Geophysical - Geological

Report on

Marsh Creek Group:

Placer Leases No. 1291, 1310, 1358

LOCATION -

About 100 km east of the City of Vernon and 30 km west of the Needles Ferry on Arrow Lake, and approximately at Latitute 50° 7', Longitude 118° 28', Vernon Mining District, B.C.

AUTHOR

A. B. L. Whittles, Ph.D.

HOLDERS OF CLAIMS

A.B.L. Whittles

R.S. Sears

D. Jones

FIELD WORK DONE -

Between June 10, 1979 and September 21, 1979.

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ASSESSMENT REPORT SUMMARY

The first detailed assessment of Marsh Creek is presented in this report. Since much of the history of mining on this creek has never been recorded, considerable time and effort were spent to assemble what was known, mainly by interviewing persons who had worked on the creek. This history (Section 3 of this report) suggests that the creek may be fairly rich in gold deposits, but that these are likely to be buried in a pre-glacial channel. A.Marsh (active until the early 1900's) was the only one who was able to get into the richer grades near bedrock, and he was not able to exploit these to any extent due to a lack of technology and to his failing health. No further major efforts have taken place on the creek, and no major company has been involved: the deposits are still intact.

A review of the geology of the area (Section 4) suggests a vein structure is the source for the free gold, and it would appear that the creek bed could have escaped the effect of glacial movements in the past. Hence the pre-glacial period gold deposits should still be in place.

Geophysical surveys were undertaken on an experimental basis. VLF-EM surveys were tried to see if the buried pre-glacial channels would present enough of a conductivity contrast to direct future exploration: although the results are only preliminary this approach appears to hold some promise.

Magnetic surveys did not provide any useable results across the creek itself, but did appear to have located a mineralized vein structure running through the Riske Mineral Claim (L195).

Considerable hand trenching, slucing and panning were carried out, at the junction of the south branch and the main flow of Marsh Creek, to test the possibility of gold entering from this branch. No previous work seems to have been done on this branch, since it is fairly steep, and dry for most of the summer. Results indicate that gold does indeed enter from this branch, and this reinforces the probability that the vein structure across the head of the valley is the main source of the gold in Marsh Creek.

In section 7 (Interpretations) attempts are made to (a) clarify the possible location of the deposits; (b) discuss possible grades; and, (c) examine the source of the gold.

In section 8, a calculation of possible total gold content in Marsh Creek is undertaken, and although many of the assumptions that had to be made in the calculations are based on very tenuous information, the answer suggests that continued work is most advisable.

Recommendations, to this end, are also given (Section 9)

1. PROPERTY DESCRIPTION, LOCATION, AND ACCESS

Access to the property is gained by proceeding east of the city of Vernon, along the Monashee Highway, to the Kettle River (See Figure 1). Approximately 2 km past the Kettle River a gravel road proceeds to the left (north). This road crosses back across the Kettle River then runs along parallel to its west bank. Approximately 4 km from the Monashee Highway, a single lane dirt road cuts to the left, crosses Marsh Creek in approximately 300 meters from the gravel road, then swings west alongside the north bank of Marsh Creek (see figures 2, 3, and 4).

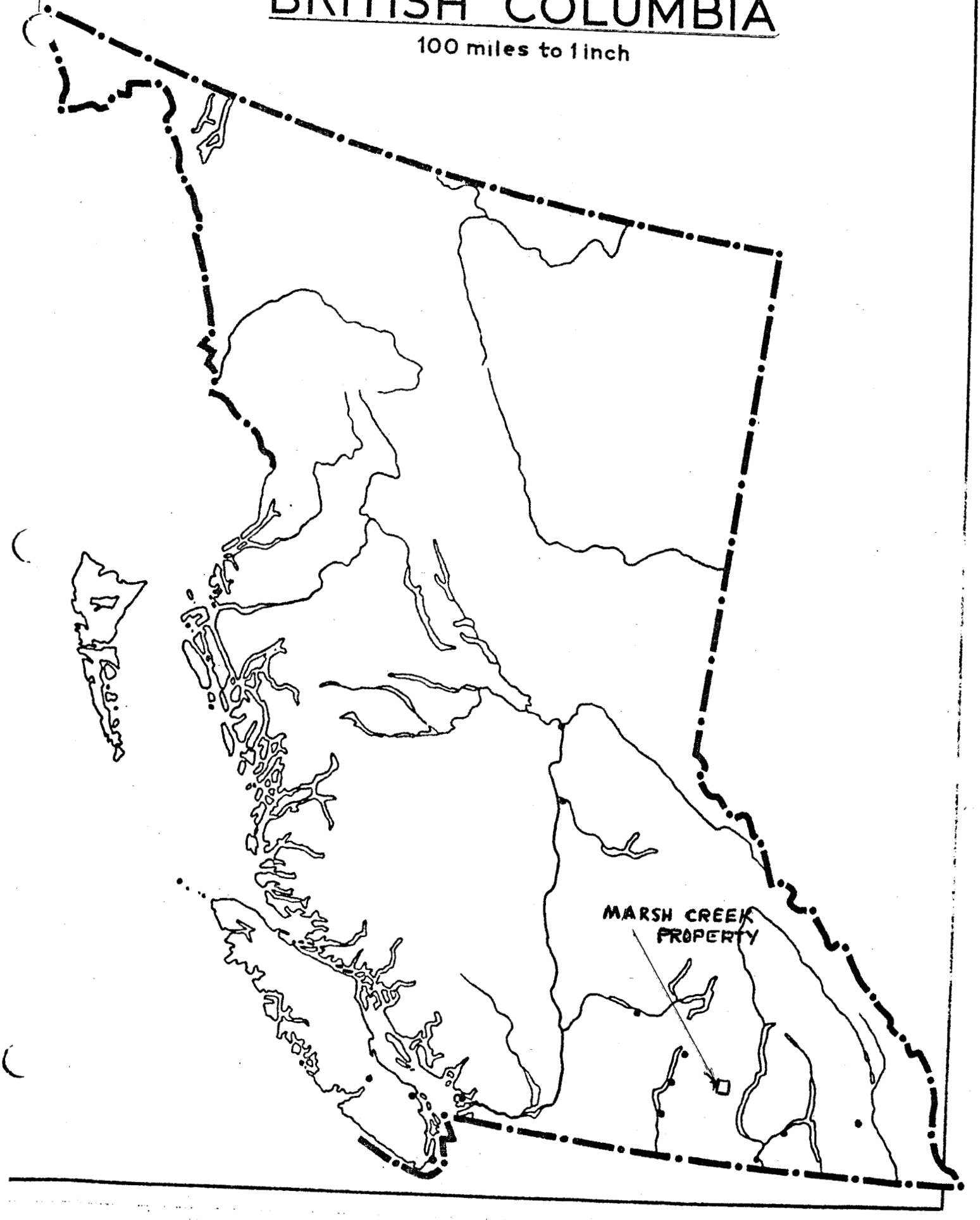
The creek bed topography is fairly flat in the lower reaches of the creek, with the banks sloping more and more steeply up to the north and south as one proceeds west up the creek. The south and central branches join the north branch just above and just below fairly steep rocky canyons. The head waters of these branches rise steeply up the east slope of Monashee Mountain. The south branch headwaters alongside a nearly vertical limestone cliff. (see figures 5 and 6)

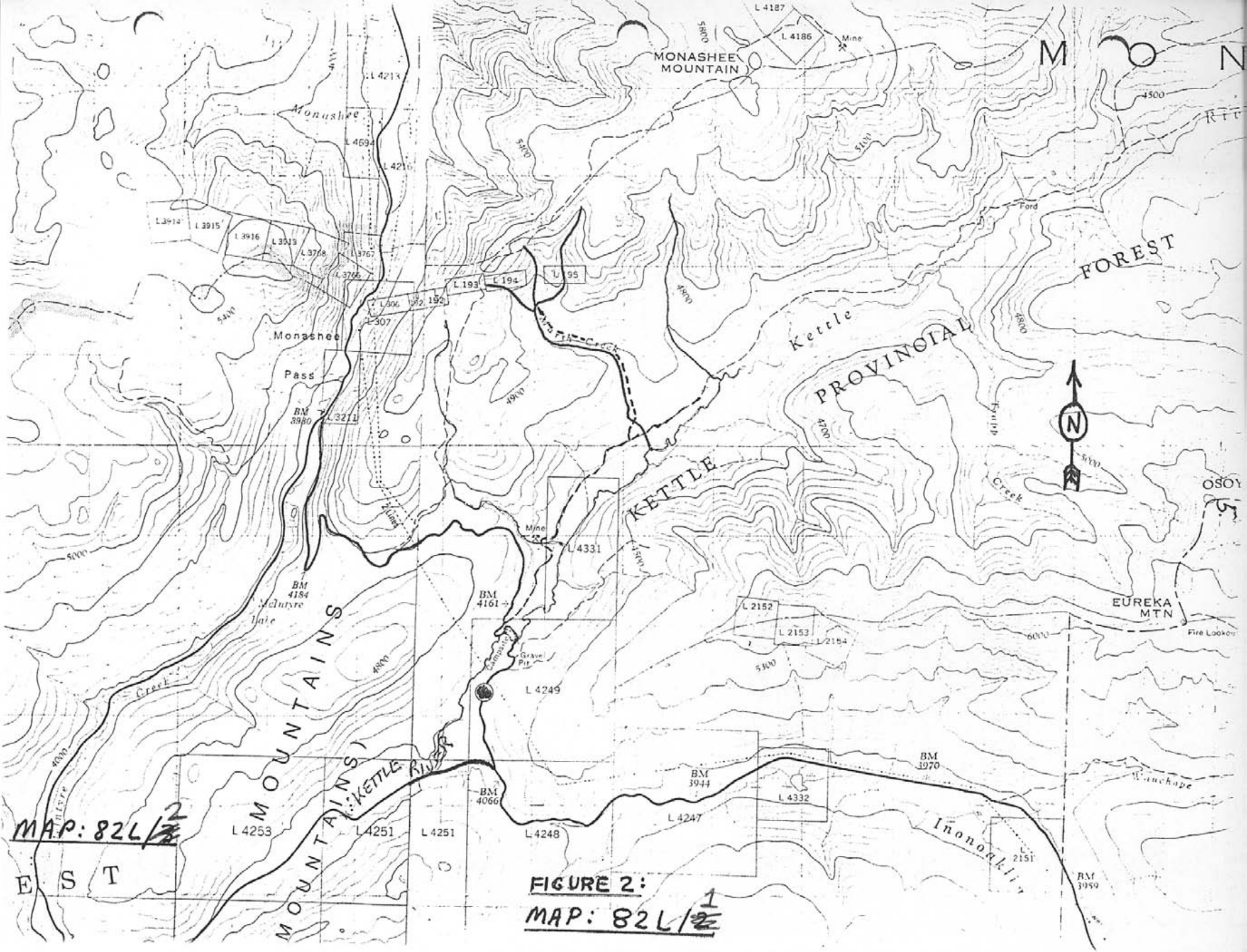
Elevations range from 4500 to 5500 feet on Figure 4, and the leases are heavily forested with mixed fir, spruce, pine and some cedar. The property is mantled by glacial till except in the canyon and on the steeper slopes of Monashee Mountain.

FIGURE 1:

BRITISH COLUMBIA

100 miles to 1 inch





MAP: 82L/2E

E S T

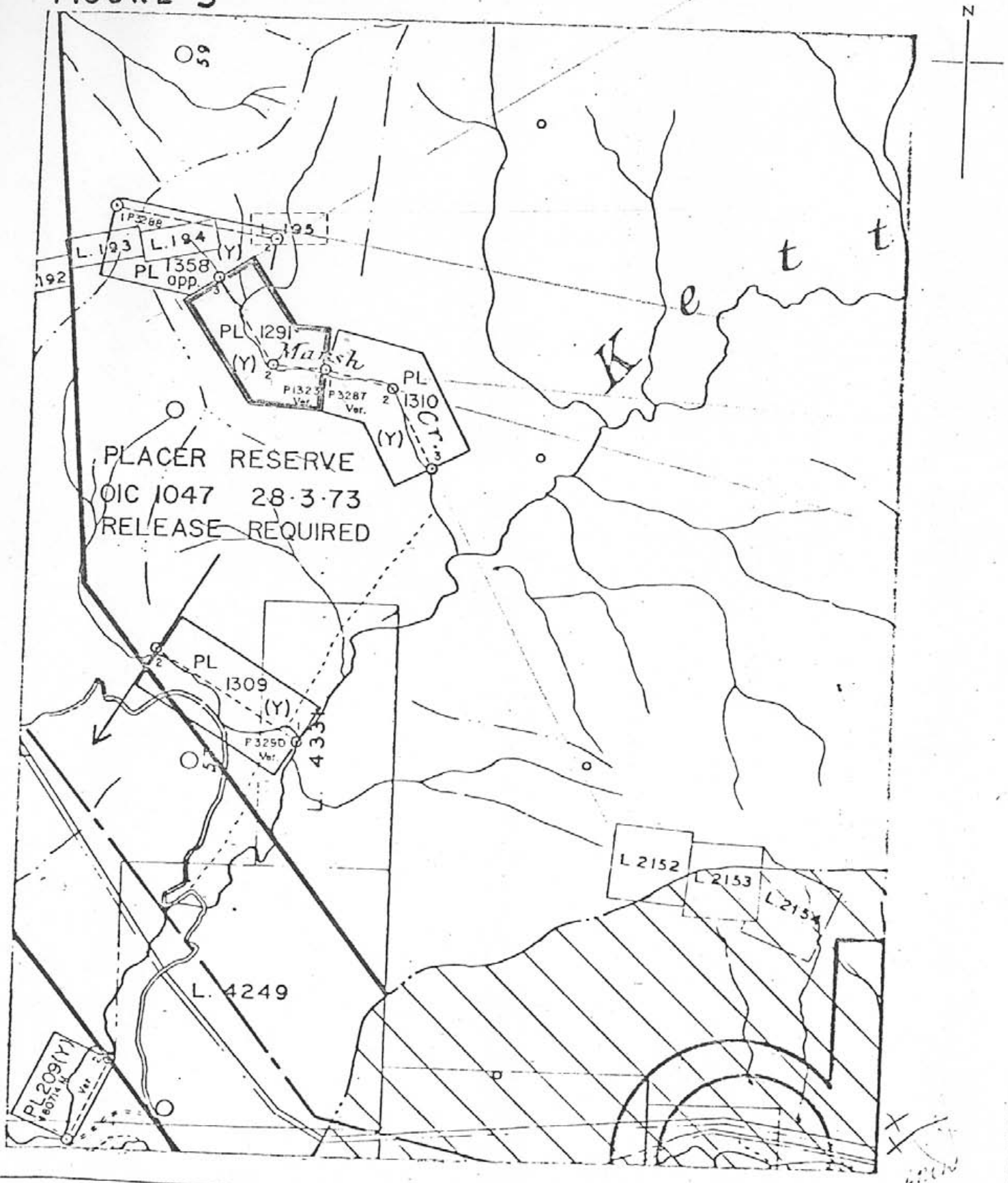
FIGURE 2:

