right up through the canyon below Wingdam.

Valley Flats - There are several broad "bays" in Lightning Creek valley between Wingdam and Stanley. One or two of these look to be almost 1/2 mile wide. If the Sanderson type or rim gravels have been eroded away in these bays, there should be interesting deep channel concentrations nearby. If they have not, then alluring prospects for minable areas of the rim gravels in these bays are presented. With the probability of geophysical work outlining bedrock contours in advance of drilling these broad valley flats are attractive.

Beaver Meadows - Here the drainage has changed course possibly two or three times, and the concentration of gold under such circumstances, while hardly predictable in detail, might easily be Bonanza type under conditions that could easily have obtained.

Alfred Brown Operation - With an operation such as Brown's now carrying on in very rich bedrock gravel at a point only a fraction of a mile above the upper limit of the Lightning Creek holdings, an opportunity is presented for a short range mining program at this point on the property. Advance drilling and, in fact, a mining operation that might develop near Stanley as a result could be carried on concurrently with the major program on the property.

Location - Quesnel, the trading center for Lightning Creek, is located on the main highway to Alaska as projected. The completion within a few years of this main transportation artery is being pressed both for military and industrial reasons. Improvement of the highway is now under way. Future improvement of this road will, in some measure, reduce freight rates from Vancouver to a Lightning Creek operation and reduce the time of going in.

Trends - There is little evidence that the present price of gold will be diminished in the next few years. It is possible that it will be increased by 5 or 6 dollars per ounce.

As the war emergency continues, mining equipment, machinery, and various supplies are sure to become increasingly more difficult to obtain. It will be necessary to use more and more used equipment and that will require more elaborate shop facilities to take care of maintenance.

Costs of all supplies and equipment are now on the increase, although it appears that price-pegging measures in Canada have had better effect so far than they have in the United States.

The increasing price of Diesel oil and increasing scarcity of transportation facilities point toward the attraction of installing hydroelectric power if possible.

Mining labor will not become any more plentiful in British Columbia and its cost will increase in proportion to the increased cost of living.

Against all of these trends, which in general are unfavorable to future mining operations in costs, there is the condition that both England and Canada are anxious to enhance their production of gold. This,--primarily to facilitate foreign war purchases.

XIII

DEVELOPMENT PROGRAM

This should be divided into several phases listed below approximately in the sequence in which they should be carried out:

I. Short range program near Stanley
   A. Prospecting and geophysical work
   B. Mining and operating

II. Long range deep lead mining at Wingdam
   A. Prospect drilling "E" cross-section
   B. Fluming Lightning Creek
   C. Mining and operating

III. Long range mining of rim gravels
   A. Geophysical work - preliminary
   B. Drilling
   C. Mining and operating
      1. By open pit methods
      2. By bedrock drifting as in deep lead

We would get a geophysical crew to spend a week or 10 days near Stanley before starting the short range program there. The crew should first take measurements with resistivity apparatus along a line at holes previously drilled by Mr. Brown, using his depths to calibrate the results of the instruments. If this work showed that geophysics will fairly accurately outline the bedrock profile, the crew should be moved west to a point on the company property, say, 500 feet inside the east line and run a profile there. This would be to determine the best part of the bedrock section in which to start churn drilling.

For I-A above, we estimate that about 20 holes should be planned for. We would select a cross-channel width of, say, 400' at a point just below Alfred Brown's shaft, and first drill 5 holes to bedrock at 100' centers. Then in the most likely section of the 400-foot width the intervals should be halved and a couple of holes drilled at 50-foot centers. Then drilling at 10-foot centers should be carried out in the rich channel itself, when found. Next, the drill should be moved up channel - or down channel - say, 150 feet (not more) and another section of close-spaced holes put down. Fewer holes would be required in the second section for the location of the channel would be more nearly known. If the first section of holes failed to find a rich pay streak, the work would be abandoned.

Cost of 20 holes, each 100 feet deep (using company drill) but contracting hole, fuel and labor.

2,000' @ $2.50 per foot	$5,000.00
Engineering	1,000.00
Contingencies 10%	600.00
	$6,600.00
Geophysical work (preliminary)	1,000.00
TOTAL..............	$7,600.00

I-B - If the channel were located by drilling, the cost of setting up for mining would be approximately as follows:

Fluming or diverting creek, say, for 1,000 ft. @ $4.00 per foot	$4,000.00
Shaft sinking, 110' @ $30.00	3,100.00
Hoist house, head frame, shaft guide, etc......	6,000.00
Mine cars, cage, screen, riffles, sluice, tailings, track, etc......................	1,750.00
Hoist, motor, cables, sheaves, etc...............	1,650.00
Compressor, jack, hammer, etc......................	3,500.00
Diesel engines 2 @ 100 h.p. and generators @ $6,000 each, switch boards and wire, etc......................	13,000.00
Timber shed, ~~hoisthouse~~, engine house, warehouse, office, etc.....................	4,000.00
Pumps, motors - 1 - 1,000 g.p.m., 1-300 g.p.m., and columnline.....................	3,650.00
Supply of small tools, greases and warehouse supplies, est.......................	1,000.00
Timber supply, caps, posts and logging..........	600.00
Erection of machinery, freight, and misc. labor......................................	1,000.00
Truck, pickup, and misc. tools..................	3,000.00
Contingencies.....................................	4,645.00
	$51,095.00

Additional working capital before profits. Labor and supply cost for two months............	12,000.00

It is obviously impossible to anticipate what production and what values would be gained from the operation estimated above, but assuming a crew of 20, including the manager, 6 miners, 6 muckers, a hoist man, a top man, a mechanic, 2 timber framers, a truck driver and roustabout, costing about $120 per day for labor, the production from underground should be at least 20 cubic yards of gravel. If this runs one ounce of gold to the cubic yard, which it could easily do judging by the results Alfred Brown is getting, the daily gross would amount to $620 and the profit of the order of $450 per day. This would return the investment in three or four months. If richer ground is struck, like some that Mr. Brown is said to be getting, one might get his money back in a single month and carry on at a profit that would go some distance toward carrying the entire Lightning Creek development. Such a bit of luck is so rare in mining, however, that it should not be expected here.

II Long range deep lead mining at Wingdam would start with drilling (the II-A part) about 8 churn drill holes at 10-foot centers on the E line about 1/2 mile west of Wingdam. As the channel location is known the first hole should be pointed at channel center. Locations following would go toward one rim. When that was found the drill would be moved back to center and started toward the other rim.

Cost of first drill section: -

8 holes - 150" @ $3.00	$ 3,600
Engineering	500
Contingencies, 10%........................	410
Total..............	$ 4,510

As the channel is broad at E line (with values, therefore, perhaps only fair) and narrows going east, it is not unlikely that another shorter section of holes would be justified at a point 375' east (half way to H section). Another line of six holes here would cost about $3500, and would explore about 3125 cu. yds. of channel gravel. This yardage - assuming half-ounce gravel, should contain a gross of $46,875.00.

Program II B and C would by this time have been decided upon. The estimated cost of fluming and beginning mining and operating is given on
39 page 39 under "Cost of Getting Started".

After mining and development are under way, it should be possible to keep 20 gravel crews busy each of two shifts in a 1000-foot channel section. Each crew should make a cut (10 yds.) each 2 shifts for a daily production of 200 yards per day, probably a little more in property drained gravel. This 200 yards should net after costs - $8.000 per yard between Section E and Wingdam, for a monthly net of $40,000. Thus the investment should be returned in about a year. Farther east the narrower channel would cut the yardage, but values should be higher.

Program III, attack on the rim gravels, is in our opinion perhaps even more important than the deep lead mining, but it is more difficult to peg for cost. It would start with a program - probably several months - of geophysical work. This would cost approximately: -

Geophysicist @ $300 per mo. - 7 mos.......	$2,100
1 recorder @ $175 per mo..................	1,225
4 assistants - nontechnical @ $5 per day 6 mos..................................	3,000
Instrument rented, say, $300 per mo.......	2,100
Travelling expense and express............	1,900
Contingencies, 15%	1,550
Geophysical work, 7 mo....	$11,875

It is possible that geophysical work will not result satisfactorily on account of the presence of various sedimentary beds and lenses having different resistivity coefficients. If that were the case, the program would be abandoned after a trial that would cost perhaps $2,000.

Part B, drilling, under program III must be a rather long guess as to cost as the continuation of such drilling programs is usually based on the results obtained as the work goes ahead. If geophysical work outlines in advance, the presence of a large area of pre-glacial rim - at some point above Wingdam - regular cross-section drilling at 100 or 150-foot intervals can start; if not, an eliminative plan must be adapted. The latter must cost more since a considerable part of it must be drilling "for information", whereas, if the rim profiles are approximately known in advance, the drilling will all be "for values" and thickness of pay.

To drill rim gravels we may use a rule of one hole per acre - drilling at about 200-foot centers each direction. Using the purely arbitrary figure of 300 acres - as we did for estimate purposes, page 48, and an average depth of 130' per hole, the cost would be: -

300 holes - 130' depth @ $2.00 per foot - $78,000

No one knows where those "300 acres" are at present, but it is our opinion that one might be justified in planning that much, if necessary, before abandoning the rim gravel phase of Lightning Creek.

What actually would happen is that one would probably select an area in one of the "bays" along the valley flat and spend not to exceed $15,000 or $20,000 drilling out a rim gravel mining set-up. At 1 hole per acre, the rim gravel drilling would cost about six-tenths of one percent of the gold contained in each acre explored.

Part C, mining and operating, of the rim gravel program would follow the prospecting. If open pit methods were considered, an estimate of costs and profits is given on page 33 et. under "Strip Mining". This method is more elastic, recovers more gold per acre, shortens the life of the mine, requires much less labor, is safer, and should be used where possible.

If it seemed best to drift mine the area as was done at the Sanderson mine, the creek would be first diverted, if necessary, by a flume (if a deep lead is also present) or by a dragline cut (which is much cheaper and probably as satisfactory). Then two shafts should be sunk some distance apart and connected together below - this to facilitate drainage, ventilation, hoisting of gravel and handling of timber and supplies. Since the leaner rim gravels must be handled on a larger production basis than the deep lead gravels, larger hoisting shafts and more adequate facilities must be provided for. The costs for setting up and developing a rim gravel area for bedrock drifting would be approximately as follows: -

2 shafts - 125' @ $60.00	$30,000
Gravel development - 1500' @ $10	15,000
Hoists, pumps, gold recovery, underground haulage equipment, and other machinery, etc............	25,000
	$70,000

Power from central station.

With the mine opened up on a panel system and places for plenty of gangs to work, the output should be at least 500 yards per day on which the net profit should be roughly $1.50 per yard. This would be a monthly profit of $22,500.

With office headquarters, bunkhouses, repair shops, general warehouse, etc. at Wingdam (already built) it would be most economic to carry on a substantial deep lead operation with several shafts operating at one time, and one or two operations in the rim gravels all at the same time. Overhead and supervision and engineering costs would be much reduced per unit of gravel mined. Advance drilling and prospecting should be the guide to mining at all times, - and virtually the guaranty of results and profits.

XIV

CONCLUSIONS AND RECOMMENDATIONS

Our conclusions may be summarized as follows:

1. There is ample evidence from company records including mint returns, personal communications, published official bulletins, and from visible evidence of tailings piles on the property, that a substantial amount of gold (actually nearly one million dollars) has been produced from a small area indeed on the Lightning Creek property. See page 14 for figures on recent operation.

2. There is excellent geologic evidence that in general conditions for gold deposition do not vary greatly from point to point along the 18-mile length of the property, although we know that actual values will vary in detail according to the vagaries of placer gold deposition.

3. It is quite plain, from published annual reports of past company operations, from Government reports, and from personal communications and observations of the writer, that mining difficulties on the property in the past have been due to failure to solve mechanical and technical problems of gravel extraction, rather than to any lack of gold values of the order usually classed as commercial in the gravels attacked.

4. It is the writer's belief that proper solution of the problems mentioned above may make available a gross gold recovery from the property in an amount of the order of 20 million dollars, possibly more.

5. Since the gross gold present seems to be so large, it is our opinion that, in the light of present information on the means and devices of solving the operating problems mentioned, there is ample justification for carrying on with the development of the property along the lines suggested in this report.

6. No one should attempt development of the property with the idea of "Get in, take a profit, and get out." It isn't that kind of a property. We believe it justifies the operator's expecting to carry out a long range program (unless war stringencies prevent) for a "million-a-year" operation, and he should be prepared if necessary to advance up to not to exceed $500,000 before profits, if preliminary drilling (costing a few thousand dollars) indicates the progressive expenditure is called for.

Our recommendations are as follows:

1. This fall, try to get an operation going at the extreme upper end of the holdings near where a bedrock drift operation is currently taking

out high-grade bedrock gravels. The drilling and preliminary would cost about $7,600. If that is successful, a mining setup would cost about $63,000 before profits.

2. Start a short drilling program at a point a half mile west of Wingdam pointed toward demonstrating a minable deep lead or channel in the area below the old operation. This would cost about $8,000.

3. Carry out geophysical work - beginning this fall - to see whether that device will indicate in advance of drilling, the bedrock contour and location of deep pay channels at points on the property above Wingdam.

4. Explore the possibility of using open-pit and stripping methods in mining the medium grade, shallow rim gravels where they may be present on the property above Wingdam.

5. Do some preliminary engineering and further calculation on the construction and cost of a mile-long flume near Wingdam for the purpose of diverting Lightning Creek, expecting (or calculating on its feasibility) to use the water thus diverted for generating electric power with a low-head turbine-generator,--see pages 37 and 38.

6. If the program of drilling outlined in paragraph 2 above results satisfactorily, start shaft-sinking for bedrock drifting operation in the deep lead just west of Wingdam,--see page 39.

7. If the paragraph 2 drilling is poor or mediocre, move up the channel one hundred feet and drill another section of holes.

If all preliminary work and prospecting should result unfavorably, the lessee would be "out" approximately the following sums:

Taxes..................................	$ 6,000
I-A Short range prospecting and geophysical work....................	7,600
II-A Deep lead prospecting............	8,000
III-A Geophysical work................	11,875
B Drilling - incomplete............	20,000
Travelling and legal expen. & misc....	5,000
	$ 58,475

It is our opinion that, <u>in the light of present information and prospects</u>, the expenditure of this amount of money on the property is justified, whatever happens.

Earl K. Nixon

Earl K. Nixon

ENGINEER 1937 OREGON SEPT. 11, 1936 EARL K. NIXON

General view of camp at Wingdam. Melvin shaft house is the large building at the right. The sheaves at the top of the shaft are in the "pilot house" above the main roof. The gravel cars were dumped at the top deck into a revolving screen, the fines going from there over Hungarian riffles in a metal sluice housed in the part of the structure resting on trestle bents at the right of the picture. The "over-size" went into bunkers in the building from which it was trammed out from chutes at ground level.

