399

K-SHELL - GEN 78(10)A.

REPORTS ON GEODETIC SURVEY

WORK DONE FROM JUNE 27, 1978 TO JANUARY 31, 1979

SURVEY CONTROL FOR CROWS NEST RESOURCES LIMITED

FERNIE - SPARWOOD, BRITISH COLUMBIA

PHOTOGRAMMETRIC MAPPING PROJECT (1978)

FERNIE - SPARWOOD AREA - S.E. BRITISH COLUMBIA

COVERING ALL COAL LAND IN S.E. BRITISH COLUMBIA

HELD BY SHELL CANADA RESOURCES LIMITED

OPERATED BY CROWS NEST RESOURCES LIMITED

MORRISSEY ~~PREEHOLD~~

B.C. COAL LICENCES

264 TO 313 INCL., 365 TO 373 INCL., 408, 412 TO 414 INCL.

490 TO 495 INCL., 588 TO 601, 1299 - 1302 INCL., 4080 TO 4089 INCL., 4090, 4092

KOOTENAY LAND DISTRICT, B.C.

NTS 82G AND 82J

LAT. 49° 05; TO 50° 10' N, LONG. 114° 30' TO 115° 10' W

BY
SHELL CANADA RESOURCES LIMITED - SURVEYING DEPARTMENT
GENERAL SURVEY CONTRACTOR

NORTHWEST SURVEY CORPORATION (YUKON) LIMITED
SUBCONTRACTOR ON PHOTOGRAMMETRIC MAPPING

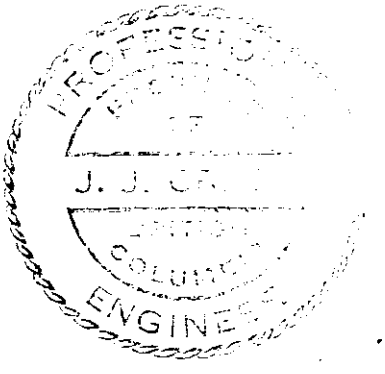
1979-04-26

Geodetic Ground Control Survey and Photogrammetric Mapping for Crows Nest Resources Ltd. (CNRL) covering all coal lands in South-eastern British Columbia held by Shell Canada Resources Limited (SCRL) were done in 1978-1979 in one unit for better technical and cost efficiency. This work was done under my direction by SCRL Surveying Department - General Survey Contractor and Northwest Survey Corporation (Yukon) Ltd. - Subcontractor on Photogrammetric Mapping.

I verify that both companies are in the commercial surveying business, have full facilities, qualified staff and carried out the work professionally according to prevailing standards. The reports given by SCRL Surveying Department are true accounts of the work done.

J. J. Crabb, P. Eng.

April 30, 1979



SURVEY CONTROL
FOR
CROWS NEST RESOURCES LIMITED
FERNIE - SPARWOOD
BRITISH COLUMBIA

BY

SURVEYING SECTION

Shell Canada Resources Limited
400 - 4th Avenue, S.W.
Calgary, Alberta, Canada T2P 0J4

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OBJECTIVE

The primary objective of the Survey Control Project in South Eastern British Columbia was to select, target and monument the ground control points for the future photogrammetric mapping of the area.

The secondary objective of the project was to provide three dimensional coordinates of the pre-selected ground control points. These were determined by Doppler Satellite and Inertial Survey Systems.

INTRODUCTION

Early in 1978, Shell Canada Resources Limited obtained control of the Crowsnest Resources Limited. In order to have good geophysical evaluation of the coal reserves in the Fernie-Sparwood area, Shell proceeded with the photogrammetric mapping of the area. The whole area was to be mapped in 1:5000 scale with several small areas of 1:2000 scale (Figure 1).

The ground survey control part of the mapped area together with the targeting and monumenting of the points was provided by Shell.

The ground control coordinates on the perimeter of the project were obtained by the JMR-1 Satellite Receivers. (Figure 3). The intermediate control points were established by the Inertial Survey System (I.S.S.) mounted in the helicopter (Figure 3).

Additional ground survey control points were established by JMR-1 Satellite Receivers mainly to control the 1:2000 scale maps.

Shell provided additional vertical surveys to three (3) satellite stations and to one (1) inertial station.

The photogrammetric mapping part of the project was awarded to the North West Survey Ltd. (Yukon) from Edmonton.

FIELD PROCEDURES AND OPERATIONS

A. Targeting and Monumenting of the Points

The original design of the ground survey control network was bounded by the photogrammetric needs. The photogrammetric block adjustment program SPACE M required ground control points every third or fourth photogrammetric model.