MAP: 82L/1E

PLACER LEASE NO. 1291, 1310, 1358

SIGNATED AREA: CHERRY CREEK MINING DIVISION: VERNON

FIGURE 3



n (approx.) based on inspection report dated October 4, 1978

ost was found 1415 m North and 320 m East of the thwest corner of Lot 4331, O.D.Y.D

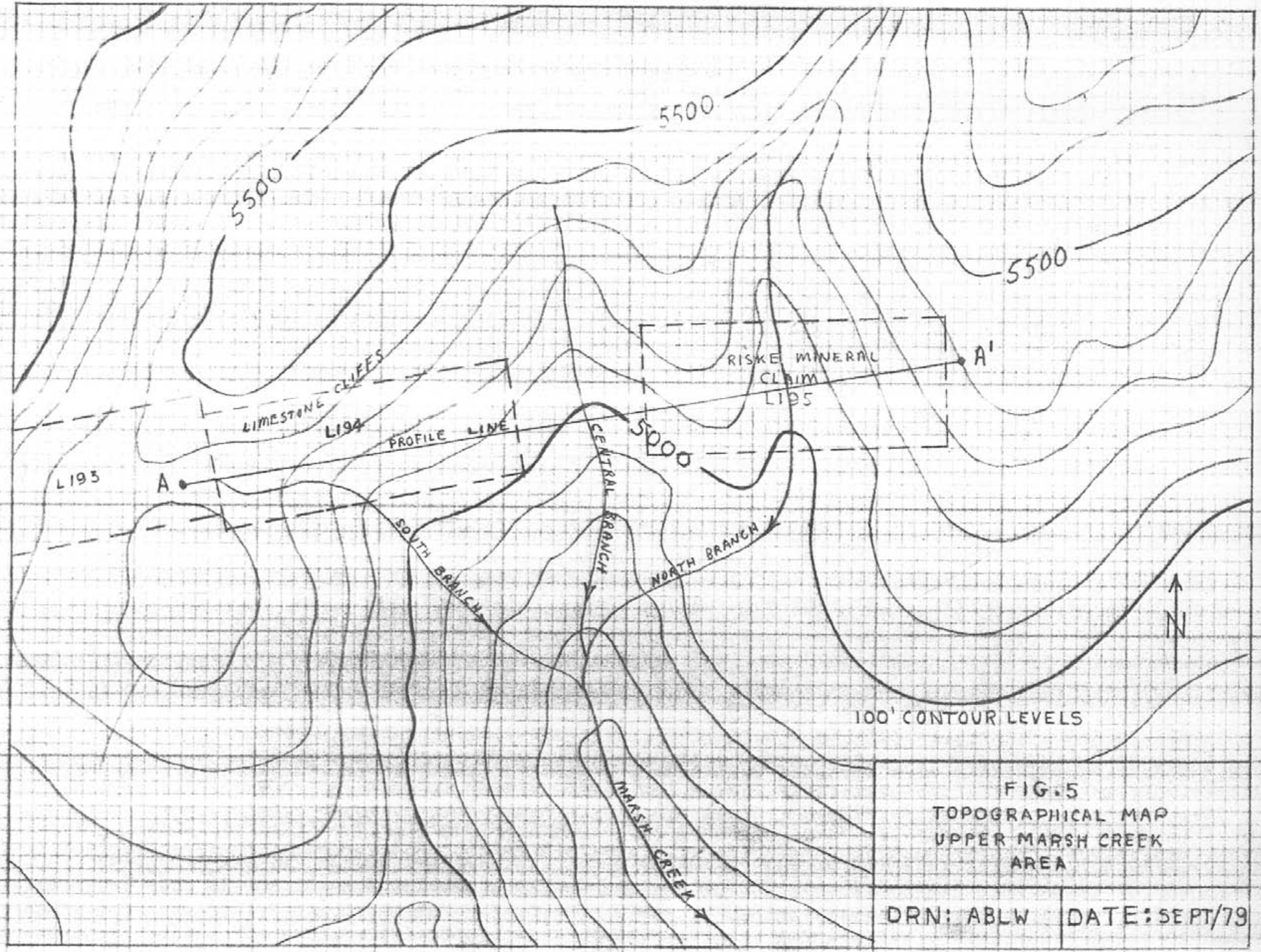


FIG. 5
TOPOGRAPHICAL MAP
UPPER MARSH CREEK
AREA

DRN: ABLW | DATE: SEPT/79

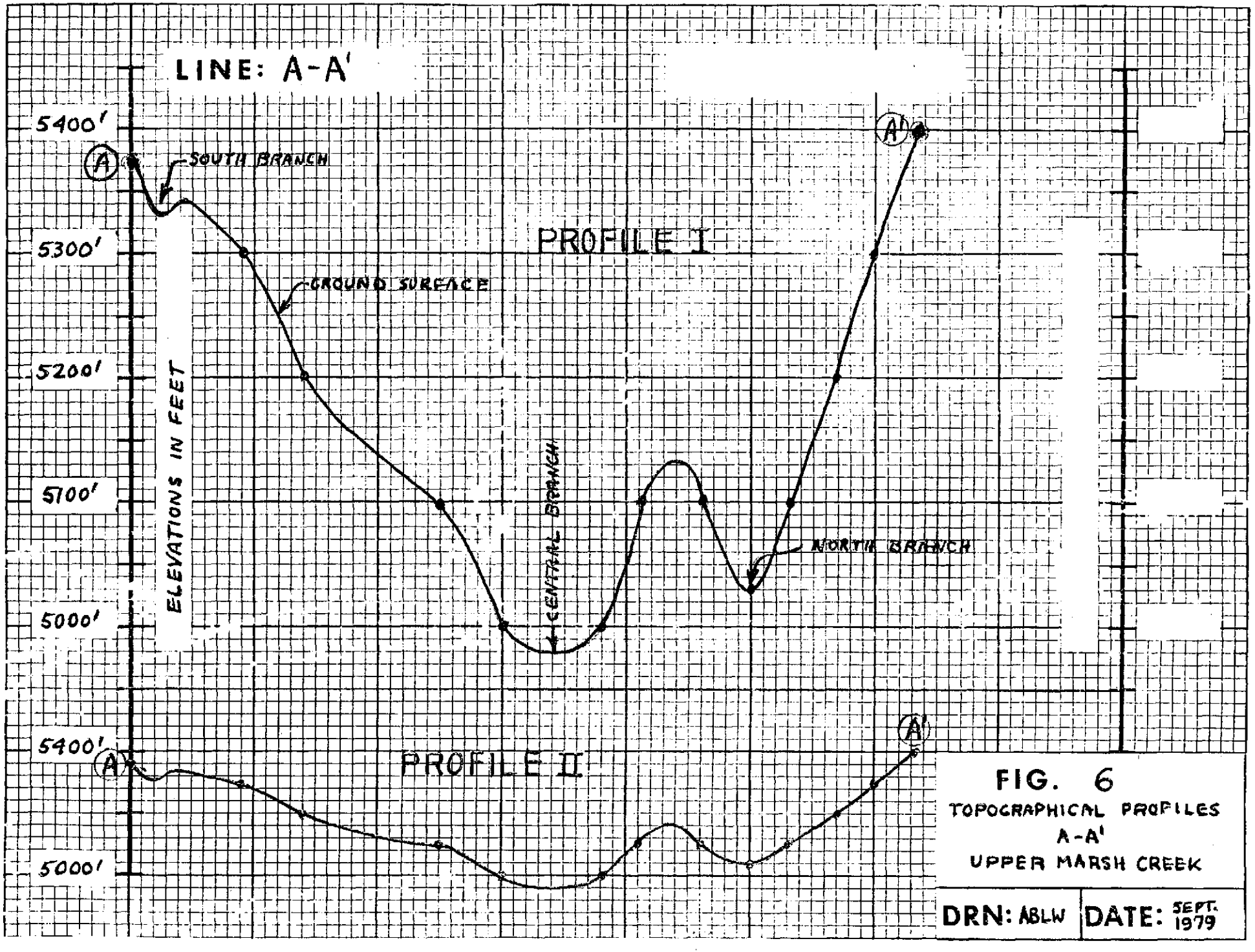


FIG. 6
TOPOGRAPHICAL PROFILES
A-A'
UPPER MARSH CREEK

DRN: ABLW | DATE: SEPT. 1979

2. OWNERSHIP

Lease No.	Tag No.	Owner
1291	P.1323	Dr.A.B.L. Whittles Nanaimo, B.C.
1310	P.3287	R. S. Sears
1358	P.3288	D. Jones Port Hardy, B.C.

3. HISTORY

Most of the following information was provided by Mr.S.C. Jones, who worked the property, with his father, in the 1930's and 1940's.

Marsh Creek was first prospected and worked by Al Marsh in 1883, who arrived there from San Francisco where he had lost the fortune he had made in the Nevada Mines.

It was in the canyon areas adjacent to the junctions of the north, central and south branches that Marsh ground-sluiced the shallow gravel, uncovering nuggets up to $\frac{1}{4}$ oz. in size. (Refer to Figure 7) Below the falls the gold was much scarcer, leading him to believe that the valley had been filled in by worthless slide material from the surrounding hillsides, burying the rich original channel to a considerable depth.

After unsuccessful attempts to locate the buried gravels close to the canyon, he began a drift on water grade about one half a km. below it. At irregular intervals from 1889 on he tunnelled through slide material and boulder clay, zigzagging from one sidewall of the valley to the other as he worked

upstream. The 1913 Minister of Mines Report notes that the adit was "first in 150' of slide, 175' blue clay, then some clay but mostly coarse gravel and boulders." Toward the end of this adit he got into clean, stream washed gravel, which proved to have good values, increasing toward bedrock.

(The length of the adit is stated to be 2500' long in the 1913 Report but an examination of the property suggests this may be exaggerated by a factor of two or three. The probable location of the adit was plotted in the 1930's by S.C.Jones, using the surface cave-ins still evident on the north bank of the creek (See Figure 7). It is possible that the adit went beyond the points shown, but no other cave-ins are noticeable, and a distance of 2500 feet would take the adit up to, or past, the canyons upstream from the falls.)

At the very end of the adit five 30' laterals were reported to have run to the south (See Figure 7) . (This report is understood to have come from a Mr. I.S. Puckett, a local rancher who had befriended Marsh, and who worked with the Joneses after Marsh's death). The two upper laterals (those two at the end of the adit) enabled Marsh to recover a good amount of coarse gold, but no reliable figures are available. Mr. Puckett stated he had seen thumb sized nuggets come out of the adit (Marsh apparently did not allow anyone in the adit but himself), and Marsh appeared to obtain enough gold to support himself for the

following 15 years.

Upon completion of these laterals, Marsh took sick, and thinking he was going to die, destroyed part of the adit, making it useless to others. After the period of 15 years mentioned earlier he felt well enough to open up his drift again. But a sudden rise in bedrock, combined with increasingly poor ventilation convinced him that he should seek outside help.

He interested R.A. Trethewey, a veteran of the Cobalt mining area, in having a shaft sunk using adequate pumping equipment to keep the water out. The work was begun in October 1920, starting about 75 feet upstream from Marsh's old adit. At a depth of 45 feet below the headframe good gravel was found resting on a gently sloping bedrock, apparently the sidewall, so three short exploratory drifts were run before starting the main working drift. Unfortunately, at just this time (August 1921) Trethewey was taken seriously ill and passed away shortly after, thus putting an end to the project.

Al Marsh did some further sporadic work near the canyon until his death in January 1925, at an age of well over 80.

Part of a letter apparently written by Marsh in these latter years is reproduced below, since it illustrates some of his experiences with the Creek. The letter was written to Western Mines Exploration Syndicate, 470 Granville St., Vancouver, B.C.

(Price of gold at that time was $20.66/ oz.)

"At the head of the Gulch where the bedrock was but lightly covered, I ground sluiced the bank for about 25 minutes for about 40 feet in length and turning the water off, there lay $5, $2, 2 fifty cent pieces, and 2-25 cent pieces. About 40 feet below that I got a $5 piece. About 40 feet below that I again found a crevice about 18 inches in length, but unfortunately it lay directly up and down the creek and the heavy spring washes would clean it out and yet there was about $18 in it."

"A few feet below that commences the real gulch or catch and seems fairly deep. I ran a cut in the top gravel and got $91.60, I sent the gold to the mint and received a return of $17.66¼/oz.".