Next to the left of the shaft house right beyond the automobile and road (which is the main highway between Quesnel and Barkerville) is the hoist house. Beyond that is the tile fire proof engine house from which the diesels have been removed.

The group of buildings in the center of the picture is the old No. 1 or Unversagt shaft.

It will be noted that the tailings pile of "over size" which occupies the area between the road and the creek was extended so far to the left that, in effect it moved the creek over. Actually the accumulation of fines unfortunately dumped back into the creek raised the water level and increased the amount of creek water that entered the gravel below.

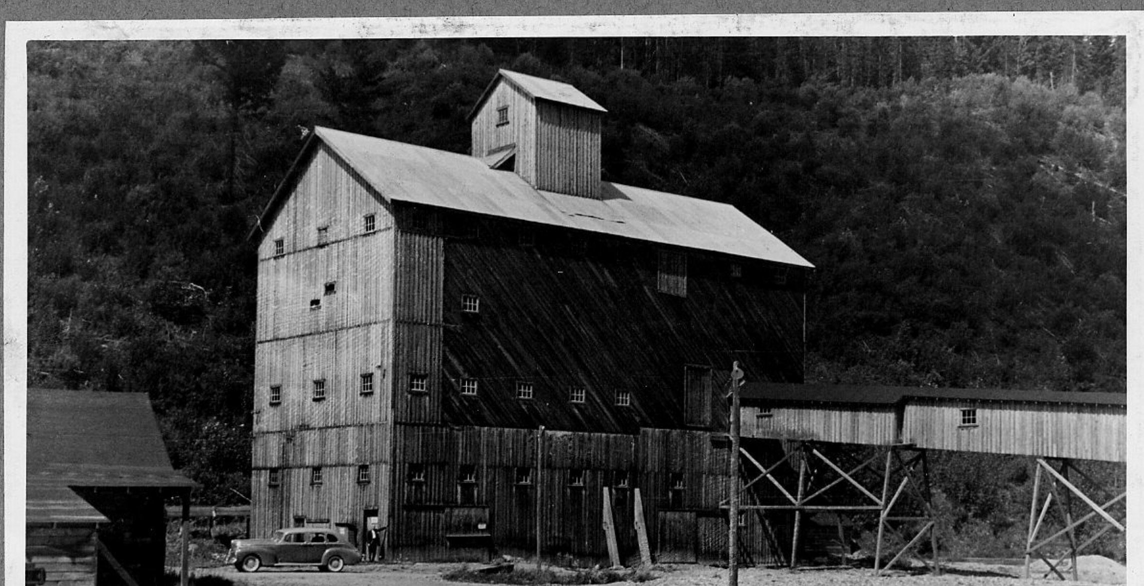
This picture was taken looking from a point marked P-60 on the map opposite Page 85.

The upper picture was taken from the bridge shown at the left on Page 60 and is looking downstream toward the west. At the top of the picture near the right is the four-story bunkhouse capable of housing 100 men. The next small building to the left was the pool hall and recreation building. The next with a sloping porch opposite the light pole is the office and engineering quarters. Farther to the left are the store and post office and other buildings and residences. At the left near the creek is the old building used for a heating plant. The stack shows.

At the center of the picture between the creek on the left and the toe of the tailings dump on the right is the depression representing the point where Lightning Creek funneled into the Melvin deep lead workings in March, 1938, and terminated the deep lead operation. Evidently a portion of the tailings pile went into the cave. Near the bottom of the picture appears a remnant of a plank barrier that was once built as an emergency measure in an effort to keep the creek out of the workings. It originally extended several hundred feet downstream. The first high water took it out.

Near the lower right hand corner of the picture is a box-like structure sticking up 10 or 12 feet through the tailings pile. This is supposed to be a remnant of the casing of the 26-inch Jansen drainage hole.

The lower picture shows the Melvin shaft house to better advantage. Comparison of the size of the automobile and the man standing behind it, with the height of the building will give some idea of the tremendous size of the structure. The left half of the building is entirely unoccupied, in fact, mainly unnecessary.



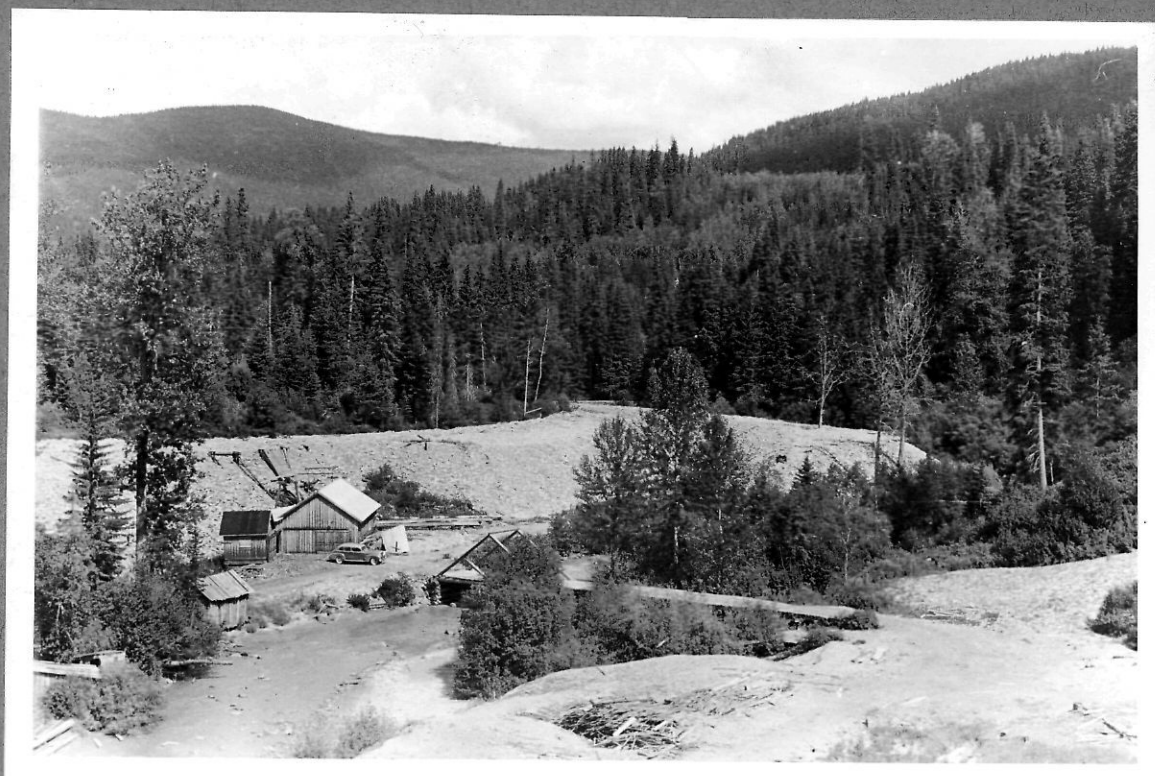
The upper picture was taken looking toward the west from a point higher on the hillside east of point P-60 on the map.

The lower picture was taken from the sawmill building shown at P-62 on the map and is looking toward the northwest.

Note on the hill slope in the left center of the picture a thick layer or terrace of inter-glacial gravel lying against the north hill slope. The hill slope in the lower left-hand part of the picture is inter-glacial gravel on the south side of the stream which has slumped down progressively and made almost a canyon of the creek flat at this point.

The upper picture was taken looking east - upstream and shows mainly the low stage of Lightning Creek at the end of July in 1941. We estimated that less than 100 second feet of water are flowing. The bridge in the picture is also shown on the map.

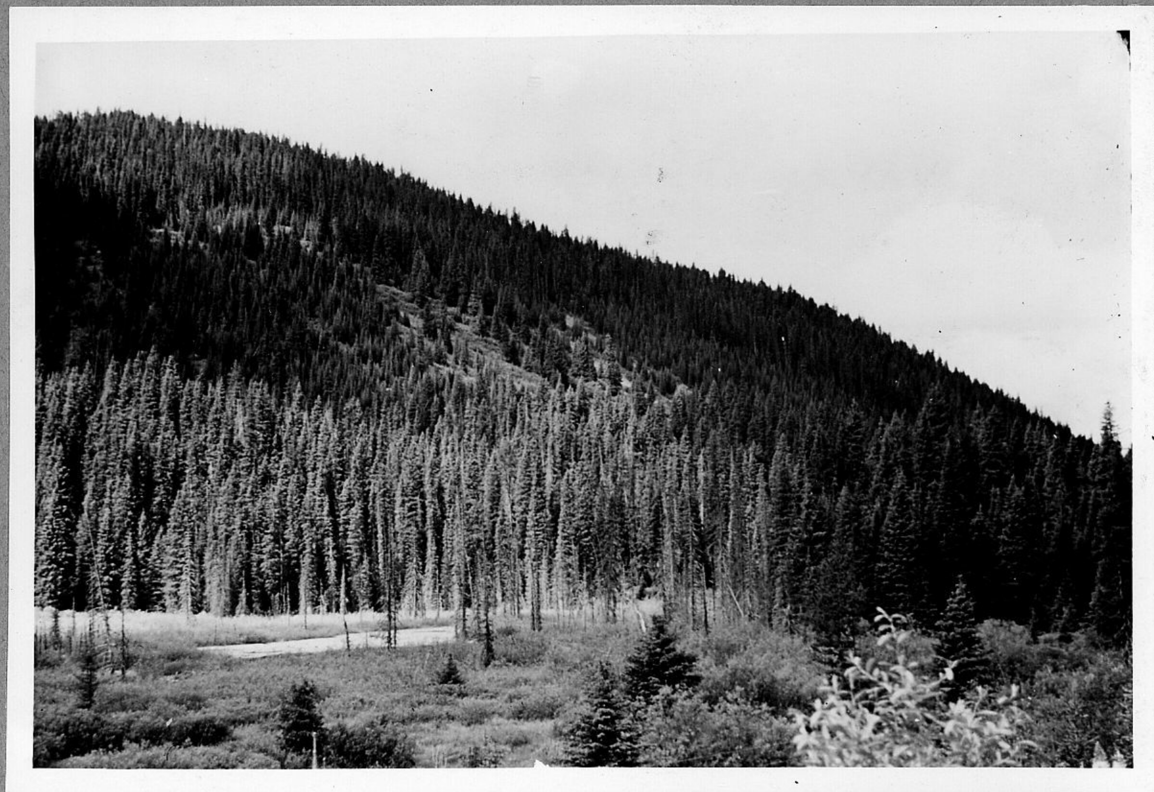
The lower picture was taken from the sawmill at P-62 on the map and shows the nature of the general topography in the back ground. Note a residual "shoulder" of inter-glacial gravel at point marked "A".



This is a panoram looking mainly upstream or east from a point marked P-64 on the map opposite Page 85. The point marked "A" in the print is just about vertically over No. 3 upstream raise of the Melvin deep lead workings. See map Page 85. At "B" the picture shows the top of No. 2 or Sanderson shaft house. The long tailings piles occupying the center of the picture is the over size from the Sanderson workings. At "C" is the bridge shown in the picture opposite Page 63. At the extreme right is the sawmill building shown at P-62 on the map, Page 85.

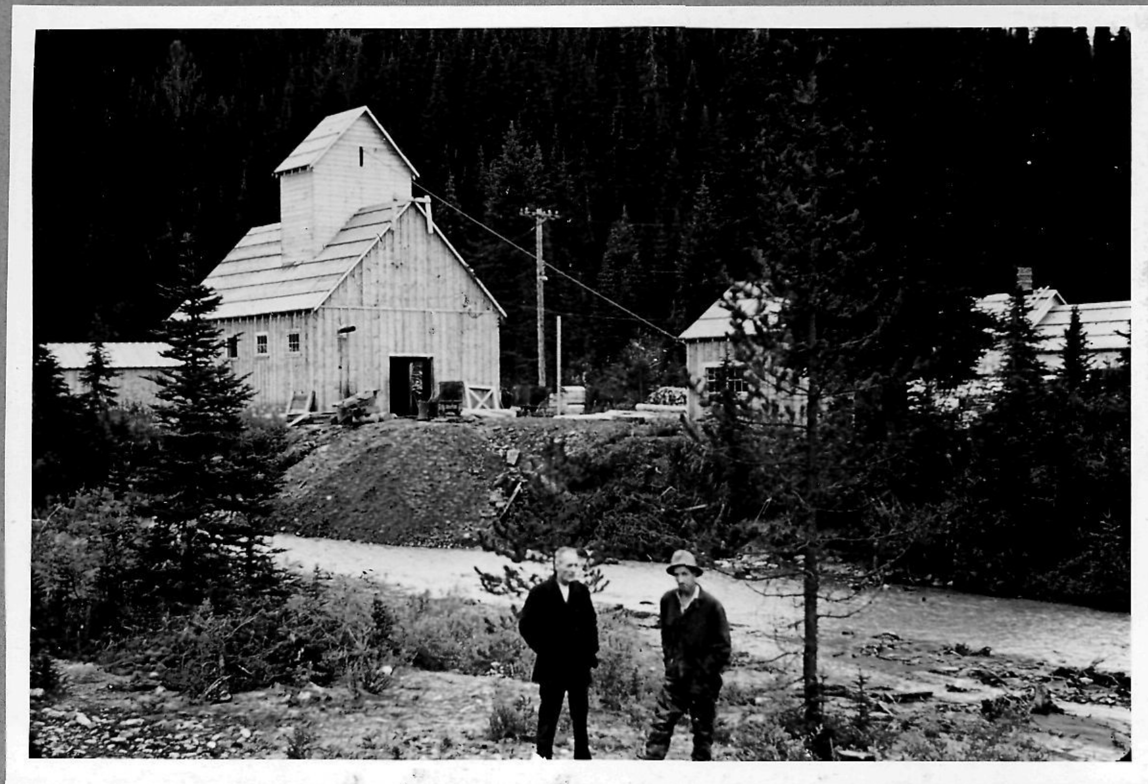
The upper picture is a "bay" or widening of the creek flat some little distance above Wingdam. Note the flatness of the surface profile across the valley bottom.

The lower picture was taken looking downstream from the bridge at P-65 on the map opposite Page 85. The location from which the panoram on Page 64 was taken is shown here. Although the stream is fairly rapid and perhaps 10 yards wide here, it is mainly less than one foot deep. Drift marks at the left of the picture indicate that the extreme rise of the water at flood stage has not been more than three or four feet.