(NOTE: Since the price of 24 K gold was $20.66/oz. at that time, this implies a grade of 20.5 K)

The letter continues:

"I located the discovery claims 1000 feet., starting about 400 feet below the line I commenced a drift so as to keep free from wet ground. I ran along the right wall and not in the real wash. My object was to bedrock before going to pay.The wall forced me over to pay and for about 60 feet in length I found it very rich, getting at times as much as $5 per small wheelbarrow of gravel when suddenly I was

stricken with the sickness at times unable to stand up and crawled on my hands and knees. Seeing I was in for a seige, I destroyed about 60 feet of the commencement of the drift leaving it as forsaken, for 15 years did it remain as such."

"My 15 years of suffering, idleness and expense left me dead broke. While still not free of the sickness I am so that I can do a fairly good day's work. I reopened the drift, and placing it in good order, I prepared for the spring work when I was forced to quit. I was but 2 feet from a heavy rise in the bed of the gulch and from appearances too much to go up it and it now demands the sinking of a working shaft which will also secure good air."

The next work of any importance was done by Mr. Puckett the local rancher who had befriended Marsh and who was conversant with most of the work that had been done on the creek. In 1935, he and his brother built a reservoir below the canyon to impound sufficient water for groundsluicing farther downstream. By this means an open-cut was begun with the intention of working back upstream to the old channel.

The following season, as his brother had left, Puckett was assisted by Sydney C. Jones and his son Clifford, who had been placer mining on Cherry (Monashee) Creek. The open-cut was continued and consideration was given to the

problem of dewatering the Trethewey shaft. By 1937, Puckett was unable to carry on, so Jones, now also joined by sons Stanley and Don, kept working at the open-cut. An attempt was made to get underground from the 15-foot face at the end of the cut, but the water-saturated boulder clay would not hold up. A two-foot hump in the bedrock was then encountered, so the open-cut was continued at the higher level until as 18-foot face was attained. No good gravel was discovered, but it was found that a certain amount of gold was scattered throughout the boulder clay, as all the gound-sluiced material was run over riffles. Later, to check on the bedrock contour below the canyon, a drift was started about 100 feet below the falls. In 24 feet, a near-vertical wall was struck, indicating the position of the final fall at the end of the canyon.

In the 1938 season one of Marsh's old upper drifts (near the canyon) was cleaned out. Several test pits were also dug near the end of the canyon. In one place, near the pegmatitic boulder (Figure 7) it was decided to remove a pile of previously stacked boulders to uncover the untouched ground beneath. The half cubic yard of gravel that had been left yielded just over an ounce of coarse gold, one nugget weighing 9¼ dwt., close to half an ounce. Further work was done in the open-cut. It was found that, of all the gold recovered that season, only 20% by weight would pass through

a 12½ per inch screen (2 mm. mesh.) 80% was coarser than this, the commonest size being between 1 and 3 grains. It is also interesting to note that some of the gold had limestone adhering.

Not too much was accomplished in 1939 and 1940, but in 1941 Dan Reiswig of Winfield became interested in dewatering the old Trethewey shaft, which still measured 45 feet in depth, and showed no signs of caving. With the assistance of Sydney and Clifford Jones he improved the road into the works, installed in the shaft a cylinder pump driven by a belt from a tractor flywheel, then added a 4-inch centrifugal, as the first one proved insufficient.

On the first pumping, a new ladder was placed and the timber checked. Next day, November 11, a visual inspection was made of the drifts leading from the bottom of the shaft, which were supposed to have been breastboarded up. However, one face of gravel had been left unprotected, with the result that the shaft caved in that afternoon, bringing the project to a sudden halt. The brief examination of the gravel showed a clean wash of well-worn pebbles up to fist-size, quite different to the overlying boulder clay, but no samples were taken.

Next year, Dan Reiswig and Sydney Jones worked out a section of the creek with a dragline. Little is known of this operation but it appears to have taken place from about

1200 W to 1500 W on the main base line (west of the present "Sam Adit"). Bedrock was reported to be hit during this operation but its nature is not certain.

Then, late in 1947, they tried again, first sinking a shaft to 14' before losing it to caving, then sinking another shaft, beside the first, to a depth of 20 feet. Both shafts were about 100 feet downstream from the small falls at the end of the Canyon. Gravel was found beneath about 10 feet of clay, but winter weather forced them to leave in November before reaching bedrock. According to Mr. Jones' notes for this period "a small quantity of heavier gold" was found at 13' depth, "a little gold" at 14', and "a little gold" at 20'.

One $\frac{1}{2}$ oz. nugget was reported to be found in one of these shafts but this report could not be confirmed (there is some disagreement as to the source of that particular nugget.)

Another placer operation was apparently underway sometime during this period, by Mr. Pine above the canyons (See Figures 4 and 7). Little gold appeared to have been extracted.

Additional work in the 1960's and 1970's was undertaken by Fosberg, Reiswig, and Brewster at different points on the creek but little information is available. Some coarse gold was reported to be recovered in a dragline/trucking operation in what is now the south western part of PL 1310.

4. GENERAL AND ECONOMIC GEOLOGY OF THE AREA

The geology of the area is discussed by Jones (1959, memoir 296 G.S.C.). Immediately to the south of the present placer claims on Marsh Creek lie granitic Coast Intrusions. These, however, are not observed along the creek due to the deep overburden. The rocks exposed in the Marsh Creek Canyons, and on the mountain slopes up from the north branch of the creek, appear to be mainly limey volcanic rocks, possibly the tuffs discussed on p. 42 of the 1959 memoir. Some non-limey fine grained volcanic rocks were encountered also, at higher elevations. Above the south branch of Marsh Creek there are prominant whitish limestone cliffs.

A quartz vein structure strikes NE along the foot of the limestone cliffs (See Figure 5) and is assumed to intersect the creek's north branch at the Riske Mineral Claim, although only float was observed, and no outcrops could be found numerous test pits were however observed along line RLO. This mineralized vein structure is listed under "Monashee" or "Riske" in the Mineral Deposit Inventory Sheets as Lots L 192, L 193, L 194, L 195, and L 306. (See Figure 5).

(Note: Some of the early reports of the Dept. of Mines mistakenly lumped these in with the St. Paul Claims farther to the north.) Numerous references are given on these sheets. The mineralization is prominant across the summit of Monashee

Mountain and extends NE an unknown distance (at least to the Riske Claim) and SW down the west slope of the Mountain, through the Monashee Creek Valley into a number of claims on its west side.(See Dawson, 1973)

The vein is described in the Mineral Deposit Inventory Sheets as of rather irregular cross section, 1 to 5 feet wide, and not easily traced. It contains free gold, gold bearing pyrite, galena, sphalerite, chalcopyrite, and magnetite. During 1939-40, 2418 tons of ore was milled and 367 oz. of gold, 1637 oz. of silver, 1556 pounds of lead, and 418 pounds of zinc were recovered.

In the Dawson (1973) report a total of 7 quartz veins were noted on the McPhail property (on the west side of the Monashee Creek Valley) distributed over a width of about 400 feet. Four of these veins were 2" to 6" wide and had only traces of mineralization. The remaining three were 1' to 3' wide. While it is not clear that this whole structure runs to the east through Monashee Mountain, there are numerous quartz outcrops observed on the slopes above Marsh Creek.

It seems likely that this vein structure is responsible for most of the gold in Marsh Creek: the gold in the creek is coarse and rough surfaced and even the smaller grains do not appear to have travelled far; also, quartz was observed in one small nugget, and limestone was found adhering to the side of a larger ½ oz. nugget suggesting that the gold

originated in a quartz vein adjacent to limestone beds. (such as occurs at the head of the south branch of Marsh Creek).

5. GEOPHYSICAL INSTRUMENTS AND SURVEYS

(a) General Field Procedures

A base line following Marsh Creek was established by surveying both up and down the Creek from the initial post for PL 1291 and PL 1310. The initial post was marked as station ON OW, and was located 1415 m. north and 320 m. east of the northwest corner of lot 4331, O.D.Y.D. (See PL 1291 lease form, map P82L/1Wd).

The location line of PL 1291 (one of the base lines of these surveys) was then run to the west at N75° W true, changing direction at station ON, 1200 W (1200 feet west of station ON,ON) to N35W true, then proceeding up the creek to ON, 1925 W at which point it leaves the Creek and goes N 35 W true up the mountain side to terminate at ON,3200 W. Stations were spaced 100 feet apart, along the line.

A random line (RL1) was established from ON, 2350W.

Another base line (Line CJ) was established to the north from station 1850 W, 300N. Line CJ heads 600 feet true north, then from there it heads at an angle of N 30 E true to station CJ 3200. Stations on this line were also marked every 100 feet. Line RLO was established from station CJ2300, N 93° W true.

All lines were surveyed, flagged and cut as necessary. A brunton compass and a "poly" chain were used on all lines, so the stations should be accurate to within 5% of their distance from station ON,OW.

(b) VLF-EM Surveys

The VLF-EM surveys were strictly of a test nature to see if these might prove of any use in determining the locations of buried, possibly gold bearing, gravel beds.

A Crone RADEM unit, tuned to the 18.6 kHz VLF station at Jim Creek, Washington, was used to obtain tilt angles (to $\pm$ 10) of the magnetic component of the VLF-EM wave.

The ground slope was also recorded during the surveys so that the effect of topography could be estimated.

The first derivative of the tilt angle (the slope of the tilt angle plot) was found by subtracting one station's tilt angle value from that of the next station, and dividing by the distance between stations. This was plotted in degrees per foot ($^{\circ}$/ft). The first derivative is used as it is less sensitive to topographical changes than the tilt angle itself.

Interpretation is based on methods discussed in Whittles (1969) and Fraser (1969). Generally speaking, all anomalies associated with rapid topographical changes were not considered since they cannot be uniquely be assigned as conductivity changes. The topographical changes can apparently cause changes of -0.10°/Ft in the tilt angle (See Whittles 1973).

Value greater than -0.10°/Ft may be considered to reflect true conductivity changes even in the presence of topographical changes. One can of course, only infer changes in conductivity - the exact cause cannot be uniquely explained.

Line RLO (Figure 8)

The data for this line is too sketchy to warrent much comment, the one slight change (at 450 N) appears to be caused by a small topographical change at that point, the location of a run off gulley. One additional comment should be made here though:a very rusty piece of guartz float was found at RLO-800 W, 300N and may mark the near location of the main quartz vein system that cuts across the head of the Marsh Creek Valley. This area should be looked at more closely.

Lines 1925 W and 1850 W (Figures 9 and 10)

These two lines together illustrate a surprizing degree of agreement with distinct ($>0.80^{\circ}$/ft) first derivative values at 110 N. One of these (On Figure 10) is $+.28^{\circ}$/ft which is surprisingly large for that location (since it is the heavily soil covered bank above the Creek).

Lesser, but still noticable and consistant VLF-EM anomalies occur at about ON (the location of the present creek) and at about 70S (the edge of the Creek bed)

The latter two anomalies are easily linked to present water locations, but the first one cannot be explained