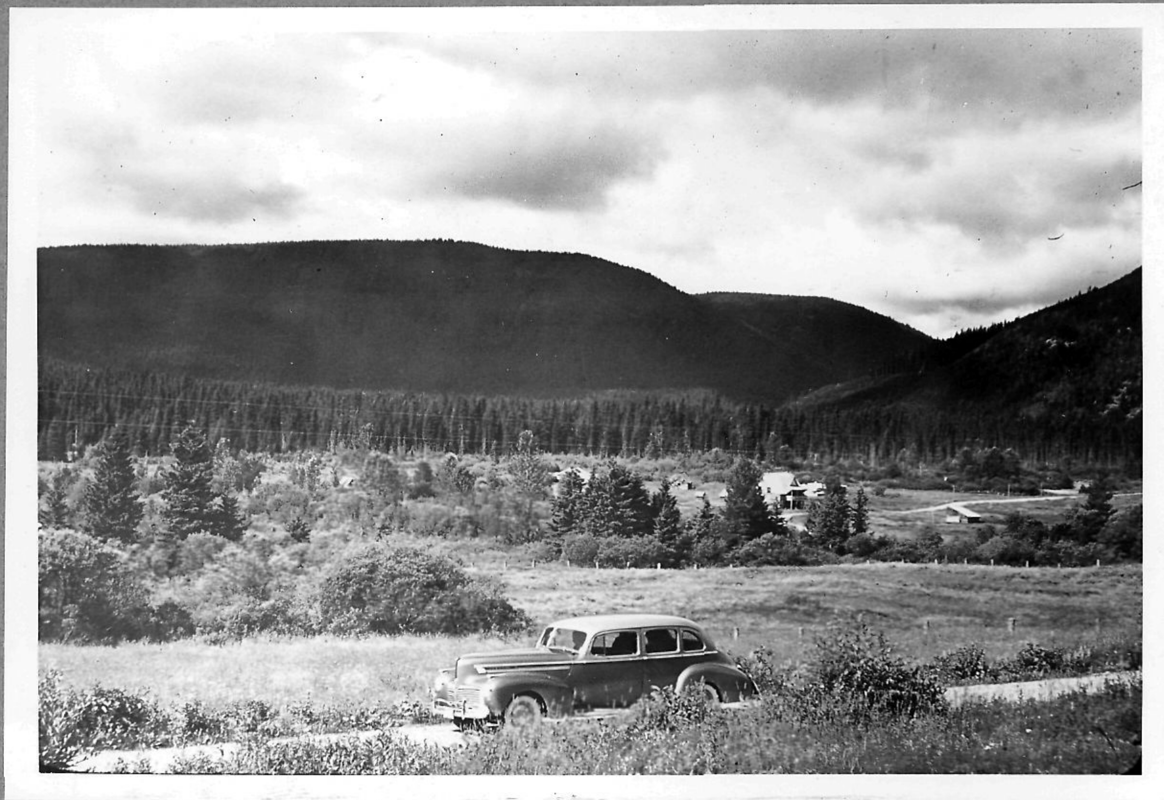
The upper picture shows the Alfred Brown operation about 1/2 mile above Stanley and just above the upper limit of the Lightning Creek holdings. Brown is the man on the right and Colonel G. S. Piper is on the left. Lightning Creek here is somewhat smaller than it is a dozen miles below at Wingdam. Brown's shaft house is the principal structure in the picture. The timber shed is next on the right, then a tool house, and a building housing 2 new 100 h.p. diesel engines direct connected to generators is not shown. Note that Brown's shaft is only about 50 feet from the creek and some of his mine workings must be practically under it, also that he is dumping his waste into the creek and running it out of its water sealed bed.

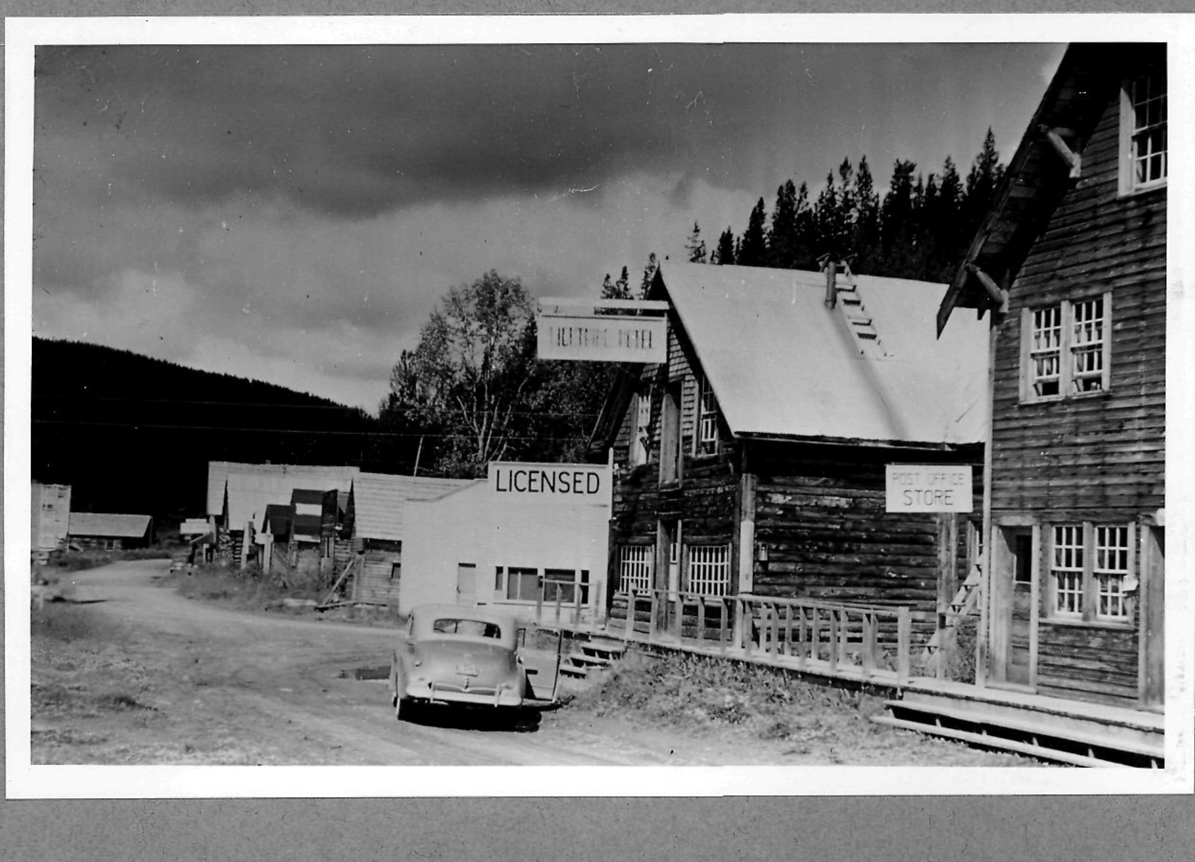
The lower picture shows one of the broad "bays" or valley flats at a point between Stanley and Wingdam. At such points as this, we expect good chances of substantial areas of pre-glacial rim gravels. Here the valley flat is probably 2,000 feet wide.



Another point where the valley has broadened to greater width. Geophysical work in places like this should give bedrock contour with no great difficulty.

Lower picture is looking west down the main and only street of the village of Stanley.



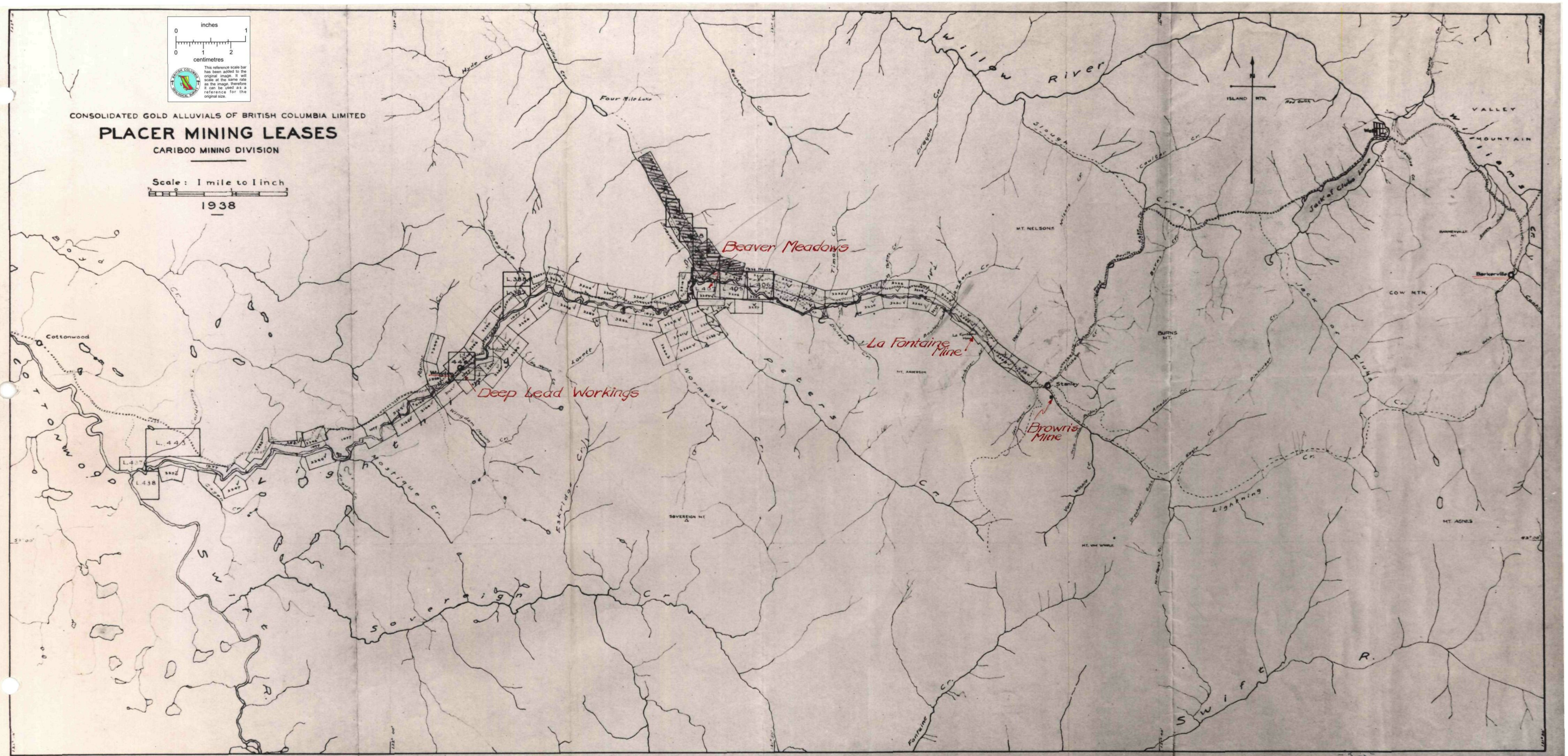

LICENSED
POST OFFICE
STORE

The map opposite this page, on a scale that has been reduced to 8/10 inch to the mile, shows the entire length of Lightning Creek, the claim pattern and holdings of the Consolidated Gold Alluvials of British Columbia, Ltd., and near the right or east edge of the map, the town of Barkerville. Williams Creek, two miles of which just below Barkerville are understood to have produced $11,000,000 or $12,000,000, joins Willow River at the village of Wells, shown on the map at the foot of Jack of Clubs Lake. Near Wells are the present important quartz mines, the Island Mountain, and the Cariboo gold quartz.

Alfred Brown's present bedrock drift operation in rich gravel is shown near the village of Stanley just above the upper or east end of the Lightning Creek holdings.

Wingdam and the principal operation in recent years on Lightning Creek is shown about 12 miles down the creek west of Stanley.

Quesnel is some distance off the map opposite the lower left hand corner.



inches
0
1
0
1
2
centimetres
This reference scale bar has been added to the original image. It will scale at the same rate as the image, therefore it can be used as a reference for the original size.
CONSOLIDATED GOLD ALLUVIALS OF BRITISH COLUMBIA LIMITED
PLACER MINING LEASES
CARIBOO MINING DIVISION
Scale: 1 mile to 1 inch
1938
Willow River
Four Mile Lake
Beaver Meadows
Deep Lead Workings
La Fontaine Mine
Brown's Mine
Stanley
Barkerville
Cottonwood
Cottonwood R.
Swift R.
Sovereign Cr.
Lightning Cr.
Jack of Clubs Lake
Jack of Clubs Cr.
Peters Cr.
Wormwald Cr.
Lovett Cr.
Eskridge Cr.
Mostique Cr.
Fontaine Cr.
Slough Creek
MT. NELSONS
COW MTN.
BURNS MT.
SOVEREIGN MT.
MT. AGNES
ISLAND MTN.
VALLEY MOUNTAIN
L. 443
L. 437
L. 438

The 16 cross sections each on a scale of 100 feet equals 1 inch that follow this page are of the channel of Lightning Creek. The first 14 are in the vicinity of Wingdam; the last 2 are at the old La Fontaine mine located about 2 miles below Stanley. The cross section lines of the first 14 are lettered E, H, D, etc. and their position is shown on the plan map following the cross sections. The cross sections are arranged in proper order from left to right, that is west to east on the plan map. All cross sections are drawn as if one were looking east or up the channel.

Although the differentiation of the sediments may not be exact, it is believed to be approximately correct. Recent reworked valley sediments are shown in green, older deep channel sediments are shown in brown. The oldest or Sanderson inter-glacial and pre-glacial in yellow.

In the upper left hand corner are shown gold values in the pay streaks calculated on a basis of $30 per ounce of gold.

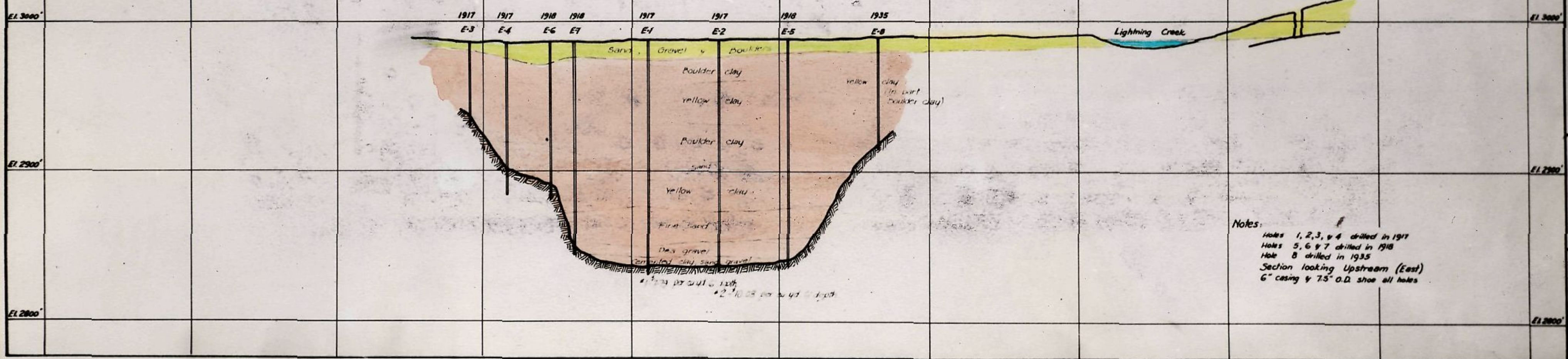
The section letter designation E, H, D, etc. is shown at the extreme right edge in the margin of the section.

These cross sections were drawn from best available information by A. M. Richmond and J. K. Haley, respectively manager and engineer during the last operation at Wingdam.

In starting a long range bedrock drifting program, the writer recommends that drilling for check purposes be started at section E, and that mining begin in that vicinity and continue eastward up the channel until it reaches the deep lead development of the Mackenzie operation.

DRILL HOLE VALUES (Gold @ $30.00 per oz. or 6.25¢ per grain)

Hole #1 - 8.5 grains 146'-150' (bedrock 150') or $0.5313 or $1.73/□' bedrock or $7.79 per cu.yd. 6' depth
#2 - 11 grains 144'-149' (bedrock 149'). or $0.6875 or $2.24/□' bedrock or $10.08 per cu.yd. 6' depth
#3 - 0.5 grains on rim 50' or $0.0313 or $0.10/□' bedrock or $0.46 per cu.yd. 6' depth
#4 - 1 color at 84'
#5 - 0.25 grains 148' (bedrock) or $0.0156 or $0.05/□' bedrock or $0.23 per cu.yd. 6' depth
#6 - No log of hole
#7 - 1 grain at 133'-136' (bedrock 136') or $0.0625 or $0.20/□' bedrock or $0.92 per cu.yd. 6' depth
#8 - No log of hole

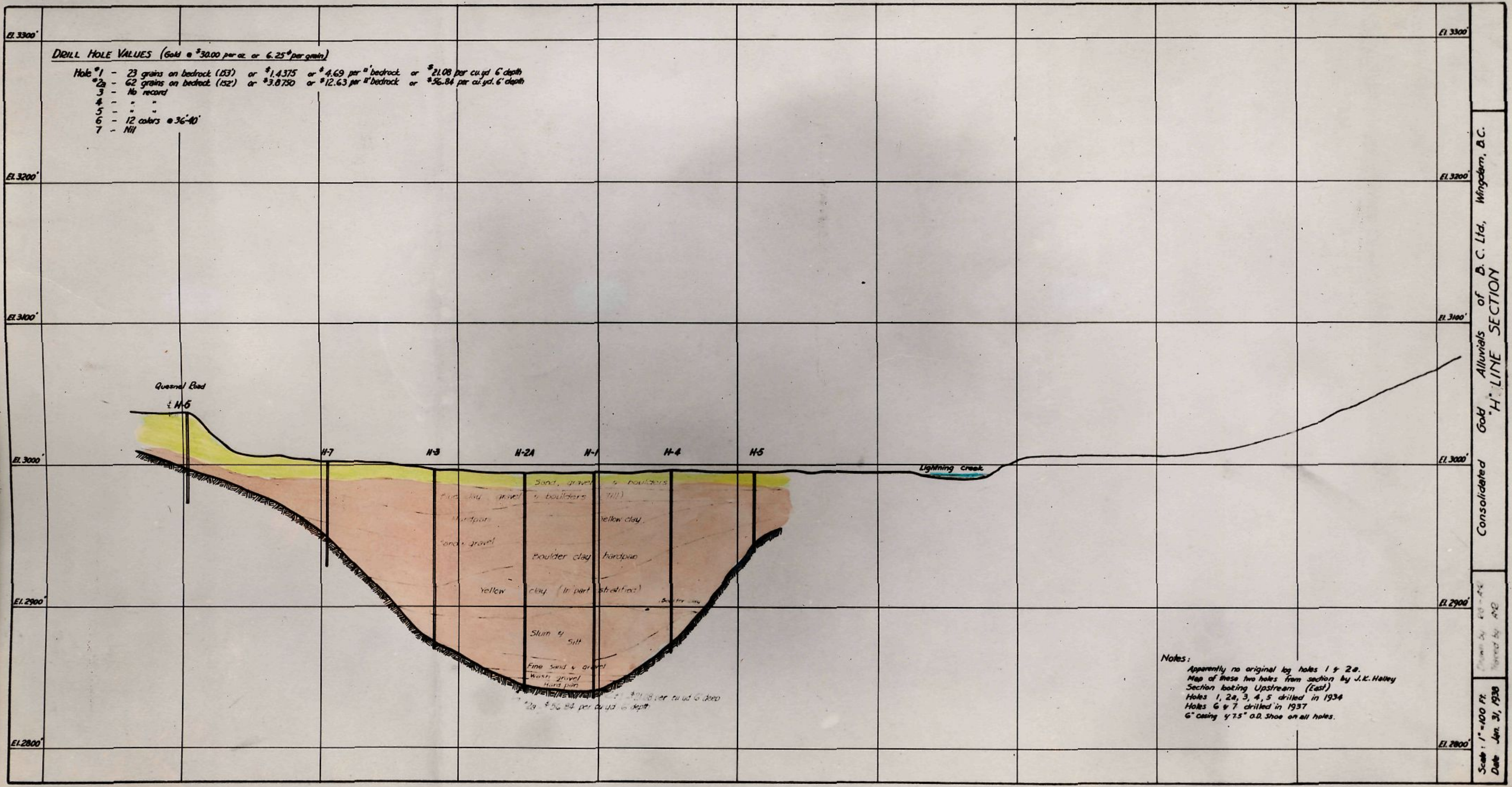


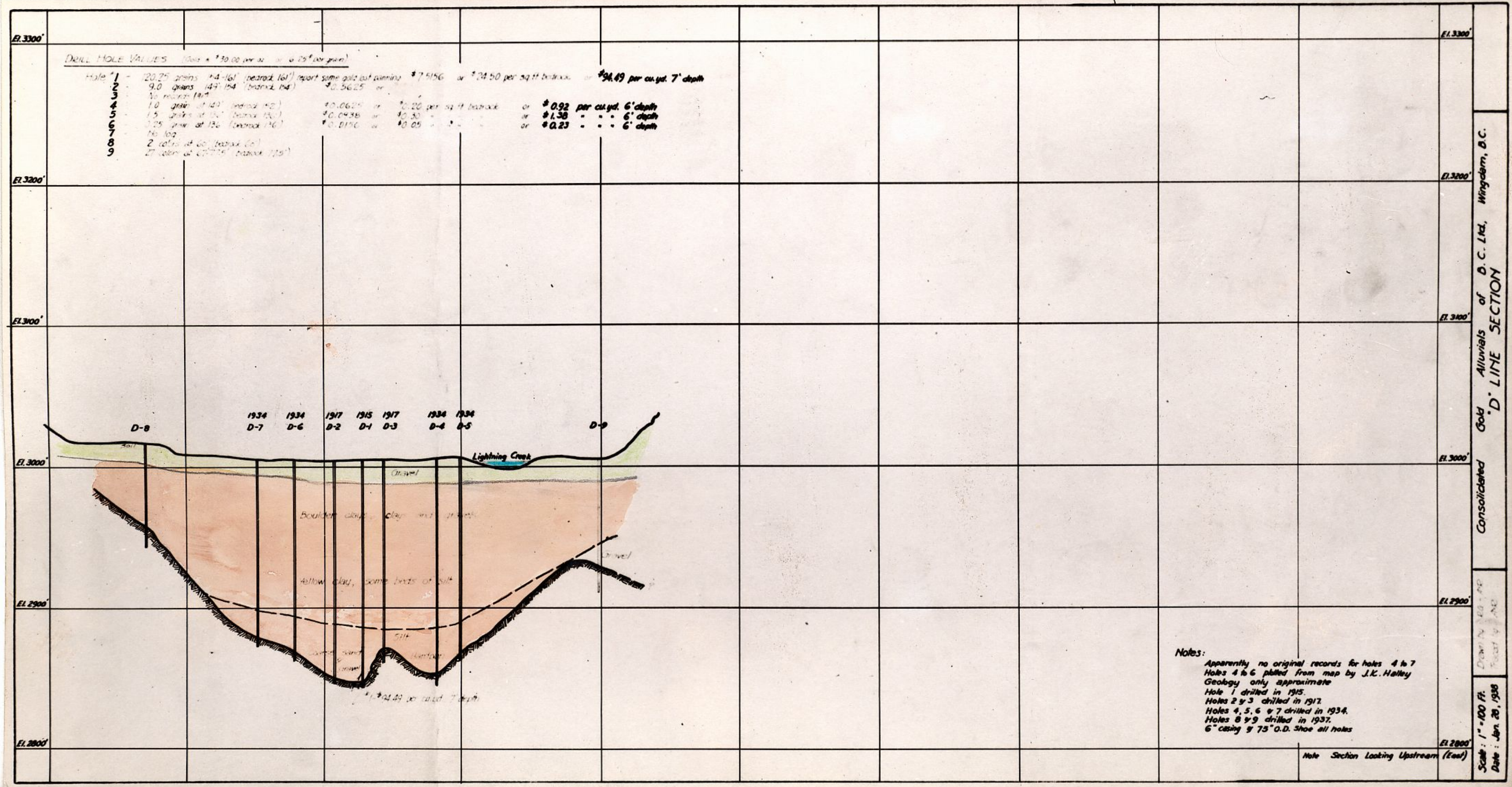
Notes:

Holes 1, 2, 3, & 4 drilled in 1917
Holes 5, 6 & 7 drilled in 1918
Hole 8 drilled in 1935
Section looking Upstream (East)
6" casing & 7.5" O.D. shoe all holes

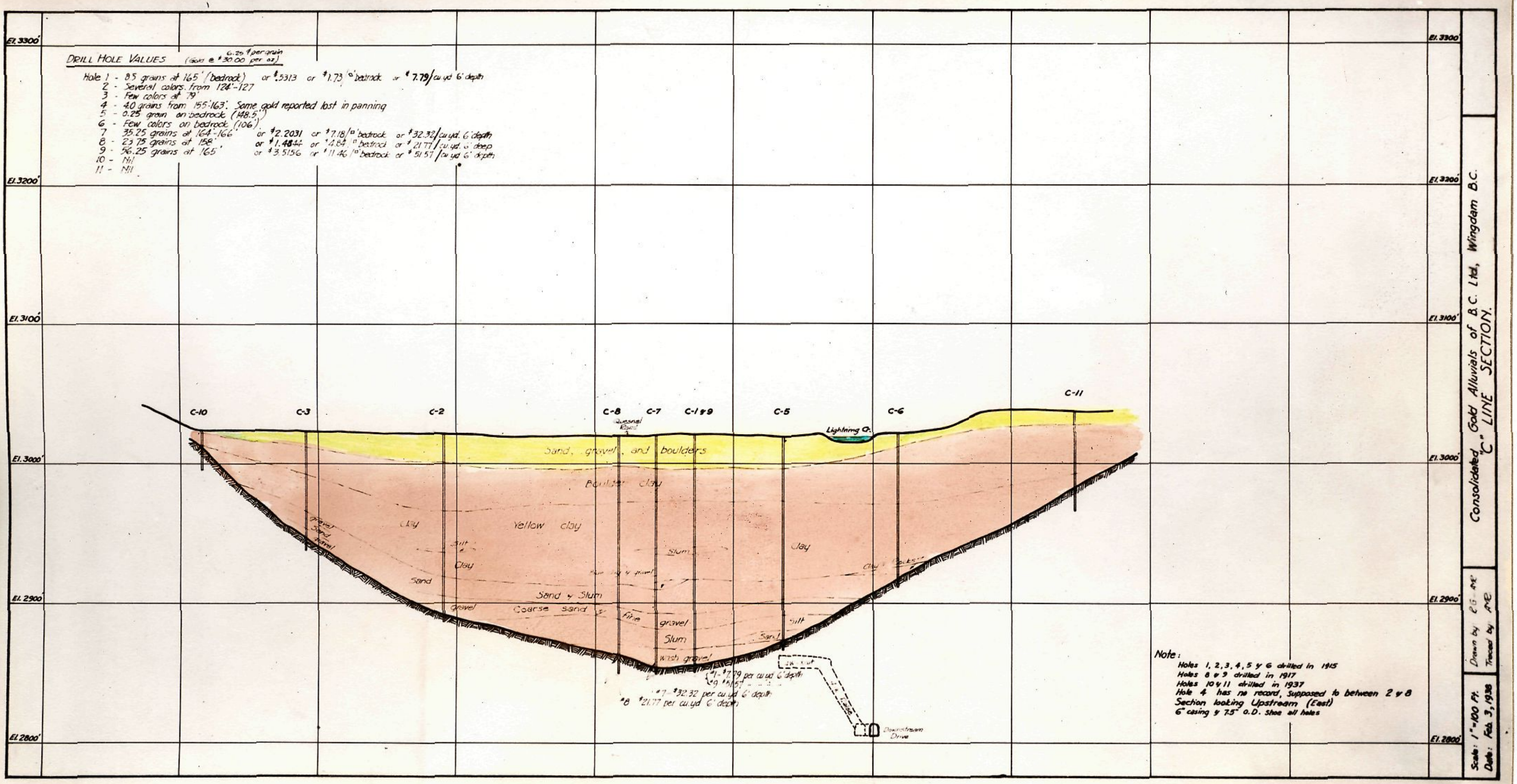
Consolidated Gold Alluvials of B.C. Ltd., Wingdam, B.C.
'E' LINE SECTION

Scale 1" = 100 Ft.
Date Jan. 30, 1938


El. 3300'
El. 3200'
El. 3100'
El. 3000'
El. 2900'
El. 2800'
DRILL HOLE VALUES (Gold @ $30.00 per oz. or 6.25¢ per grain)
Hole #1 - 23 grains on bedrock (153') or $1.4375 or $4.69 per □' bedrock or $21.08 per cu.yd 6' depth
#2a - 62 grains on bedrock (152') or $3.8750 or $12.63 per □' bedrock or $56.84 per cu.yd. 6' depth
3 - No record
4 - " "
5 - " "
6 - 12 colors @ 36'-40'
7 - Nil
Quesnel Road
H-6
H-7
H-3
H-2A
H-1
H-4
H-5
Lightning Creek
Sand, gravel & boulders
Fine clay, gravel & boulders (till)
Hardpan
Yellow clay
Sand & gravel
Boulder clay hardpan
Yellow clay (in part stratified)
Boulder clay
Sluin & silt
Fine sand & gravel
Wash gravel
Hard pan
#1 $21.08 per cu yd 6' deep
#2a $56.84 per cu yd 6' depth
Notes:
Apparently no original log holes 1 & 2a.
Map of these two holes from section by J.K. Halley
Section looking Upstream (East)
Holes 1, 2a, 3, 4, 5 drilled in 1934
Holes 6 & 7 drilled in 1937
6" casing & 7.5" O.D. Shoe on all holes.
Consolidated Gold Alluvials of B.C. Ltd., Wingdam, B.C.
"H" LINE SECTION
Scale: 1" = 100 Ft.
Date: Jan. 31, 1938