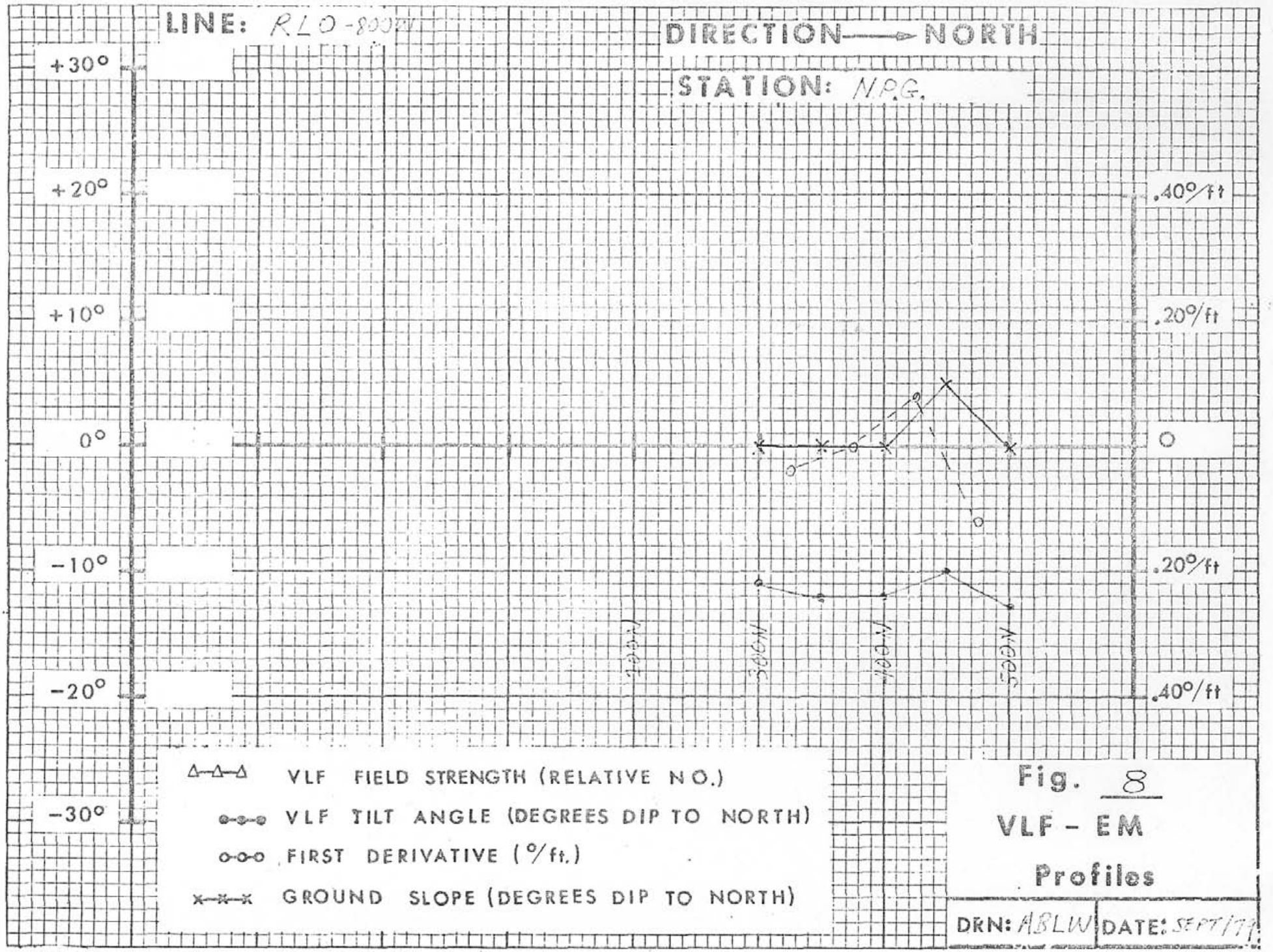
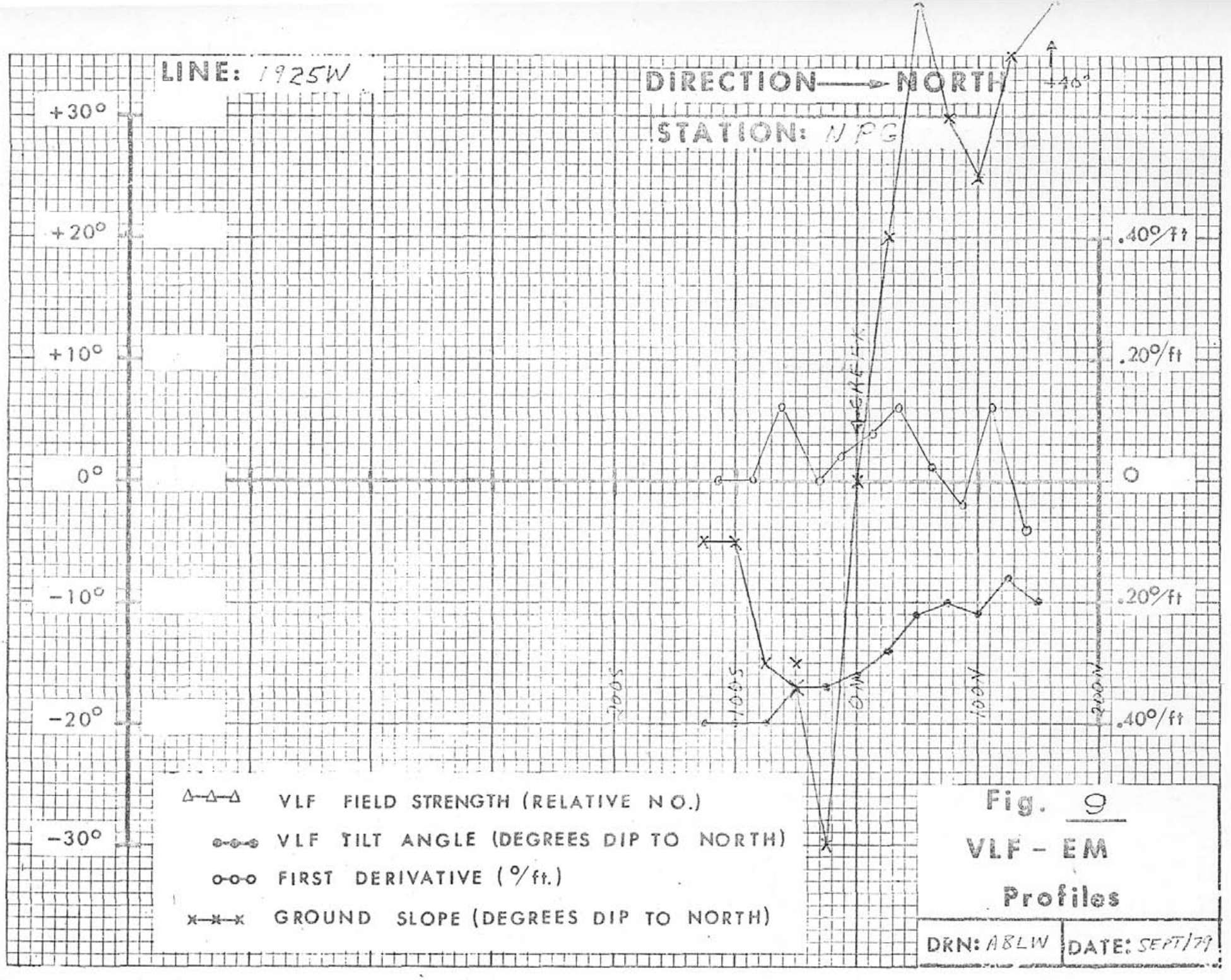


Fig. 8

VLF - EM

Profiles

DRN: ABLW DATE: SEPT/77


LINE: 1925W
DIRECTION → NORTH
STATION: NPG
+40°
+30°
+20°
+10°
0°
-10°
-20°
-30°
.40%/ft
.20%/ft
0
.20%/ft
.40%/ft
Δ–Δ–Δ VLF FIELD STRENGTH (RELATIVE NO.)
VLF TILT ANGLE (DEGREES DIP TO NORTH)
FIRST DERIVATIVE (%/ft.)
GROUND SLOPE (DEGREES DIP TO NORTH)
Fig. 9
VLF - EM
Profiles
DRN: ABLW
DATE: SEPT/79

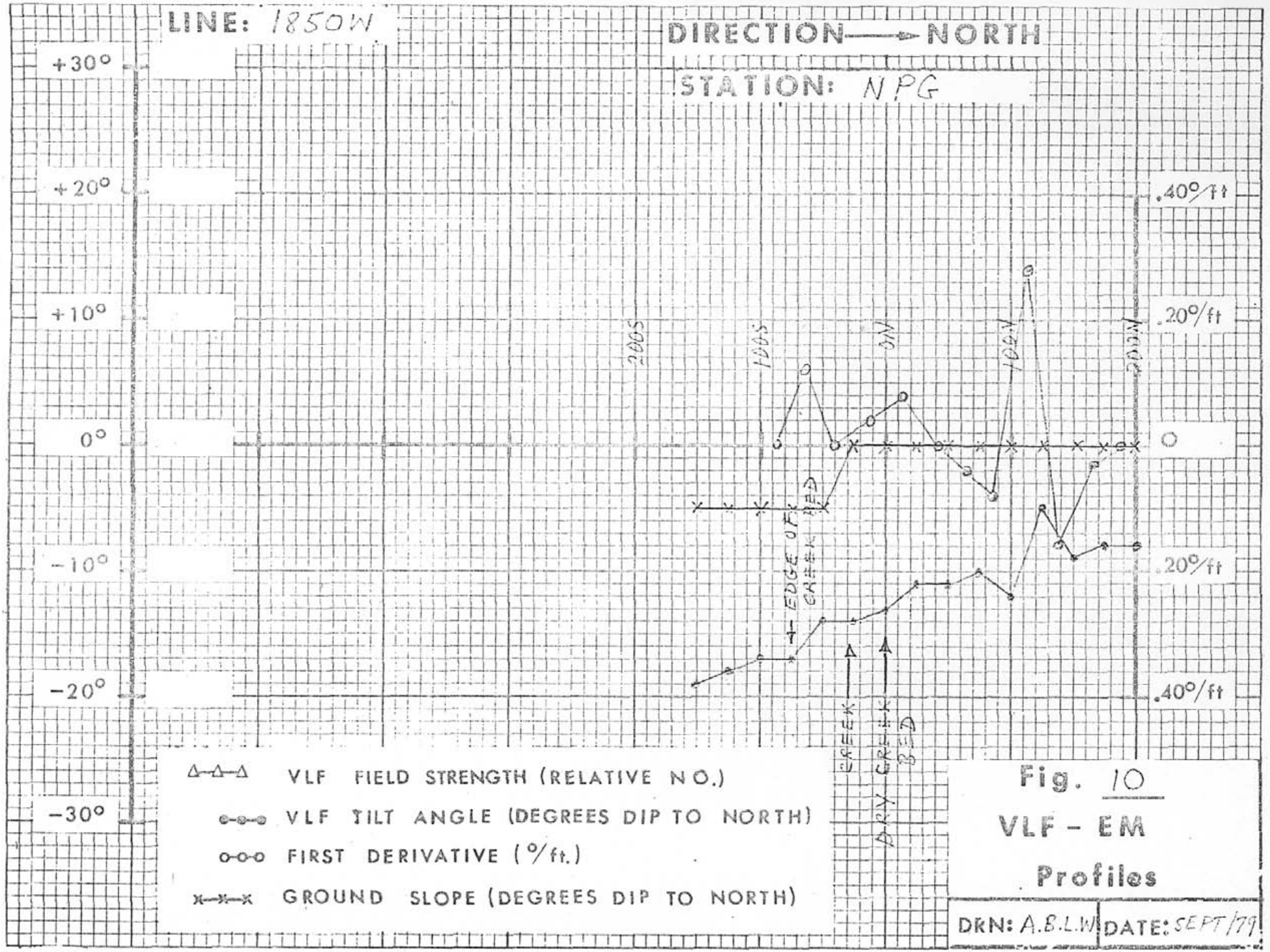


Fig. 10

VLF - EM Profiles

DRN: A.B.L.W DATE: SEPT/79

as easily The data does, however, suggest the possibility of a buried channel (See section 7, Interpretations)

(c) Magnetometer Surveys

A McPhar M 700 vertical componet fluxgate magnetometer was used, which is capable of $\pm$ 5 gammas precision, and a reproducibility of about $\pm$ 10 gammas.

The base station for the readings on the leases was set up at a clearly marked 10" spruce tree at ON, 1950W about 6ft (3M) above bare country rock (a limey volcanic tuff?) The base station reading was set as -110 gammas.

It was hoped that the magnetic surveys might be of some help in:

(i) determining the location of near surface alluvial magnetite (and associated gold) beds; and,

(ii) indicating the location of deeper gravel deposits, since these could contrast to the more magnetic country rock (limey volcanic tuffs?)

Line RLO (Figure 11)

No significant changes are observed except for the higher (less negative) values for stations near or on the creek (100 W to OW). The values observed for most of the rest of the line (which traversed bare or shallowly covered country rock) are similiar to those above the base station (-110 gammas, 1950 W, ON) which is also located over the bare country rock).

Line RLO - 800 W (Figure 12)

The values observed along this line are quite variable, although with one exception there seems to be a trend (marked as a dashed line) from about - 80 gammas at 500 S to - 260 gammas at 500 N. This probably reflects a gradual change in rock composition from south to north.

The one exception is of further interest as it occurs close to 300 N, the location of a shallow erosional feature (a shallow dry gulley), and a piece of very rusty quartz float was found at that location. This may be the location of the quartz vein system that strikes through the area.

Lines 1925 W and 1850 W (Figures 13 and 14)

The results for these lines are generally inconclusive, and the data seemed very hard to reproduce at the various stations. The reasons for this are not clear at present, and it is felt that the lines would need to be rerun very carefully before any comments could be made.