DRILL HOLE VALUES (Gold @ $30.00 per oz or 6.25¢ per grain)
Hole #1 - 120.25 grains 154-161' (bedrock 161') report some gold lost panning $7.5156 or $24.50 per sq. ft. bedrock or $94.49 per cu. yd. 7' depth
2 - 9.0 grains 149'-154' (bedrock 154') $0.5625 or
3 - No records 1917
4 - 1.0 grain at 142' (bedrock 142') $0.0625 or $0.20 per sq. ft. bedrock or $0.92 per cu. yd. 6' depth
5 - 1.5 grains at 130' (bedrock 130') $0.0938 or $0.30 " " " or $1.38 " " " 6' depth
6 - 0.25 grain at 136' (bedrock 136') $0.0156 or $0.05 " " " or $0.23 " " " 6' depth
7 - No log.
8 - 2 colors at 60' (bedrock 60')
9 - 27 colors at 67'-71.5' (bedrock 71.5')
El. 3300'
El. 3200'
El. 3100'
El. 3000'
El. 2900'
El. 2800'
D-8
1934 D-7
1934 D-6
1917 D-2
1915 D-1
1917 D-3
1934 D-4
1934 D-5
D-9
Soil
Lightning Creek
Gravel
Boulder clay, clay and gravel
Gravel
Yellow clay, some beds of silt
Silt
Coarse sand & gravel
Hardpan
#1 - $94.49 per cu. yd. 7' depth
Notes:
Apparently no original records for holes 4 to 7
Holes 4 to 6 plotted from map by J.K. Halley
Geology only approximate
Hole 1 drilled in 1915.
Holes 2 & 3 drilled in 1917.
Holes 4, 5, 6 & 7 drilled in 1934.
Holes 8 & 9 drilled in 1937.
6" casing & 7.5" O.D. Shoe all holes
Note Section Looking Upstream (East)
Consolidated Gold Alluvials of B.C. Ltd., Wingdam, B.C.
'D' LINE SECTION
Scale: 1" = 100 Ft.
Date: Jan. 20, 1938


DRILL HOLE VALUES (Gold @ $30.00 per oz) 6.25 ¢ per grain
Hole 1 - 8.5 grains at 165' (bedrock) or $.5313 or $1.73 /□' bedrock or $7.79/cu yd 6' depth
2 - Several colors from 124'-127
3 - Few colors at 79'
4 - 4.0 grains from 155'-163'. Some gold reported lost in panning
5 - 0.25 grain on bedrock (148.5')
6 - Few colors on bedrock (106')
7 35.25 grains at 164'-166' or $2.2031 or $7.18/□' bedrock or $32.32/cu yd. 6' depth
8 - 23.75 grains at 158' or $1.4844 or $4.84 /□' bedrock or $21.77/cu.yd. 6' deep
9 - 56.25 grains at 165' or $3.5156 or $11.46 /□' bedrock or $51.57 /cu yd 6' depth
10 - Nil
11 - Nil
El. 3300'
El. 3200'
El. 3100'
El. 3000'
El. 2900'
El. 2800'
C-10
C-3
C-2
C-8
Quesnel Road
C-7
C-1 & 9
C-5
Lightning Cr.
C-6
C-11
Sand, gravel, and boulders
Boulder clay
Clay
Yellow clay
gravel
Sand
gravel
Silt
Clay
Sand
Slum
Clay
Sand & Slum
Gravel
Coarse sand
Fine
gravel
Slum
wash gravel
Silt
Sand
#1 - $7.79 per cu yd 6' depth
#9 $51.57
#7 - $32.32 per cu yd 6' depth
#8 $21.77 per cu.yd 6' depth
Raise
Downstream Drive
Note:
Holes 1, 2, 3, 4, 5 & 6 drilled in 1915
Holes 8 & 9 drilled in 1917
Holes 10 & 11 drilled in 1937
Hole 4 has no record, supposed to between 2 & 8
Section looking Upstream (East)
6" casing & 7.5" O.D. Shoe all holes
Consolidated Gold Alluvials of B.C. Ltd, Wingdam B.C.
"C" LINE SECTION.
Drawn by R.G. & A.E.
Traced by A.E.
Scale: 1" = 100 Ft.
Date: Feb. 3, 1938

DRILL HOLE VALUES (Gold @ $30.00 per oz or 6.25¢ per grain)

Hole #1 - No gold
#2 - 10.8 grains 159'-163' (bedrock 163') $0.6750 or 6' @ $9.90 per cu. yd.

El. 3300'

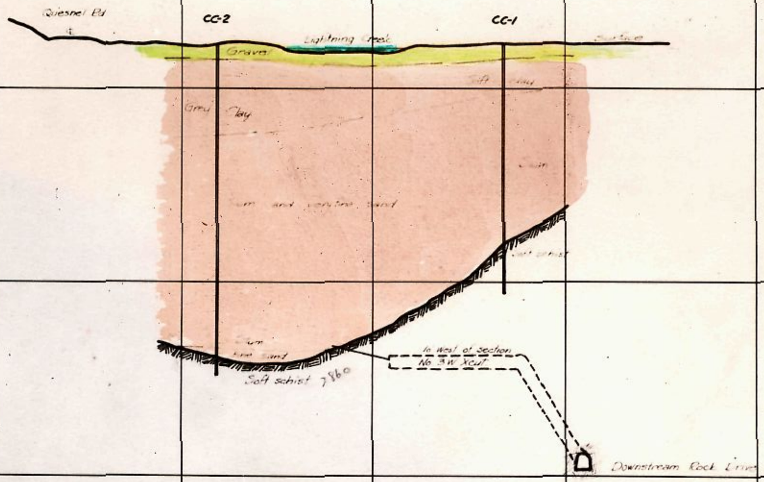
El. 3200'

El. 3100'

El. 3000'

El. 2900'

El. 2800'



Notes:
Holes drilled in 1937
Section looking Upstream (East)
All holes 6" casing 7.5" O.D. Shoe.

Consolidated Gold Alluvials of B.C. Ltd., Wingdam, B.C.
"CC" LINE SECTION

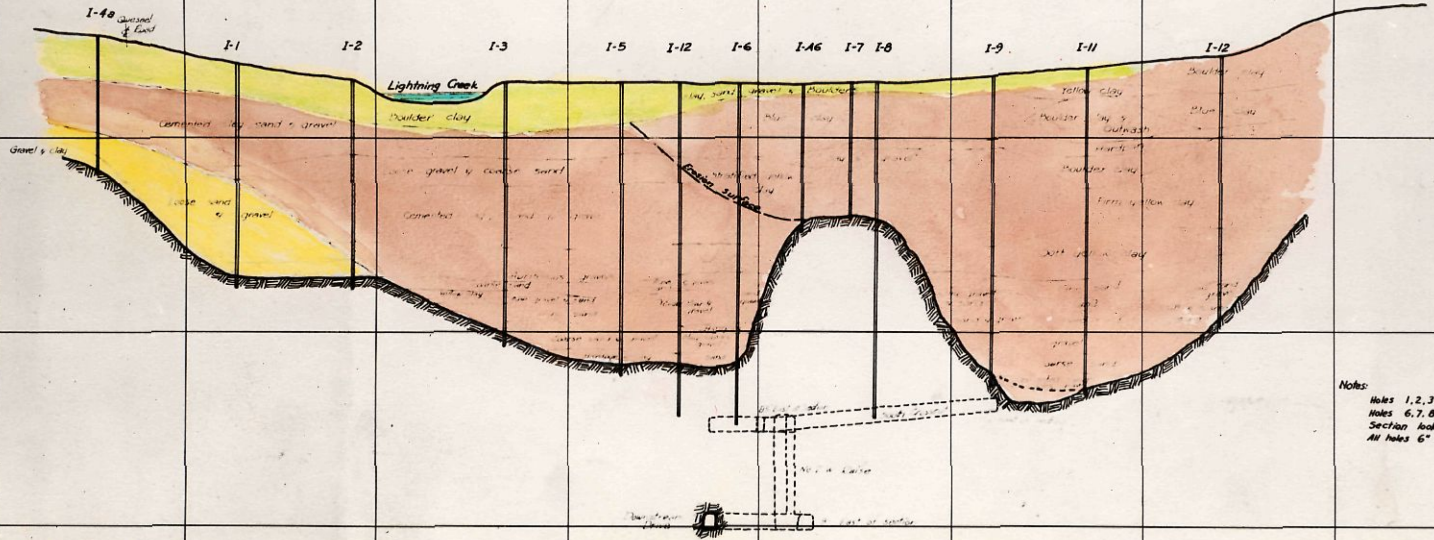
Drawn by
Traced by

Scale: 1" = 100 Ft.
Date: Feb. 1938

Consolidated Gold Alluvials of B.C. Ltd, Wingdam, B.C.
"I" LINE SECTION

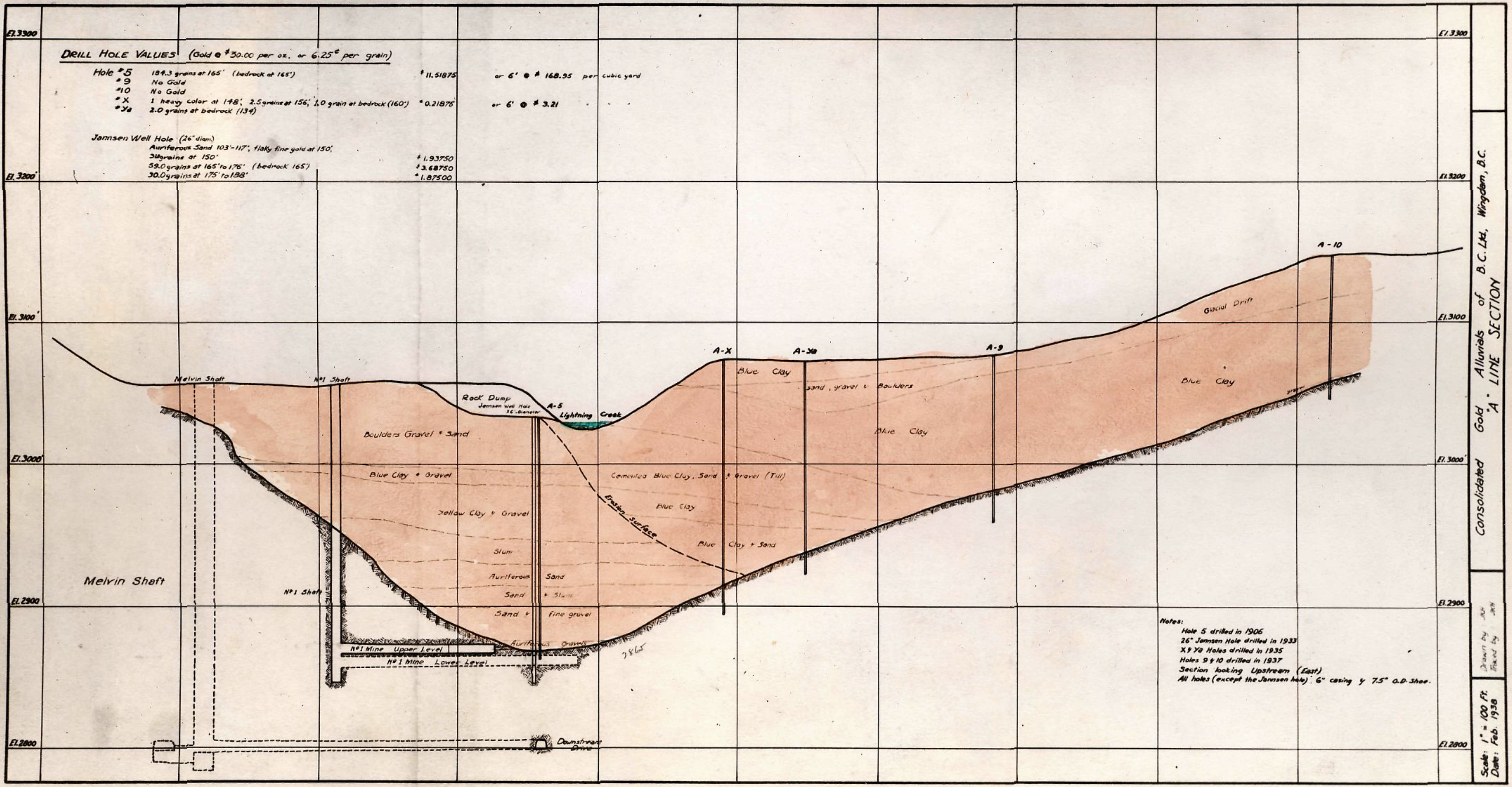
DRILL HOLE VALUES (Gold @ $30.00 per oz or 6.25¢ per grain)

Hole	Values	Bedrock	Value	Thickness	Per cubic yard
Hole #1	Colors at 85'				
	1.5 grains at 109'-111'	(bedrock 111')	$0.0938	or 2'	@ $4.13 per cubic yard
Hole #2	5.0 grains at 84'-91'		$0.3125	or 7'	@ $3.93 " " "
	3.0 grains at 101'	(bedrock 101')	$0.1875	or 6'	@ $2.75 " " "
Hole #3	Colors at 72'-76'				
	4.5 grains at 84-90'		$0.2813	or 6'	@ $4.13 " " "
	Colors at 94'-98'	(bedrock 130')			
Hole #4a	No gold				
Hole #5	1.0 grain 72'-76'		$0.0625	or 4'	@ $1.38 " " "
	0.25 grain 76'-81'		$0.0156	or 5'	@ $0.27 " " "
	1.0 grain 81'-86'		$0.0625	or 5'	@ $1.10 " " "
	1.75 grains 90'-95'		$0.1094	or 5'	@ $1.93 " " "
	6.0 grains 137'-146'	(bedrock 146')	$0.3750	or 9'	@ $3.67 " " "
Hole #6	1.0 grain 72'-79'		$0.0625	or 7'	@ $0.79 " " "
	12.5 grains 85'-90'		$0.7813	or 5'	@ $13.75 " " "
	2.0 grains 97'-99'	(bedrock 144')	$0.1250	or 2'	@ $5.50 " " "
Hole #7	No gold				
Hole #8	24 colors 64'-69'	(bedrock 69')			
Hole #9	14 colors at 123', 9 colors at 145', & 12 colors at 154'	(bedrock 154')			
Hole #10	Colors at 35'-37' and 48'-53'	(bedrock 136')			
Hole #11	No gold				
Hole #12	0.92 grains 71½'-78'		$0.0575	or 6½'	@ $0.78 per cubic yard
	2.92 grains 84'-90'		$0.1825	or 6'	@ $2.68 " " "
	3.0 grains 90'-96'		$0.1875	or 6'	@ $2.75 " " "
	0.83 grains 96'-101'		$0.0519	or 5'	@ $0.91 " " "
	0.08 grains 101'-105'		$0.0050	or 4'	@ $0.11 " " "
	1.5 grains 105'-115'		$0.0938	or 10'	@ $0.83 " " "
	0.11 grain 126'-143½'		$0.0069	or 17½'	@ $0.03 " " "
	6.75 grains 143½'-145'	(bedrock 145')	$0.4219	or 6'	@ $6.19 " " "