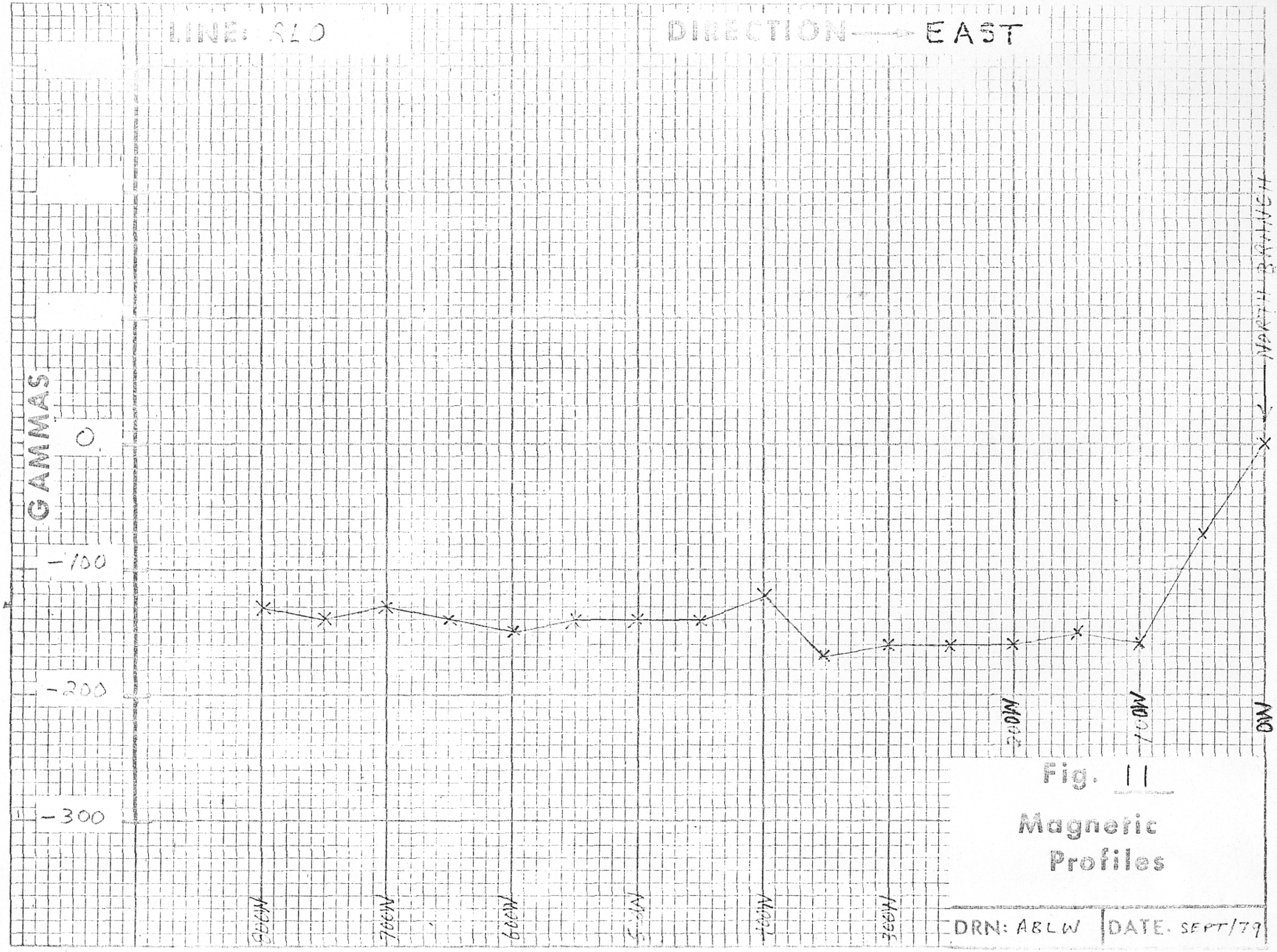


Fig. 11

Magnetic Profiles

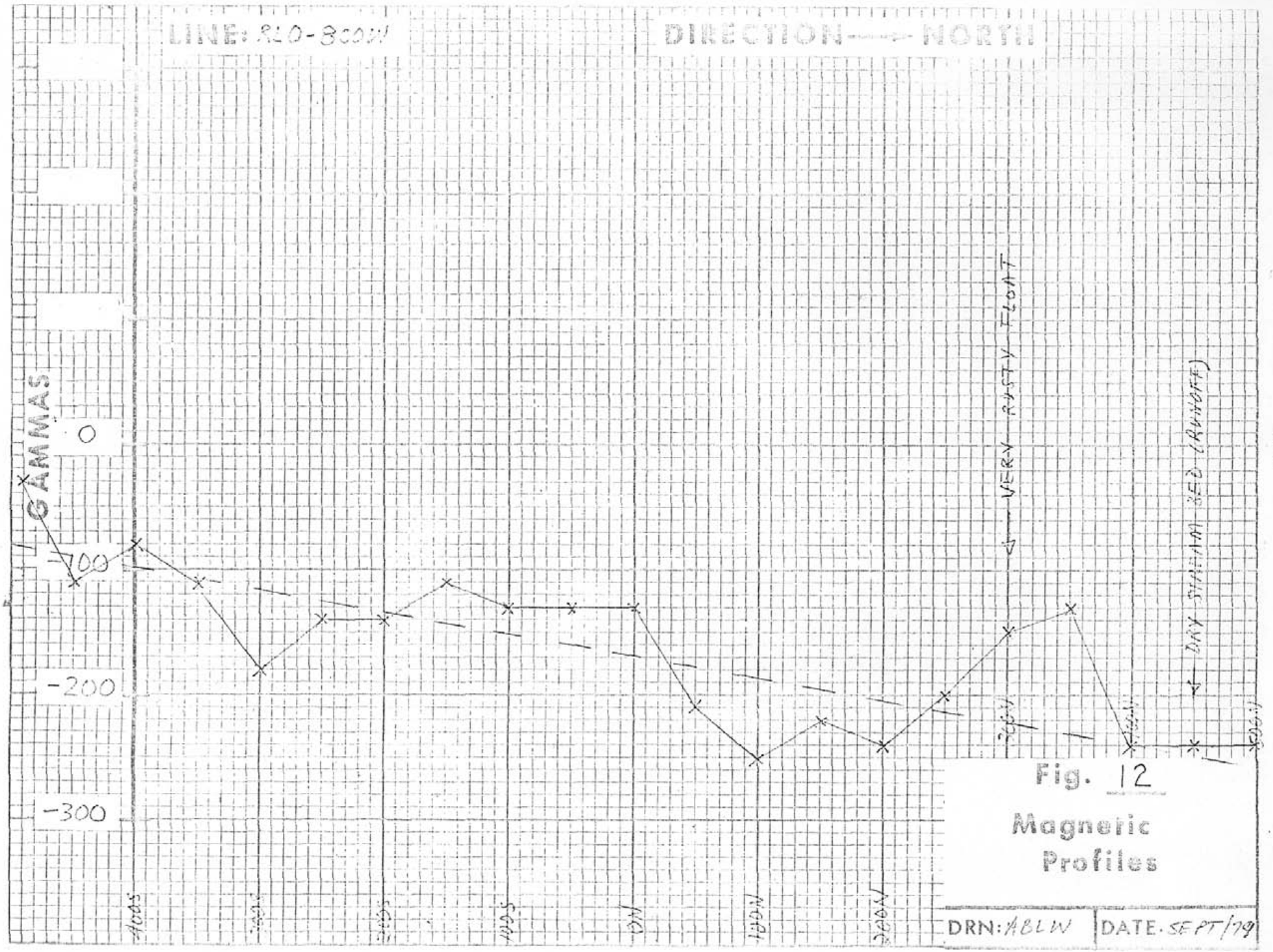


Fig. 12

Magnetic Profiles

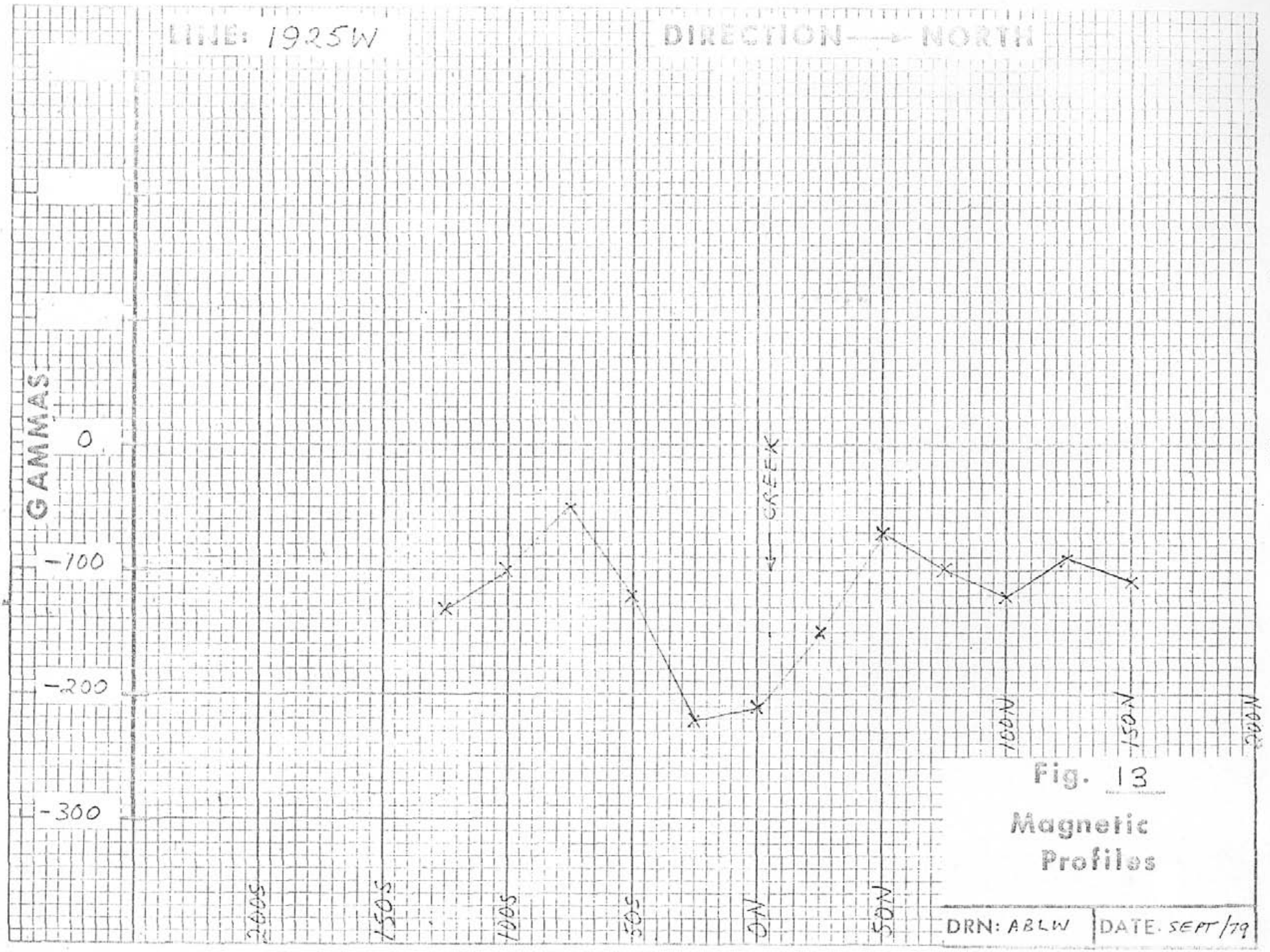


Fig. 13

Magnetic Profiles

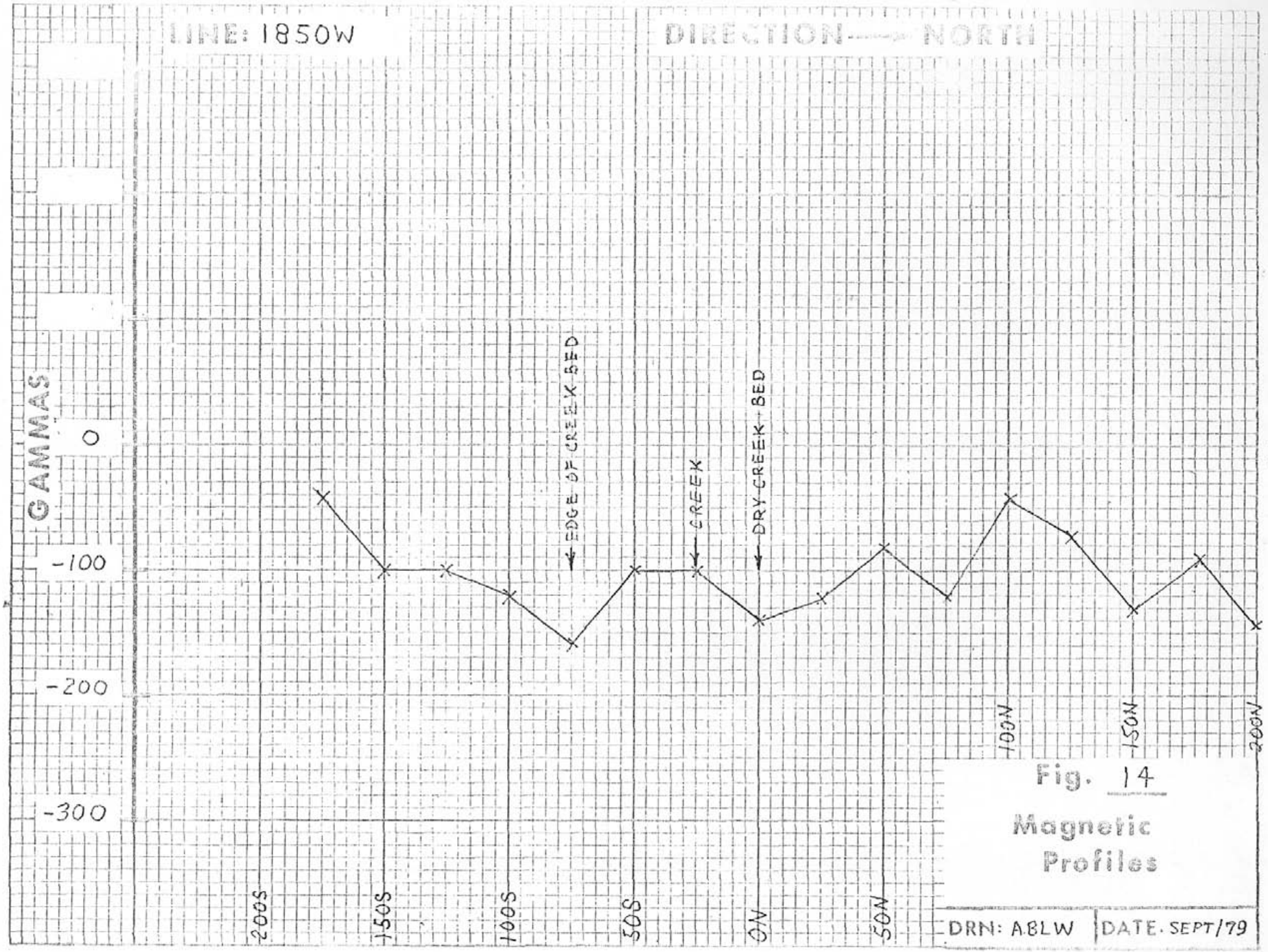


Fig. 14

Magnetic Profiles

DRN: ABLW | DATE: SEPT/79

6. TRENCHING AND PANNING TESTS

A considerable amount of hand work was carried out to test the "theory" that gold could be coming from the vein structure that cuts across the head of the Marsh Creek Valley. Most of the previous workers seemed to have assumed a more northerly source of the gold, and no work appears to have been done on the normally dry south branch.

To check this "theory", trenching was carried out at the junction of the south branch and the main stream of Marsh Creek. All material was put through a sluice box system and panned.

An estimated 25 yards of gravel were put through the following system: a long tom, grizzly, a wooden sluice box with 1" cross riffles spaced every 8", and a aluminum sluice box. The aluminum sluice box had an indoor/outdoor type of carpet matting, over which expanded metal riffles were placed, and this, in turn, was held in place by a spring clamped series of cross riffles. The total length of the aluminum sluice box was about 3 feet.

The whole system was tested by injecting 10 pieces of solder of various sizes and shapes into the long tom at various intervals during a run. All pieces of the solder were recovered and it is felt that the gold, being even more dense, should be subject to close to 100% recovery expect possibly some of

the very smallest"fines". Many fines were observed in the gold pan upon clean up, and it would appear that the modern design of the aluminum sluice box is quite efficient.

The procedure was to put ½ to 3 yards of gravel through the system before washing all of the heavier materials caught in the wooden and aluminum sluice boxes into a gold pan. Each of the resulting concentrates was given a sample number corresponding to those shown in Figures 15 and 16, and in Tables 1 and 2; the west wall view of the trenching is shown in the figure16, the north wall was solid country rock, and the east end looked down stream.

The samples were not tested in detail nor were the individual gold samples weighed. Only general observations were made, as recorded in Table 1.

The results were ranked in Table 2, and some general observations are possible. Gold values in the fragmented bedrock (FB) are generally poor to fair, while the best values were obtained in the coarse gravels just above the hard undecomposed bedrock at the deepest part of the channel. The values in the finer gravel are generally good. The monitered samples are hard to comment on since they covered a wide area, and involved a great deal of movement and agitation of the material.

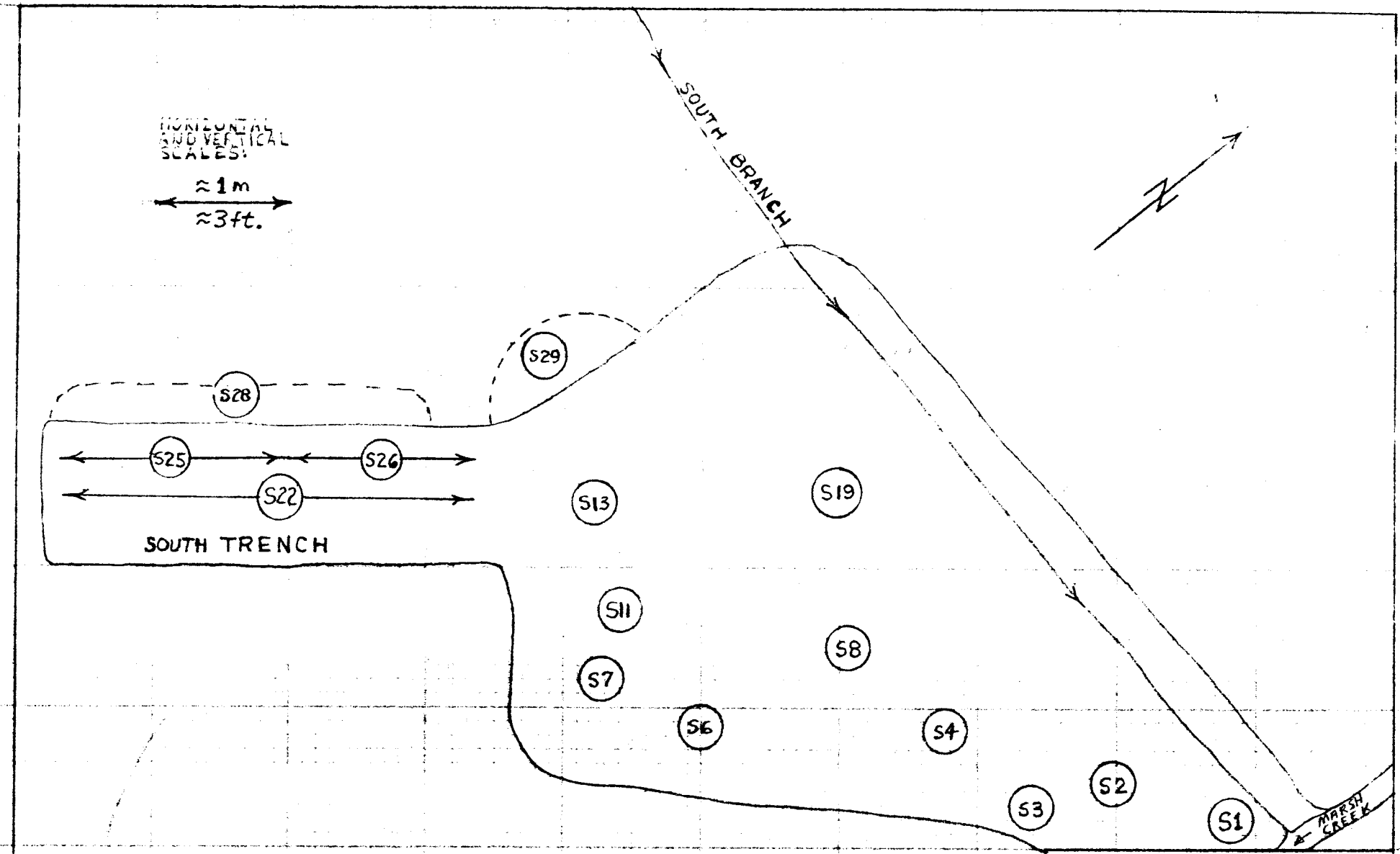


FIG. 15
PLAN VIEW OF
TRENCHING/SAMPLING

DRN. ABLW	DATE: SEPT.'79

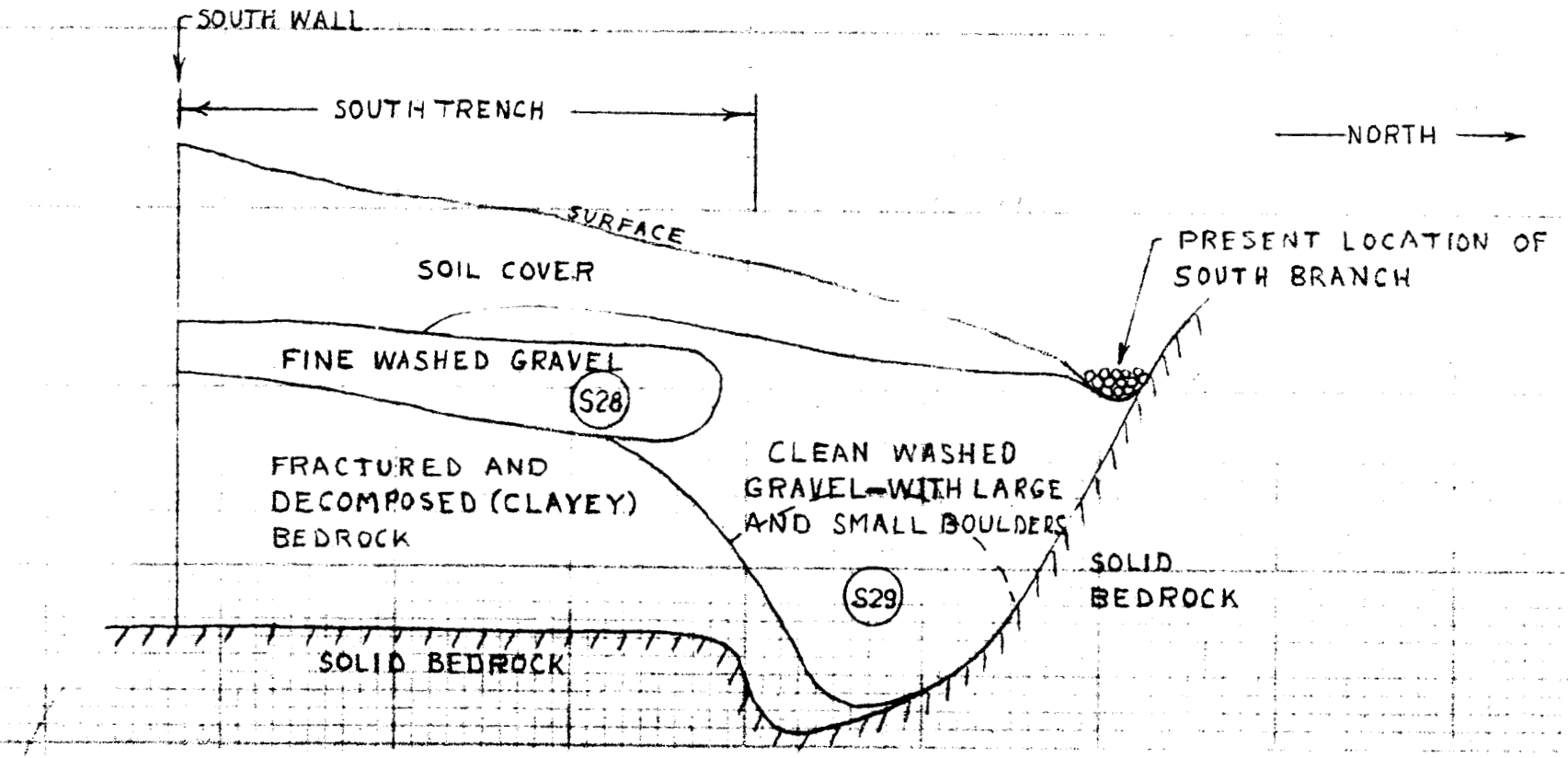


FIG. 16
WEST WALL VIEW OF TRENCHING

DRN: ABLW	DATE: SEPT. '79

Table 1: Summary of Trenching/Panning Results

Sample Number	Gravel Characteristics	Black Sand Content	Gold Content
1.	≈ ½ yd.	-	6 coarse colors
2.	≈ ½ yd.	-	several fine colors
3.	Fine, sandy, easily dug (≈ ½yd.)	-	one small 6 mm. nugget and numerous colors
4.	Fine, sandy, easily dug (≈ ½ yd.)	-	≈ 2 dozen colors
5.	≈1 yd. of coarse gravel, with angular fragments, on bedrock	-	a few small colors
6.	≈1 yd. of medium gravel, more rounded pebbles	traces	one 1 mm. coarse flake ≈ 1 dozen fine colors
7.	≈1 yd. fine to medium	≈1c.c.	one 2 m.m. round nugget ≈ 2 dozen fine colors
8.	≈1 yd. of very coarse gravel, and angular fragments from decomposed bedrock. 1½ feet below samples 4 and 6	≈1/10c.c	two 0.5 m.m. coarse colors ≈ 1 dozen fine colors

9.	1 yd. of fairly coarse, angular fragments from a short trench 4 feet long, down 1 to 2 feet below sample 7	≈0.5 c.c.	one 1 m.m. coarse flake ≈ 1 dozen fines
10.	≈ 2 yd. of very coarse, angular fragments (decomposed bedrock) Hydraulic nozzle was used on same area as samples 4, 5, 6, 7, 8, and 9.	≈0.5 c.c.	one 1 m.m. flake three 0.5 m.m. flakes ≈ 2 dozen fines
11.	Monitered areas near samples 6 and 7 to bedrock (plus four feet to the west) exposing the edge of the old channel. Gravel was medium to coarse with some bedrock material.	≈1.c.c.	one 1 m.m. flake ≈1 dozen fines
12.	½ yd. of monitered material from trench near samples 8 and 9. Gravel was fairly fine wash from monitering.	≈¼ c.c.	two 1½ m.m. flakes ≈1 dozen fines
13.	Soil and gravel monitered; fairly fine	traces	≈1 dozen fines
14.	Fine gravel; clean up of monitered material in area covered by samples 8 and 9.	≈¼ c.c.	≈½ dozen fines
15.	Quite coarse and angular. Clean up of all the monitered material in area covered by samples 4, 5, and 6 down to fragmented bedrock	≈1½ c.c.	three 1½ m.m. flakes two 1 m.m. flakes ≈½ dozen coarser fines (one of the coarser pans obtained)

16.	¼ yd. hole dug into clay which appears to be the result of bedrock decomposition along a fracture. Located between (and below) samples 4, 5 and 6	≈ 1/10 c.c.	≈ 1 dozen fines
17.	Fine gravel, round and angular fragments, some from bedrock. Cut down approximately 3 feet below sample 11.	≈ ¼ c.c.	one 1 m.m. coarse ≈ 1½ dozen fines
18.	2-4 yds. of variable gravel from monitering the entire area (covered by samples 4, 5, 6, 7, 11 and 13) to bedrock.	≈ 1 c.c.	one small nugget with quartz in it (4 X 2 X ½ m.m.) two 1 m.m. flakes ≈ 4 dozen fines (one of best pans)
19.	A mixture of fine, coarse washed stream gravel with some bedrock fragments. Monitered to bedrock.	traces	five 1 m.m. flakes ≈ 3 dozen fines
20.	1/3 yd. mixture of clay (decomposed bedrock) and bedrock fragments. Pit dug below S 6, into bedrock channel.	traces	≈ 2 dozen fines
21.	1/3 yd. mixture of clay and bedrock fragments, below samples 20. Deepest point in trenching, into a 6" wide fractured and weathered zone.	traces	two ½ m.m. flakes ≈ 1 dozen fines

22.	Soil and very fine sandy gravel. Top 1½ feet of south trench	≈1 c.c.	one 2 m.m. flake one 1 m.m. flake ≈ 2 dozen fines
23.	Clay, bedrock fragments, and some fine gravel. Next 1 foot of material below sample 22	≈½ c.c	one 1½ m.m. flake one 1 m.m. flake ≈ 3 dozen fines
24.	Fine clean gravel with some clayey gravel. Next foot below sample 23.	≈¼ c.c.	one 1 m.m. flake ≈1 dozen fines
25.	Heavily weathered bedrock (clay) and fine sand. Next foot below sample 24, but confined to south end of trench.	traces	two ½ m.m. flakes ≈ ½ dozen fines (a poor pan)
26.	Medium washed gravel. Same level as sample 25, but confined to north end of trench.	traces	two ½ m.m. flakes ≈ ½ dozen fines
27.	Bedrock fragments and clay 2 feet below S 26. Whole sample came from decomposed bedrock.	traces	≈ ½dozen fines (a very poor pan)
28.	Fine gravel a cut into the west wall approximately 1 foot deep. (See Figures 15 and 16).	≈1 c.c.	one 1 m.m. by 4 m.m. "nugget", very irregular one 1 m.m. flake ≈ ½ dozen fines
29.	Mixed gravel, above firm bedrock channel at deepest point in west wall of buried channel. (See figure 15 and 16) The fractures in the bedrock ran down hill, and the bedrock sloped to the east at about 30°.	≈1 c.c.	one 2 X 3 X 1 m.m. "nugget" five 1 m.m. flakes ≈1 dozen fines (a good pan)

Table 2: Ranking of Sample Results

Poor	Fair	Good	Excellent
2 F B	4 C G	(1 F G)	(3 F G)
5 F B	6 M G	7 C G	15 M
13 M	8 F B	(above hard bedrock)	18 M
14 M	9 FB	10 M	29 C G, above hard bedrock.
25 F B	11 M	17 FG	
26 M G, FB	12 M	19 M	
27 F B	16 F B	22 SC,FG	
	20 F B	23 F G, F B	
	21 F B	28 F G	
	24 F G F B		

FB = fragmented (decomposed) bedrock

M = monitered

CG = coarse gravel

MG = medium gravel

FG = fine gravel & sand

SC = soil cover

( ) Source of gold unclear

Samples 1 and 3 were taken very close to the south branch's junction with the north branch, and may involve gold from the north or central branches, not necessarily only from the south branch.