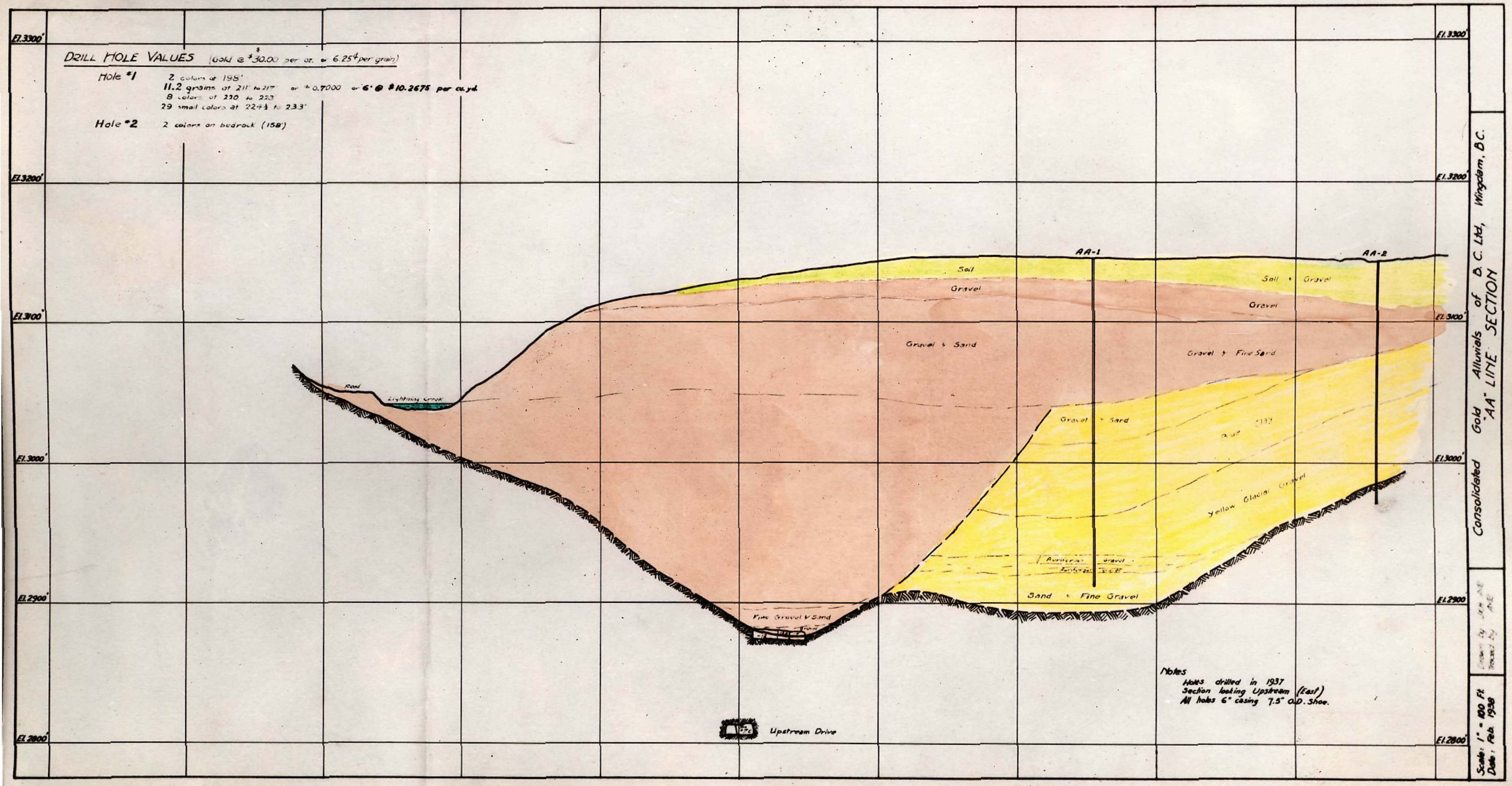


Notes:
Holes 1, 2, 3, 4a & 5 drilled in 1934
Holes 6, 7, 8, 9, 10, 11 & 12 drilled in 1935
Section looking Upstream (East)
All holes 6" casing & 7.6" O.D. Shoe.

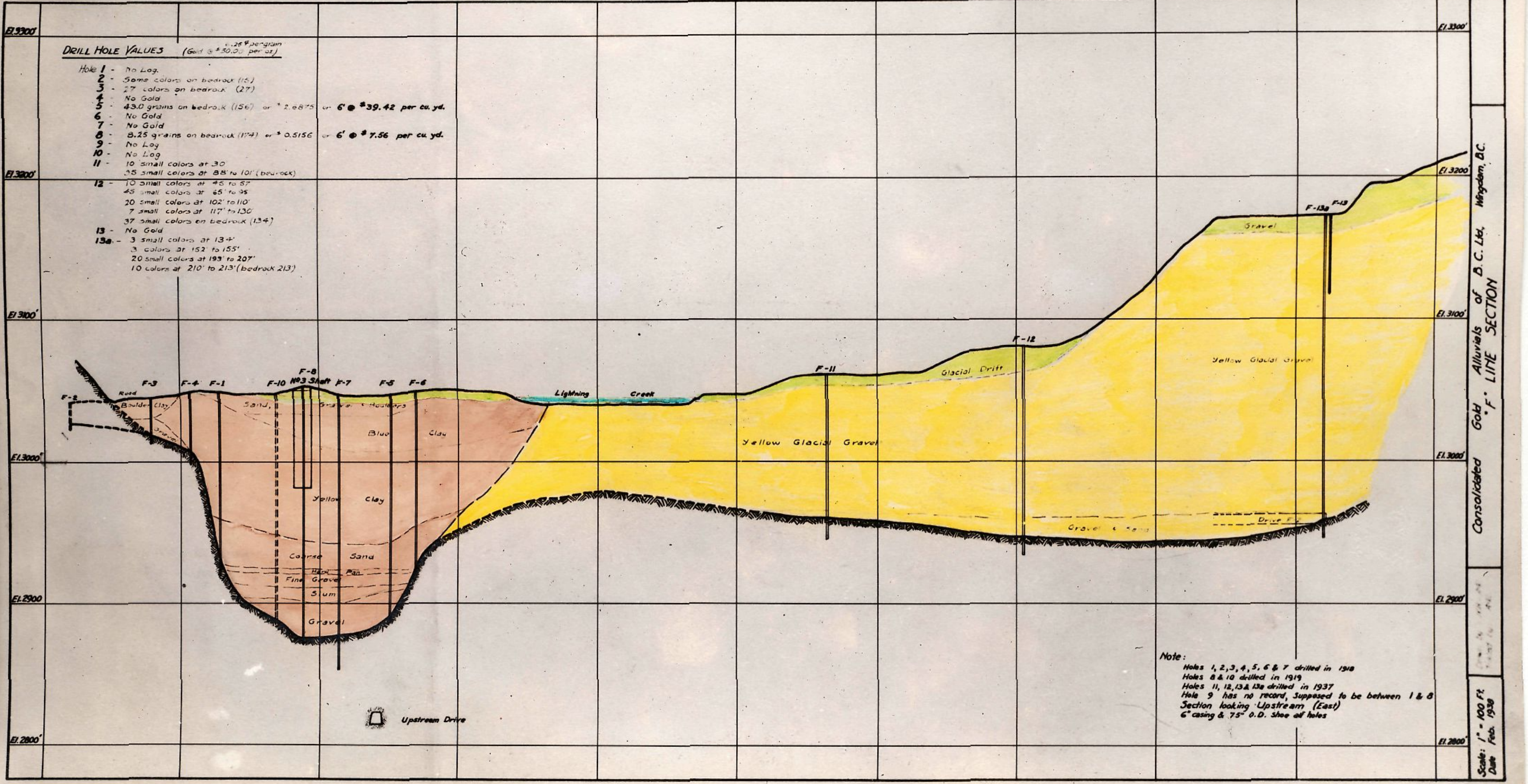
Scale: 1" = 100 Ft.
Date: Feb. 3, 1938



Consolidated Gold Alluvials of B.C. Ltd, Wingdam, B.C.
"A" LINE SECTION
DRILL HOLE VALUES (Gold @ $30.00 per oz. or 6.25¢ per grain)
Hole #5 184.3 grains at 165' (bedrock at 165') $11.51875 or 6' @ $168.95 per cubic yard
#9 No Gold
#10 No Gold
#X 1 heavy color at 148'; 2.5 grains at 156'; 1.0 grain at bedrock (160') $0.21875 or 6' @ $3.21
#Ya 2.0 grains at bedrock (134')
Jannsen Well Hole (26" diam.)
Auriferous Sand 103'-117'; flaky fine gold at 150';
31 grains at 150' $1.93750
59.0 grains at 165' to 176' (bedrock 165') $3.68750
30.0 grains at 175' to 188' $1.87500
El. 3300
El. 3200
El. 3100
El. 3000
El. 2900
El. 2800
Melvin Shaft
No 1 Shaft
Rock Dump
Jannsen Well Hole 26" Diameter
A-5
Lightning Creek
A-X
A-Ya
A-9
A-10
Glacial Drift
Blue Clay
Sand, gravel & Boulders
Blue Clay
Blue Clay
Boulders Gravel & Sand
Blue Clay & Gravel
Cemented Blue Clay, Sand & Gravel (Till)
Erosion Surface
Yellow Clay & Gravel
Blue Clay
Slum
Blue Clay & Sand
Auriferous Sand
Sand & Slum
Sand & fine gravel
Auriferous Gravels
Melvin Shaft
No 1 Shaft
No 1 Mine Upper Level
No 1 Mine Lower Level
Downstream Drive
Notes:
Hole 5 drilled in 1906
26" Jannsen Hole drilled in 1933
X & Ya Holes drilled in 1935
Holes 9 & 10 drilled in 1937
Section looking Upstream (East)
All holes (except the Jannsen hole): 6" casing & 7.5" O.D. Shoe.
Drawn by
Traced by
Scale: 1" = 100 Ft.
Date: Feb. 1938



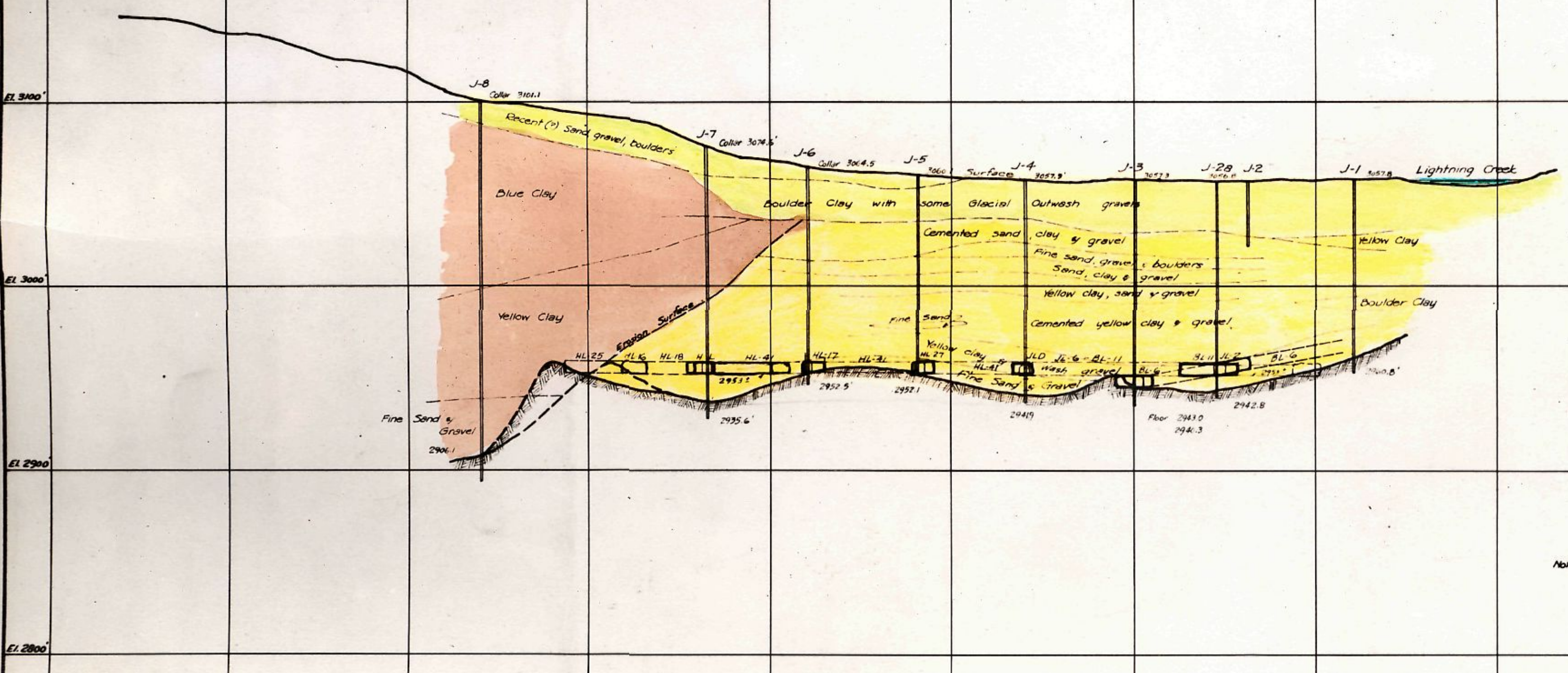
Consolidated Gold Alluvials of B. C. Ltd., Wingdam, B.C.
"AA" LINE SECTION
Scale: 1" = 100 Ft.
Date: Feb. 1938
DRILL HOLE VALUES (Gold @ $30.00 per oz. or 6.25¢ per grain)
Hole #1
2 colors at 198'
11.2 grains at 211' to 217' or $0.7000 or 6' @ $10.2675 per cu. yd.
8 colors at 220 to 223
29 small colors at 224½ to 233'
Hole #2
2 colors on bedrock (158')
El. 3300'
El. 3200'
El. 3100'
El. 3000'
El. 2900'
El. 2800'
AA-1
AA-2
Soil
Soil & Gravel
Gravel
Gravel & Sand
Gravel & Fine Sand
Road
Lightning Creek
Gravel & Sand
Yellow Glacial Gravel
Auriferous Gravel
Sand & Fine Gravel
Fine Gravel & Sand
Upstream Drive
Notes
Holes drilled in 1937
Section looking Upstream (East)
All holes 6" casing 7.5" O.D. Shoe.