7. INTERPRETATIONS

There is good evidence that sizeable gold deposits exist on the property, and indications are that this gold originated in the mineralized quartz vein structure that runs across the top of the Marsh Creek valley. It would further appear that the topographical grade of the creek is too steep above the falls for much gold to be trapped there, even though Marsh took considerable gold out of that area in places. The main catchment area probably lies below the falls.

(a) Location of Gold Deposits

The most important questions at the present is the location of the main gold bearing beds. It is clear from Marsh's work that in the lower part of PL 1291 (near the old Puckett cabin) the channel strikes north west, under the north bank of Marsh Creek, as much as 100 to 200 feet north of the present creek bed. As we move to the north the situation become more ambiguous and two possibilities seem equally probable.

(i) The buried channel lies under the present stream bed, just below the falls, down to the Marsh workings. There is evidence from the earlier work of Jones et al (See Section 3: History) of a sharp drop off in the bed rock, just below the falls.

(ii) On the other hand, the VLF-EM results indicate a

marked change of conductivity 110 feet north of the base line in the present creek bed. This conductivity high lies under the deep cover of the north bank of the creek (as does Marsh's adit downstream) and is consistant on both Lines 1925W and 1850 W, being quite strong on the latter (a first derivative value of +0. 28°/ft.) It is possible that the old creek flow either came in from the north, or else the creek, when it formerly came through the canyon and over the falls, turned north for 100 feet, then again east, creating a channel about 100 feet north of the present one.

As noted already, support for this latter interpretation comes from the direction of the Marsh adit which was following the sidewalls of the buried channel. There is also the persistant beliefs of those involved in past work, that there is a buried channel coming in "from the north".

One of the puzzles in the present writer's mind has been the location of the 1920 Trethewey shaft. It might appear that such a shaft should be sunk up stream where Marsh obtained his richest values, but it is down near the entrance to the adit. One can only assume that Marsh felt that the bedrock at any location along the creek should be rich. Hence the shaft appears to have been sunk with the view to moving up along bedrock at the deepest point in the old channel.

(b) Grade of Deposits

The question of a reasonable estimate of the total gold

values possible in the area are discussed in the following section of this report. For the present, it is sufficient to point out that some very rich grades are indicated in certain locations near bedrock; for example, just below the falls Jones et al sluiced ½ yd. of gravel and obtained almost 1 oz. of gold. Also, Marsh reported he obtained approximately ¼ oz. of gold per small wheelbarrow of gravel (refer to his letter is Section 3: History). Mr. S.C.Jones has related that Mr. Puckett once stated that Marsh's wheelbarrow consisted of a peach box mounted on cross member and a wheel. This would imply many oz. of gold per yard in the areas near bedrock in the old buried channel.

(c) The Source of the Gold

Gold possibly has come down all three branches of the creek, but the main source is likely the presently dry south branch, and the central branch. Hence further exploration up these two branches might encounter pockets of good gold values.

The south branch is quite steep however, and catchment would probably be quite spotty. It is interesting to note that the trenching results indicate gold distributed throughout most of the gravels of the south branch. The west wall diagram (Figure 16) shows several distinct flow sequences. The following sequence seems most probable (from earliest to latest):

(i) Bedrock weathering to several feet.

(ii) Bedrock covered by light flow and fine washed gravel carrying good gold values.

(iii) Heavy flow confined to central part of channel, cutting through the fine gravel and the weathered bedrock to hard unweathered bedrock at the deepest point: this phase apparently deposited coarse gravel and the best gold values.

(iv) The fine soil cover represents the present stage of light flow (the branch is essentially dry from the end of June until the fall rains).

The decomposed bedrock is a bit of a puzzle since it is relatively low in gold values, even though it is heavily fractured. The flow over this material must have been too light to cause the gold to work into the fractures.

The central branch is also of interest since it goes underground into gravel deposits before it joins the north branch; a more level grade which could prove to be a good catchment area.

The north branch seems the least attractive, as indications are that not much gold was found above the canyon. The mineralization on the Riske Claim that lies across this branch also appears to be less intense than that to the SW. It is, however, possible that the north branch earlier flowed more to the east, toward the location of the buried channel followed by Marsh. This can perhaps be tested by VLF-EM surveys.

8. A DISCUSSION OF GOLD PROSPECT ON MARSH CREEK

(a) Procedures for Evaluation

The quartz vein system running across the upper part of the valley is likely to be the main source of free gold on Marsh Creek. It is possible to form a very rough estimate of the approximate value of the gold in the creek, by making a few simple calculations. The assumption used in making the calculations are discussed in detail in Section 8 (c)

The following procedure was used for the calculation:

(i) A profile A - A' (Figure 6) of the land surface was made from the topographical map (figure 5) reproduced from Dawson (1973).

(ii) The area eroded away between A and A' was then calculated.

(iii) A thickness for the quartz vein system was assumed, then the volume of gold bearing quartz eroded away was calculated.

(iv) A density of the quartz vein system was assumed, and the total tonage of the vein was estimated.

(v) The grade of gold was determined by assuming the values given in the Mineral Deposit Inventory sheet are representative of the eroded quartz system.

(vi) The amount of gold was then calculated from the tonnage (iv) and the grade (v).

(b) Calculations

(i) Line A - A' was drawn on Figure 5 and two profiles were obtained: one plotted at 100 ft/inch vertical scale to 450 ft/inch on the horizontal (Profile 1) the second(Profile 11) at 400 ft/inch and 450 ft/inch respectively.

These profiles are plotted on Figure 6. Profile 11 is plotted on a more realistic vertical scale to give a better "picture" of the eroded vein system; it allows one to better evaluate whether it is reasonable to assume that most of the gold in the vein could be deposited in the creek as erosion took place.

(ii) The total area of the quartz vein system was then calculated in sq.ft. by estimating the squares inside the eroded pattern. There are approximately 14 of the larger square each containing about 450 ft X 100 ft. = $4.5 \times 10^4 ft^2$, (All of the quartz vein from the surface up to the 5400 ft. level is assumed to have eroded and deposited all its gold in Marsh Creek)

Hence the area of the quartz vein system eroded is

4.5×10^4 ft.$^2 \times 14 = 6.3 \times 10^5$ ft.^{2}

(iii) The width of the quartz vein system was assumed to be 4 ft. wide (see Sections 4 and 8 (c) of this report), so the volume eroded was:

6.3×10^5 ft.$^2 \times 4$ ft. $= 2.52 \times 10^6$ ft.^{3}

(iv) The specific gravity of the quartz vein system was assumed to be 2.6 (Berry and Mason p.476) and the weight density of water to be 63 lbs/ft^3 (Berser, 1973, p218). Hence the tonnage of the quartz vein was determined as:

$$2.52 \times 10^6 \text{ ft.}^3 \times 2.6 \times 63 \frac{\text{lb}}{\text{ft}^3} \times \frac{1 \text{ ton}}{2000 \text{lb}}$$

$$= 2.06 \times 10^5 \text{ tons}$$

(v) The grade of gold was estimated from the Mineral Deposits Inventory sheets for the "Monashee" property Map No. 82L/SE-1, by noting that 367 oz. of gold was milled from 2418 tons of ore in the 1939 - 40 operations on the west side of Monashee Mountain, in the same vein system we are dealing with.

Hence

$$\frac{367 \text{ oz. of Au}}{2418 \text{ tons}} = 0.512 \frac{\text{oz.Au}}{\text{ton}}$$

(vi) The amount of gold was thus determined to be

$$\frac{0.512 \text{ oz}}{\text{ton}} \times 2.06 \times 10^5 \text{ tons} = 3.13 \times 10^4 \text{ oz.}$$

(vii) The value of the gold (as of the end of Sept. 1979) was approximately (in Canadian Dollars)

$$\frac{\$460}{\text{oz.}} \times 3.13 \times 10^4 \text{oz.} = \$14,400,00$$

(c) Some Comments on the Assumptions made in the Calculations

While one must clearly acknowledge the tenuous nature of many of the assumptions that had to be made, the possible

value of the gold deposits as estimated makes further work very important: the value of the deposits may exceed $10,000,000 - $15,000,000.

Let us look a little more closely at some of the assumptions.

(i) Assumption: the vein eroded away between A and A' deposited most of its gold in Marsh Creek. This assumption seems reasonable when one looks at Profile II of Figure 6, and realizes the creek is deep enough, and oriented in the correct direction to have likely escaped the scrapping effect of the most recent glacial period.

In fact, additional gold bearing materials from the northeast of Monashee Mountain could have been dropped in the Marsh Creek area.

It is also possible that eroded vein material above the 5400 ft. elevation level could have deposited gold in Marsh Creek.

On the other hand, there is no certainty that the present creek bed is in the exact location of the pre-glacial bed. This was apparently not the case with Cherry Creek (Report of the Minister of Mines, 1925, p.A185), although Marsh Creek is generally narrower and may be closer to its earlier location. The amount of gold washed out of the creek is also unknown.

(ii) Assumption: the vein system eroded away averaged 4 ft. in width. The width of this system is highley variable as noted in Section 4 of this report; however, there are several veins in the vicinity, over a distance of several hundred feet. Still another vein was found in 1979 in the present exploration program; a previously unrecorded adit was surveyed into the system to the south of the South Branch of Marsh Creek (See Adit RL1, on Figure 4). Hence there may be many eroded veins in the upper part of the Creek. Other mineral deposits have been observed on other parts of the Creek (Such as the old "Red Patty Mine", on PL1310).

Hence the assumption seems reasonable; it is however, fairly critical; a difference of 1 ft. added to the width estimate, or 1 ft. subtracted, would mean 20% more added to the gold estimates, in the first case, and 25% subtracted, in the second.

(iii) Assumption: the grade of gold is 0.152 oz./ton of the vein material. It seems reasonable to assume the grade is similiar to that mined, and in any case, it is the only guidepost we have! The following points should be noted:

(1) the ore mined may have been pre-hand sorted or high graded; if so, it is unlikely this was done only with gold in mind (1,637 oz. of silver, 1,556 lbs. of lead, and 418 lbs. of zinc were also recovered).

(2) The elevation at which the ore was mined is probably close to the average elevation of the eroded portion at the head of Marsh Creek.

(3) The same vein structure definitely continues across the upper part of Marsh Creek (See Dawson, 1973).

(4) It is not clear that all of the gold milled was free gold; if not, the estimates of oz./ton would be too high.

(5) Some of the gold appears to have been deposited in the adjacent rock, such as limestone. It is unlikely this would have been milled in the 1939-40 operations; hence the gold content may be even higher than the 0.152.oz/ton estimated used .

(6) The reports of rich gold finds in the final workings of Marsh's long adit, the sizable nuggets found by Marsh in the Canyon, and the coarse gold reported on the old Brewster claim all suggest good gold values will be found on or near bedrock, that the gold was deposited in pre-glacial times and has remained in place since, and that the retreat of the glaciers buried the original Creek channel in several tens of feet of glacial gravels.

9. RECOMMENDATIONS

(a) The most important question at the present time is the exact location of the old creek beds, which should contain the main gold deposits. Their probable location needs to be determined so that appropriate sampling can be carried out.

To this end, it is recommended that VLF-EM lines be run across the present creek bed, and across the regions to the north of the creek. These lines should initially be spaced every 400 feet along the base line, starting at 1600 W and heading toward ON, OW station. The lines should extend at right angles to the base line 200 feet to the north, and to 100 feet south of the present creek. If the VLF-EM anomaly presently observed at 110N, 1850 W is lost at any point, fill-in lines will be necessary. This work is suggested for the coming year (1980).

(b) Also in 1980 it is suggested that some initial exploration be considered using either a long arm back hoe, or by drilling, in the region just below the falls, where there appears to be a sudden drop off of the country rock into an old buried channel.

Further excavations/drilling sites might be suggested by the VLF-EM surveys.

All excavated material should be put through a sluicing/panning process in an organized fashion and carefully logged.

(c) A mining engineer needs to be involved since any excavations will require:

(i) a proper pit design;

(ii) a diversion of the creek waters;

(iii) tailing ponds;

(iv) the design of a large scale sluicing system;

(v) a reclaimation plan; and

(vi) a specific written approval from the Department of Mines and other involved Government Agencies.

(d) Further minor exploration by trenching/panning could take place:

(i) farther up along the south branch of Marsh Creek, starting at the trenching discussed in this report;

(ii) in the Blueberry Creek area covered by the other leases proposed to be included in this group.

(e) Seimic exploration might be tried on an experimental basis, although it is unlikely that it would prove to be of much use with the high velocity glacial clay being so close to the surface. A high speed material such as that would mask lower speed gravels underneath.

(f) Additional magnetic surveys might also be considered below the falls on the same lines as the VLF-EM surveys are run. This would have a lower priority, and be considered experimental also, with the view to seeing if more consistant patterns could be obtained.

(g) If time permits, it would be worthwhile to explore the mineralization indicated by the float, previous surveys (Dawson, 1973), and the magnetometer high, found on the Riske Mineral Claim at station RLO-800 W,300N.

(h) Finally, it is vital to note that further assessment work must be completed and filed in time to cover the other leases proposed to be included in this group since these leases were not issued until after the present field work discussed in this report was completed.

The work recommended for the mining engineer may fit this need.

10. REFERENCES

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11. APPENDICES

A. COST ANALYSIS

The various activities engaged in, and the estimated cost for the field work follow:

Date Field Work	Activity	Personnel	Cost
June 9, 1979	Travel, Nanaimo to Marsh Creek (400 miles @ $0.25/mile	Dr. A. B. L. Whittles	$250.00 100.00
June 10, 1979	Exploration of PL 1310, Sluicing tests	Dr. A. B. L. Whittles G. Kinneard	250.00 50.00
June 11, 1979	Sluicing test on the Kettle River (½ day)	Dr. A. B. L. Whittles G. Kinneard R. Sears B. Whittles	125.00 25.00 25.00 25.00
June 12, 1979	Sluicing tests on the south branch of Marsh Creek; running of lines 1850 N, 1925 W	Dr. A. B. L. Whittles R. Sears B. Whittles	250.00 50.00 50.00
June 13, 1979	Discussion with C. Jones, etc. re previous work, proposed placer operation, on site. Surface observations of working at Red Patty "Mine".	B. Whittles	250.00
June 14, 1979	Exploration along, and establishment of Line CJ	Dr. A. B. L. Whittles R. Sears B. Whittles	250.00 50.00 50.00
June 15, 1979	Returned to Nanaimo	Dr. A. B. L. Whittles Travel Costs	250.00 100.00

June 9-15, 1979	Food and Accomodations (trailer used)	4 men for 4 days 3 men for 3 days @ 10.00/man/day	$250.00
July 10, 1979	Travel, Nanaimo to Marsh Creek	Dr. A. B. L. Whittles Travel	250.00 100.00
July 11, 1979	Move and set up sluicing system on south branch of Marsh Creek	Dr. A. B. L. Whittles R. Sears W. Sears B. Whittles	250.00 50.00 50.00 50.00
July 12, 1979	Sluiced on south branch, explored and established lines on upper part of north branch of Marsh Creek and on Blueberry Creek	as above	400.00
July 13, 1979	Trip to Vernon		
July 14, 1979	Water pump moved to south branch, sluiced to bedrock on north side of trench	as above	400.00
July 15, 1979 to July 19, 1979	Trenching, sluicing, panning and recording results	as above @ 400.00/day	2000.00
July 20, 1979	No work undertaken		
July 21, 1979	Line Cutting and surveying Lines RL1 and RLO EM and Magnetic surveys	as above	400.00
July 22, 1979	Magnetic and EM Surveys ($\frac{1}{2}$day) on lines 1925 W and 1850 W	Dr. A. B. L. Whittles B. Whittles	125.00 25.00

July 23, 1979 July 24, 1979	Further trenching on south	as above	$400.00 400.00
July 25, 1979	Returned to Nanaimo	Dr. A. B. L. Whittles Travel Costs	250.00 100.00
July 10, 1979 to July 25, 1979	Food and Accomodation	4 men at $10/day for 16 days	640.00
Sept.19, 1979	Travel to Marsh Creek	F. Loring (Mining Engineers) Travel	250.00 100.00
Sept.20, 1979	Study of site, stadia measurements	F. Loring G. Kinniard S.C. Jones	250.00 50.00 50.00
Sept.21, 1979	Return from Marsh Creek	F. Loring Travel	250.00 100.00
Sept.19, 1979 to Sept.21, 1979	Food and Accomodation	3 men for 3 days @ $10.00/day	90.00
		Subtotal for Field Work	$9430.00

(2) Report Writing

April 7,8	Initial maps and history	Dr. A. B. L. Whittles	500.00
Sept.8,29,30 Oct.6,7 & 8	Final writing of report,completion of diagrams	as above	1500.00
	Duplicating Costs		50.00

Typing	25.00
Maps and Areal Photos	20.00
Reports Subtotal Costs	$ 2,095.00
Total Costs	$11,525.00

A B L Whittle

B. RESUME OF EXPERIENCE OF FIELD WORKERS

Mr. R. Sears has been prospecting for approximately two years on a full time basis, and was experienced in line cutting and basic surveying. W. Sears and B. Whittles were involved only in line cutting and laboring. G. Kinneard has had 2 years of College geology and 9 years of part-time field experience on his own, and under the direction of Dr.A.B.L. Whittles. Mr. F. Loring is a graduate Mining Engineer with 32 years of mining and exploration experience. He is a registered B.C. Engineer.

C. RESUME OF TECHNICAL AND FIELD EXPERIENCE OF DR. A.B.L. WHITTLES Ph.D.

(1) University training at the University of B.C. and the University of Toronto, with the completion of a Ph.D. in Physics (Geophysics Section) in 1964, from U.B.C.

(2) Two summers of experience in the geophysical section of Imperial Oil Ltd., in Alberta.

(3) Surveying experience, Buttles Lake Power Project.

(4) Four years at the B.C. Institute of Technology, teaching geophysical prospecting courses to day and evening students.

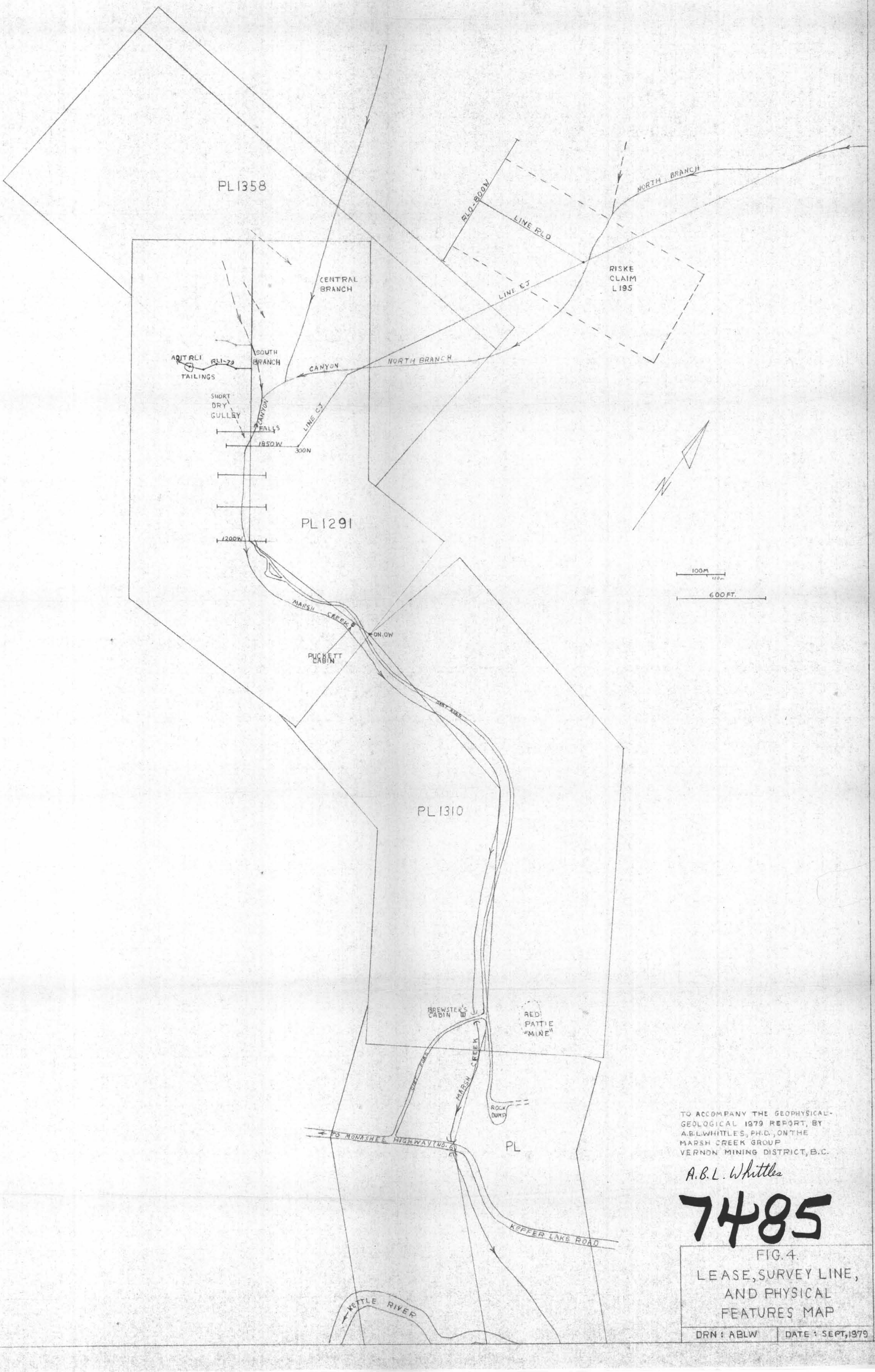
(5) Four years at Malaspina College, in charge of the Geological Technology, including the teaching of geophysical prospecting and geology courses.

(6) Consulting experience during the past 14 years with companies in Vancouver, Victoria, Calgary and Edmonton, including field supervision and interpretation.

(7) An active member with the Society of Exploration Geophysicists, and the B. C. Geophysics Society.

A B L Whittles

Dr. A. B. L. Whittles, Ph.D.



TO ACCOMPANY THE GEOPHYSICAL-GEOLOGICAL 1979 REPORT, BY A.B.L.WHITTLES, PH.D., ON THE MARSH CREEK GROUP VERNON MINING DISTRICT, B.C.

A.B.L. Whittles

7485

FIG. 4.
LEASE, SURVEY LINE, AND PHYSICAL FEATURES MAP

DRN : ABLW | DATE : SEPT, 1979

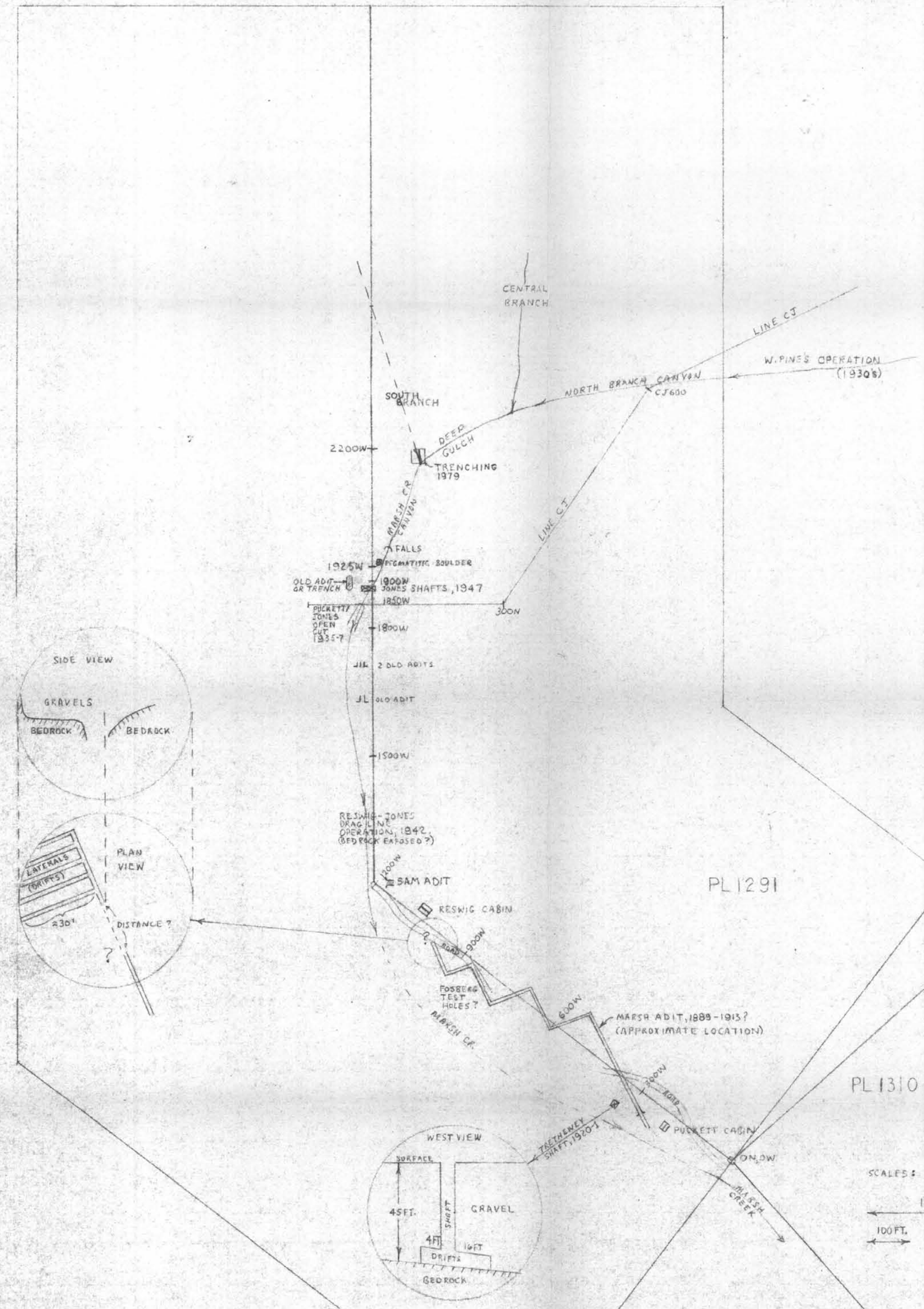


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FIG. 7
SKETCH MAP:
DETAILS OF MARSH CREEK WORKINGS

DRN: ABLW | DATE: SEPT. 1979

To accompany the Geophysical Geological 1979 Report, by A.B.L. Whittles, Ph.D., on the Marsh Creek Group Vernon Mining District, B.C.

A.B.L. Whittles