El. 3300'
El. 3200'
El. 3100'
El. 3000'
El. 2900'
El. 2800'
DRILL HOLE VALUES (Gold @ $30.00 per oz.) ∴ .25$ per grain
Hole 1 - No Log.
2 - Some colors on bedrock (15)
3 - 27 colors on bedrock (27)
4 - No Gold
5 - 43.0 grains on bedrock (156) or $2.6875 or 6' @ $39.42 per cu. yd.
6 - No Gold
7 - No Gold
8 - 8.25 grains on bedrock (174) or $0.5156 or 6' @ $7.56 per cu. yd.
9 - No Log
10 - No Log
11 - 10 small colors at 30
35 small colors at 88' to 101' (bedrock)
12 - 10 small colors at 45 to 57
45 small colors at 65' to 95
20 small colors at 102' to 110'
7 small colors at 117' to 130'
37 small colors on bedrock (134)
13 - No Gold
13a. - 3 small colors at 134'
3 colors at 152' to 155'
20 small colors at 193' to 207'
10 colors at 210' to 213' (bedrock 213)
F-2
F-3
F-4
F-1
F-10
F-8
No 3 Shaft
F-7
F-5
F-6
F-11
F-12
F-13a
F-13
Road
Boulder Clay
Sand,
Gravel
Boulders
Blue
Clay
Yellow
Clay
Coarse
Sand
Hard Pan
Fine Gravel
Slum
Gravel
Lightning
Creek
Yellow Glacial Gravel
Glacial Drift
Gravel
Yellow Glacial Gravel
Gravel & Sand
Drive F-2
Upstream Drive
Note:
Holes 1, 2, 3, 4, 5, 6 & 7 drilled in 1918
Holes 8 & 10 drilled in 1919
Holes 11, 12, 13 & 13a drilled in 1937
Hole 9 has no record, Supposed to be between 1 & 8
Section looking Upstream (East)
6" casing & 7.5" O.D. Shoe all holes
Consolidated Gold Alluvials of B.C. Ltd., Wingdam, B.C.
"F" LINE SECTION
Scale: 1" = 100 Ft.
Date Feb. 1938

Drill Hole Values (Gold @ $30.00 per oz. or 6.25¢ per grain)

Hole #1	Many colors (33) from 20'-96' with 11 colors at 85' (bedrock 97')		
Hole #2a	1.0 grain 78'-83'	$0.0625	or 5' @ $1.10 per cubic yard
	1.5 grains 99-108'	$0.0938	or 9' @ .92 per cubic yard
	3.5 grains 108-114' (bedrock 114')	$0.2188	or 6' @ $3.21 " " "
Hole #3	0.5 grains 35'-37'	$0.0313	or 2' @ $1.38 " " "
	1.5 grains 90'-96'	$0.0938	or 6' @ $1.38 " " "
	3.5 grains 98'-101'	$0.2188	or 3' @ $6.42 " " "
	16.0 grains 104'-111'	$1.0000	or 7' @ 12.57 " " "
	43.0 grains 111'-117' (bedrock 117')	$2.6875	or 6' @ $39.42 " " "
Hole #4	0.75 grains 9'-15'	$0.0469	or 6' @ 0.69 " " "
	1.0 grain 100-103'	$0.0625	or 3' @ $1.83 " " "
	87.5 grains 103-109'	$5.4688	or 6' @ $80.22 " " "
	9.0 grains 110'-116' (bedrock 116')	$0.5625	or 6' @ $8.25 " " "

Hole #5	0.5 grains at 9'	$0.0313	or 1' at $2.75 per cubic yard
	0.48 grains 95'-98½'	$0.0300	or 3½' at $0.75 " " "
	6.5 grains 100'-108' (bedrock 108')	$0.4063	or 8' at $4.47 " " "
Hole #6	0.13 grains 90'-92'	$0.0081	or 2' at $0.36 " " "
	9.75 grains 100'-105'	$0.6094	or 5' at $10.73 " " "
	9.00 grains 105'-112' (bedrock 112')	$0.5625	or 7' at $7.07 " " "
Hole #7	0.25 grains 108-110'	$0.0156	or 2' at $0.69 " " "
	12.25 grains 113'-119'	$0.7656	or 6' at $11.23 " " "
	7.5 grains 122'-128'	$0.4688	or 6' at $6.88 " " "
	7.25 grains 129'-138' (bedrock 139')	$0.4532	or 9' at $4.43 " " "
Hole #8	7 colors 166'-184' (bedrock 195')		



Note: Section Looking Upstream (East)
Holes all drilled in 1935
All holes 6" casing 7.5" O.D. Shoe

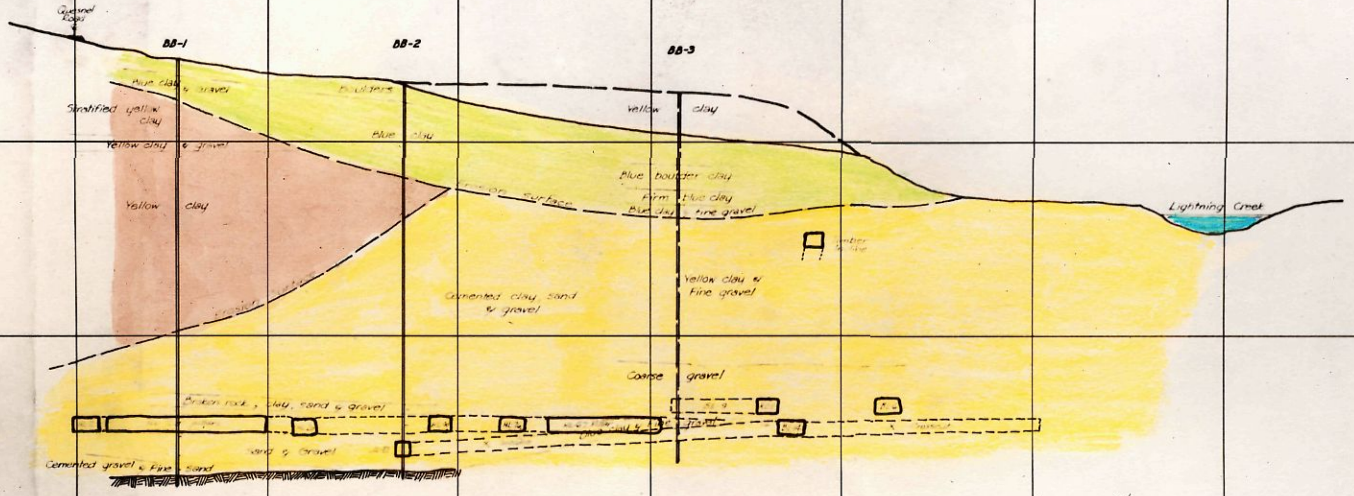
Consolidated Gold Alluvials of B.C. Ltd., Wingdam, B.C.
'J' LINE SECTION & WORKINGS

Drawn by R.G.-A.R.
Traced by A.R.

Scale 1" = 100 Ft.
Date: Jan. 26, 1938

DRILL HOLE VALUES (Gold @ $30.00 per oz. or 6.25¢ per grain)

Hole #1	- 0.5 grains at 177-180'	or $0.0313	or	3' @ $0.92 per cu yd.
	6.0 grains at 180-186'	or $0.3750	or	6' @ $5.50 per cu.yd.
	- 1.0 grain at 191½-193'	or $0.0625	or	1½' @ $3.67 per cu.yd.
	- 3.75 grains at 203-210'	or $0.2344	or	7' @ $2.95 per cu yd.
	- 4.0 grains at 210-215'	or $0.2500	or	5' @ $4.40 per cu.yd.
Hole #2	- 0.75 grains at 148-151'	or $0.0469	or	3' @ $1.38 per cu. yd.
	0.5 grains at 165½-168'	or $0.0313	or	2½' @ $1.10 per cu.yd.
	6.0 grains at 168-176'	or $0.3750	or	8' @ $4.13 per cu.yd.
	1.88 grains at 176-189'	or $0.1175	or	13' @ $0.80 per cu yd.
	1.38 grains at 189-198'	or $0.0863	or	9' @ $0.85 per cu.yd.
Hole #3	0.25 grains at 150'	or $0.0156	or	6' @ $0.18 per cu yd.
8" hole	0.5 grains at 160'	or $0.0313	or	6' @ $0.36 per cu yd.
	0.75 grains at 170'	or $0.0469	or	6' @ $0.54 per cu yd.
	2.0 grains at 181-183'	or $0.1250	or	6' @ $1.43 per cu. yd

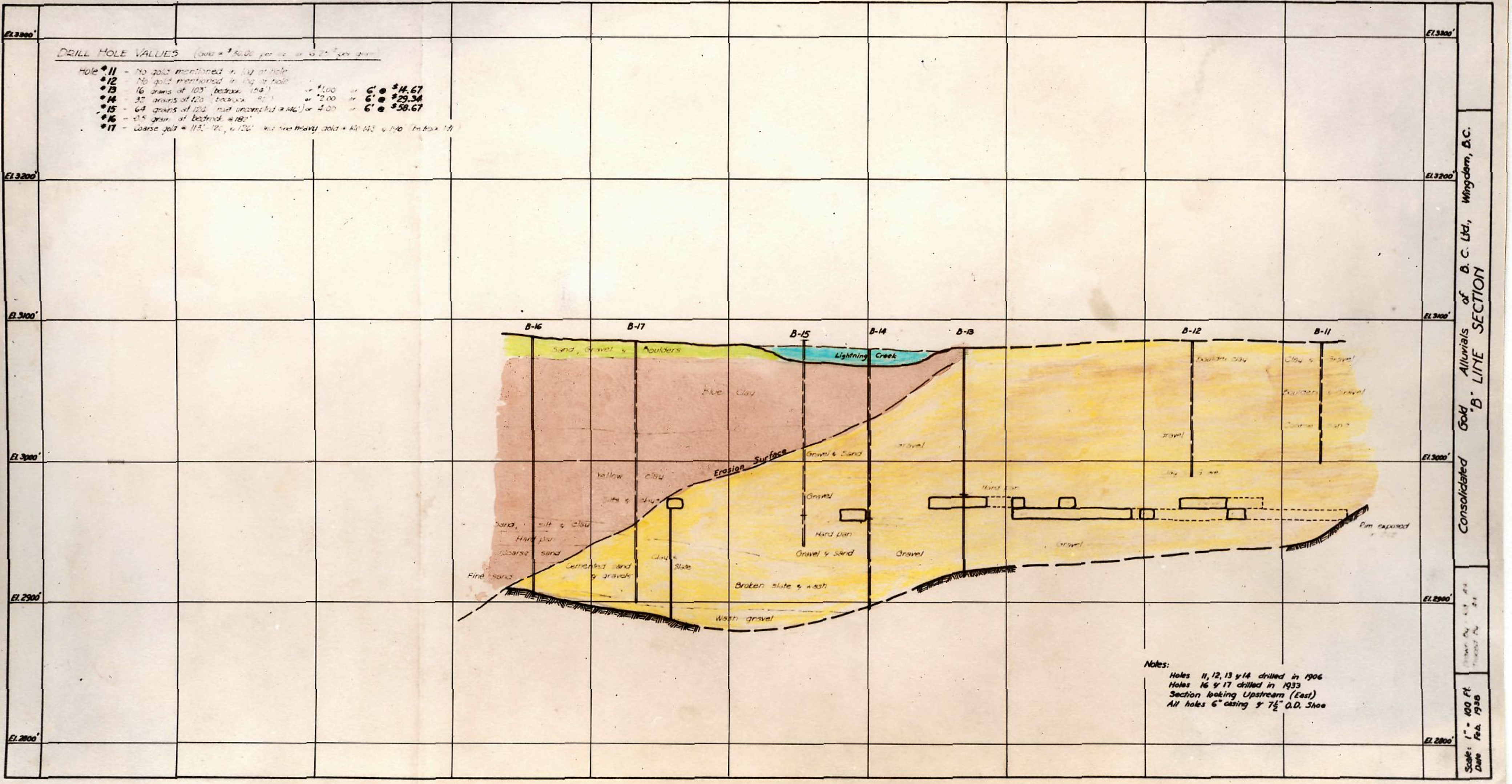


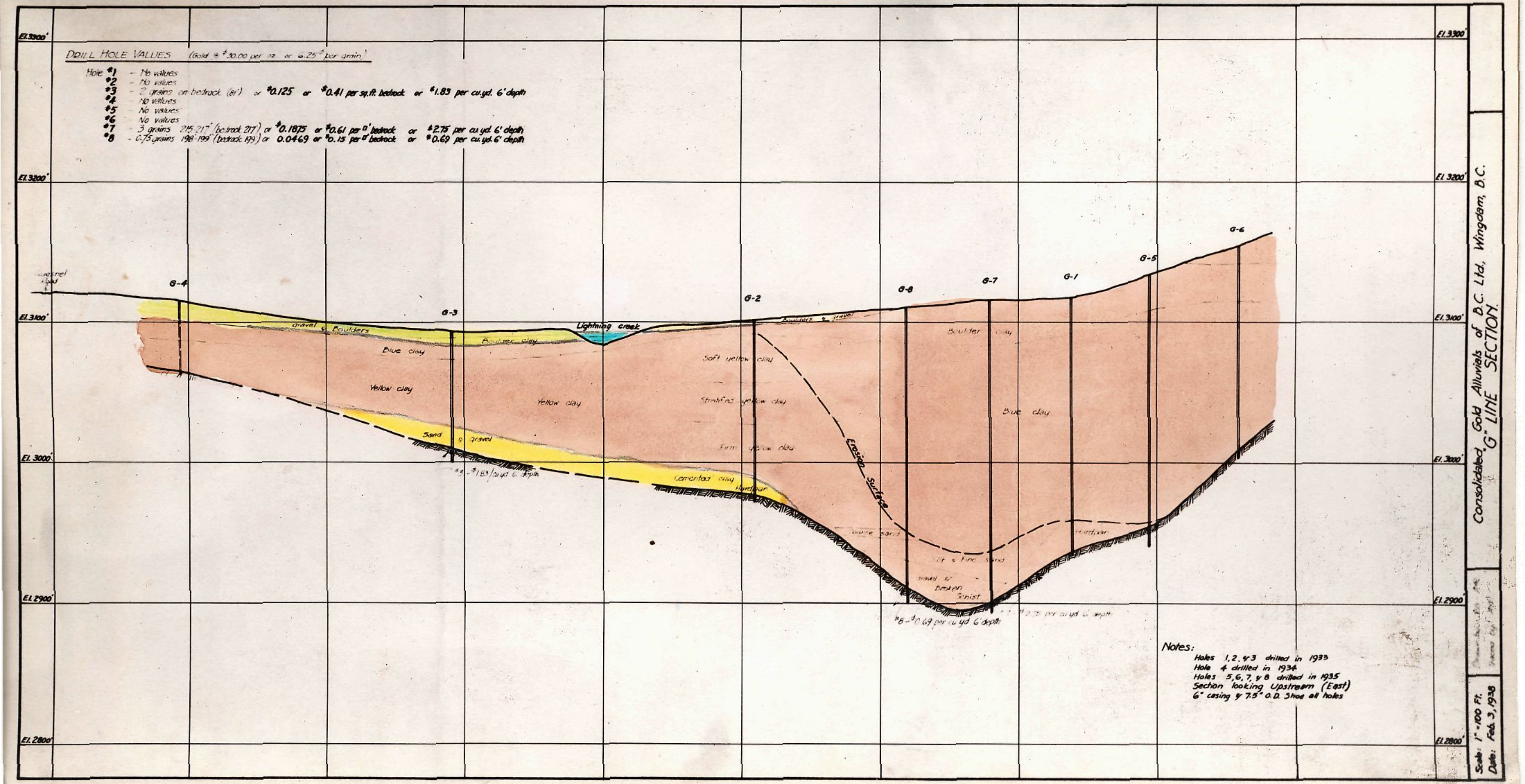
Notes:

Holes 1 & 2 drilled in 1935
Hole 3 drilled in 1936
Section Looking Upstream (East)
Hole 3 - 8" casing 8.5" O.D. Shoe
Other holes 6" casing 7.5" O.D. Shoe

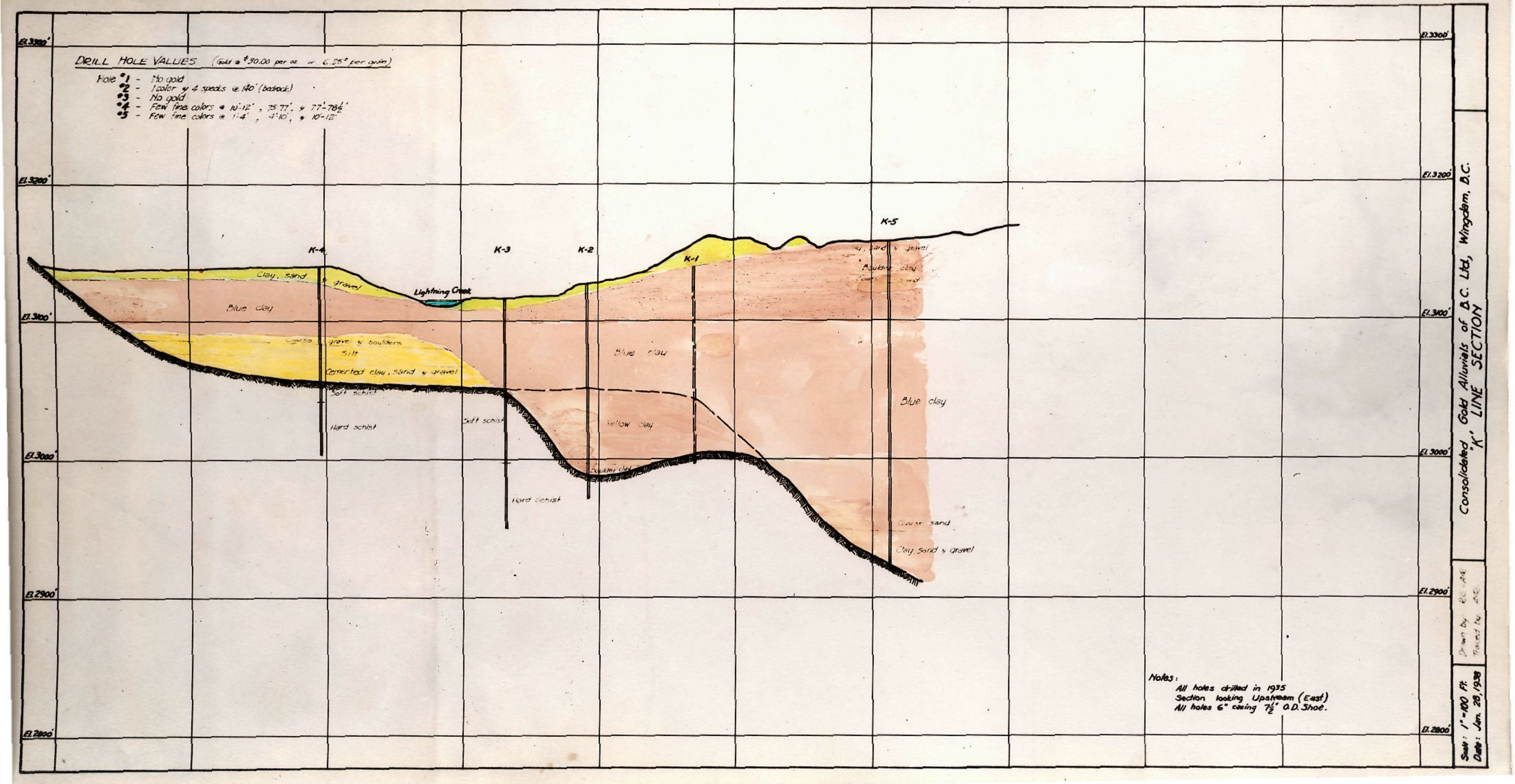
Consolidated Gold Alluvials of B.C. Ltd, Wingdam, B.C.
"D-D" LINE SECTION

Scale: 1" = 100 Ft
Date: Feb. 1938

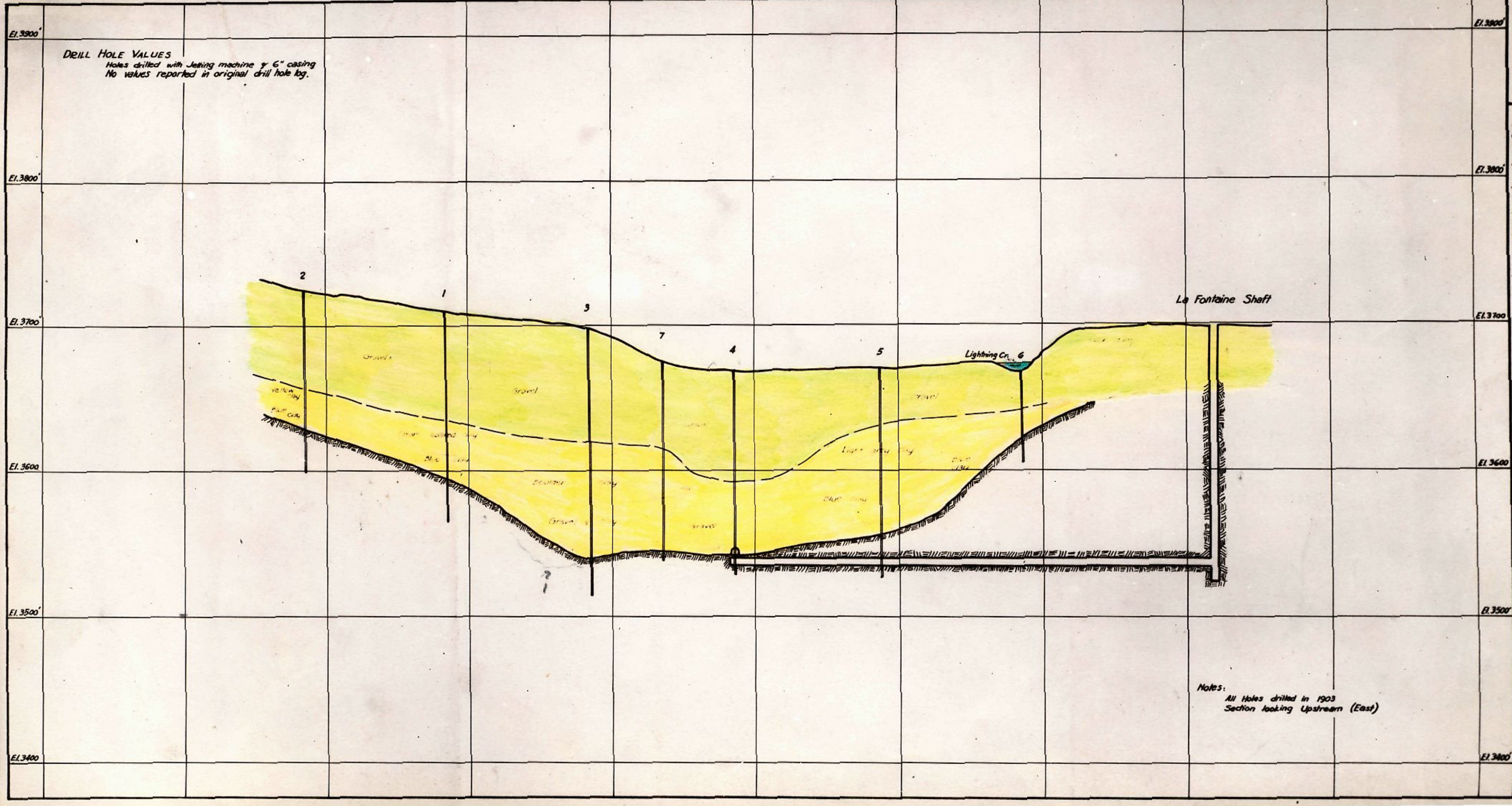

DRILL HOLE VALUES
Hole #11 - No gold mentioned in log of hole
#12 - No gold mentioned in log of hole
#13 - 16 grains at 105' (bedrock 154') or $1.00 or 6' @ $14.67
#14 - 32 grains at 120 or $2.00 or 6' @ $29.34
#15 - 64 grains at 124 or 4.00 or 6' @ $58.67
#16 - 0.5 grain at bedrock @ 182'
#17 - Coarse gold
El. 3300'
El. 3200'
El. 3100'
El. 3000'
El. 2900'
El. 2800'
B-16
B-17
B-15
B-14
B-13
B-12
B-11
Sand, Gravel & Boulders
Lightning Creek
Blue Clay
Yellow clay
Silts & clays
Sand, silt & clay
Hard pan
Coarse sand
Fine sand
Cemented sand & gravels
Clay & Slate
Erosion Surface
Gravel & Sand
Gravel
Hard pan
Gravel & sand
Broken slate & wash
Wash gravel
Boulder clay
Clay & Gravel
Boulders & Gravel
Coarse Sand
Rim exposed
Notes:
Holes 11, 12, 13 & 14 drilled in 1906
Holes 16 & 17 drilled in 1933
Section looking Upstream (East)
All holes 6" casing & 7½" O.D. Shoe
Consolidated Gold Alluvials of B. C. Ltd., Wingdam, B.C.
'B' LINE SECTION
Scale: 1" = 100 Ft.
Date Feb. 1938



Consolidated Gold Alluvials of B.C. Ltd, Wingdam, B.C.
"G" LINE SECTION.
Scale: 1" = 100 Ft.
Date: Feb. 3, 1938
DRILL HOLE VALUES (Gold @ $30.00 per oz or 6.25¢ per grain)
Hole #1 - No values
#2 - No values
#3 - 2 grains on bedrock (81') or $0.125 or $0.41 per sq.ft. bedrock or $1.83 per cu.yd. 6' depth
#4 - No values
#5 - No values
#6 - No values
#7 - 3 grains 215-217' (bedrock 217') or $0.1875 or $0.61 per □' bedrock or $2.75 per cu.yd. 6' depth
#8 - 0.75 grains 198-199' (bedrock 199') or 0.0469 or $0.15 per □' bedrock or $0.69 per cu.yd. 6' depth
El. 3300'
El. 3200'
El. 3100'
El. 3000'
El. 2900'
El. 2800'
G-4
G-3
G-2
G-8
G-7
G-1
G-5
G-6
Lightning creek
gravel & Boulders
Boulder clay
Blue clay
Yellow clay
Sand & gravel
Cemented clay
Hardpan
Soft yellow clay
Stratified yellow clay
Firm yellow clay
Erosion Surface
Boulders & gravel
Boulder clay
Blue clay
Silt & fine sand
Gravel & broken schist
Hardpan
#3 - $1.83/cu yd 6' depth
#8 - $0.69 per cu yd 6' depth
Notes:
Holes 1, 2, & 3 drilled in 1933
Hole 4 drilled in 1934
Holes 5, 6, 7, & 8 drilled in 1935
Section looking Upstream (East)
6" casing & 7.5" O.D. Shoe all holes


DRILL HOLE VALUES (Gold @ $30.00 per oz or 6.25¢ per grain)
Hole #1 - No gold
#2 - 1 color & 4 specks @ 140' (bedrock)
#3 - No gold
#4 - Few fine colors @ 10'-12', 75-77', & 77'-78½'
#5 - Few fine colors @ 1'-4', 4'-10', & 10'-12'
El. 3300'
El. 3200'
El. 3100'
El. 3000'
El. 2900'
El. 2800'
K-4
K-3
K-2
K-1
K-5
Lightning Creek
Clay, sand & gravel
Blue clay
Coarse gravel & boulders
Silt
Cemented clay, sand & gravel
Soft schist
Hard schist
Soft schist
Hard schist
Blue clay
Yellow clay
Boulder clay
Sand & gravel
Boulder clay
Blue clay
Coarse sand
Clay, sand & gravel
Notes:
All holes drilled in 1935
Section looking Upstream (East)
All holes 6" casing 7½" O.D. Shoe.
Consolidated Gold Alluvials of B.C. Ltd., Wingdam, B.C.
'K' LINE SECTION
Scale: 1" = 100 Ft.
Date: Jan. 28, 1938

Drill Hole Values
Holes drilled with Jetting machine 6"(?) casing
Hole #1 - 75 colors on bedrock
Hole #2 - 169 colors on bedrock
Hole #3 - 186 colors on bedrock
Hole #4 - 4 colors on bedrock
Hole #5 - 2 colors on bedrock
Hole #6 - 55 colors on bedrock
El. 3800'
El. 3700'
El. 3600'
El. 3500'
El. 3400'
El. 3300'
1
2
3
4
5
6
Lightning Cr.
Surface gravel
Fine gravel
Fine gravel & clay
Yellow clay & gravel
Yellow clay & gravel
Blue clay
Blue clay
Blue clay
Light blue clay
Coarse sand
Yellow sand
Blue clay
Light Blue clay
Fine cream colored sand & gravel
Reddish gravel
Yellow gravel & clay
Reddish gravel
Light blue clay
gravel
Notes: This section 2 miles downstream from No. 1 Section.
All holes drilled in 1903
Section looking Upstream, (East)
Consolidated Gold Alluvials of B.C. Ltd., Wingdam, B.C.
LA FONTAINE, No. 2 SECTION
Scale: 1" = 100 Ft.
Date: Feb 1938



Consolidated Gold Alluvials of B.C. Ltd., Wingdam, B.C.

LA FONTAINE Nº1 SECTION

Scale 1" = 100 Ft.
Date Feb. 1938

This is the plan map of the workings at Wingdam. The locations of shafts, buildings, drifts, cross-section lines, highway, the course of Lightning Creek, also tributary streams and the location of the deep lead or deep channel are shown.

Lightning Creek is shown in green; the trace of the deep channel in pink.

Undoubtedly the deep channel is much more crooked in detail than is indicated on the map.

The mile-long flume to divert Lightning Creek would start about at Section A-A and go to just beyond Section E. to the west.

The Mackenzie deep lead development work is shown on this map. It goes from just beyond Section C. on the west almost to Section J on the east or a horizontal distance of 3100 feet.

The Sanderson mine workings total about 15 acres and are shown between Sections F and G.

Note that churn drilling on Section K did not reach the deep lead. The same follows for Sections J. B-B, and B. Closer spacing of holes directed in the deep lead is indicated. The scale of this map is 300 feet equals 1 inch.