The dimensions of the targets were designed to suit the scale of the photography. The targets were made out of white cotton material with a wooden frame. They were crosses of forty (40) feet in diameter and three (3) feet wide.

Surveyors, together with photogrammetrists decided that some targets were to be used for both of the mapping scales (1:2000, 1:5000). The targets used for 1:2000 mapping scale were painted black at the centre (spray paint) and the 1:5000 mapping scale targets were white.

The targets were prefabricated in Sparwood by Shell at the beginning of June 1978. A special bracket attachment was designed for the helicopter to transport six (6) prefabricated targets at one time. The targets were made in the four (4) ten feet long sections and were folded and bundled for easy transportation. A total of 90 targets were made for the entire project.

The targets were to be attached to the ground by steel nails and/or by heavy rocks.

The placement and the position of the ground control point was the responsibility of both the photogrammetrist from North West Survey Corporation (Yukon) and the surveyors from Shell.

The photogrammetrist was to be concerned with the position of the survey control for a block of required topographic maps. The surveyor was to be concerned with the requirements for the Doppler and Inertial Survey Systems for the position of ground control network.

North West Survey Corporation (Yukon) provided Shell with one field survey engineer for the correct location of the targeting in the mapping area.

The survey crew arrived at Sparwood on June 12, 1978 and spent three days on reconnaissance and site selection, target and fuel distribution. Shell utilized two survey crews in two helicopters, a Bell 206B helicopter (Kenting Helicopters) and a Hughes 500C (Lift Air Helicopters).

The survey crew employing the Hughes 500C commenced the placing of the targets at the north end while the second survey crew began at the south end of the project. Each crew placed seven (7) to eight (8) targets each working day. The survey crews experienced a problem with the supply of the steel nails in Sparwood. This was resolved by prompt shipment from Calgary.

The survey control stations were monumented by standard Shell survey posts placed at the centre of the targets.

The surveyors spent a total of nine (9) working days on the targeting project. Out of these nine (9) days, three (3) days were spent on reconnaissance and site selections, five (5) days on targeting and one (1) day on photographing all of the stations. In that period, sixty-nine (69) targets were placed from the helicopters for the photogrammetric project. Other (10) targets were set from the trucks. These were used for additional photo-identification and checkpoints.

The targeting part of the project in Fernie-Sparwood area was completed without any delays and with no time lost due to bad weather or helicopter malfunction. The help of the surveyor from North West Survey Corporation (Yukon) was greatly appreciated by Shell personnel.

B. Doppler Satellite Survey System

In the initial stage of the project, only ten (10) control points were to be established by Doppler techniques. These were to provide a block outline control framework for the remaining stations which were to be established by the Shell Inertial Survey System. However, due to the problems with the processing of the Inertial Survey Data, another thirty (30) Doppler stations were added at later stages. These were mainly to control the areas of 1:2000 scale maps.

Derek Salvage arrived in Sparwood on the 19th of June, 1979, joining Tony Melton, Tony Mikes and the rest of the survey team. Seven receivers, seven solar panels and fourteen 12 volt batteries were brought from Calgary. After discussion with the surveyors on site, it was decided to establish ten Doppler Stations with Monitor Stations in the north on the Shell Control Point on Horseshoe Ridge and in the south on Squaw, Centre, Packhorse or any other primary control point that the helicopter could reach safely.

On June 20th the receivers were put out on the first of the sites, along with a solar panel and a 90 amp hour 12 volt battery. On Horseshoe Ridge, two Shell Stations were discovered. As there was no readily available data as to which was the primary Shell Control Point, both of the points were occupied (Shell 103 and 104). Some difficulty was experienced in locating some of the stations to be occupied. They had been targeted, but the patches of snow still on the ground made them difficult to find. Eventually, four sites were found and occupied.

Finding a suitable Monitor Station in the south also proved very difficult. Eventually "Packhorse", near the Flathead River, was selected and after several trial runs, was landed beside and occupied.

The next day the receiver on Shell 103 was moved to occupy 78-60. This site was surrounded on three sides by high mountains and had to be re-occupied later on during the week to provide sufficient data for processing. Another site, 78-32 near Island Lake, Fernie, had to be re-occupied for a further three days as all the exterior cables were devoured by some voracious wild animals.

In general, the first part of the Doppler project ran smoothly. The sites were occupied for four days, with batteries and tapes being changed every two days. The targeted sites were well cleared and after the snow had gone, were easy to find.

The satellite antenna erected over the marker and the vagaries of the up-draughts and winds in the mountains did make landing at times, a little 'difficult'.

The first part of the Doppler Satellite Survey was completed on July 1, 1979. During the processing of the data, a discrepancy of approximately seven metres was discovered in the coordinates of the two Monitor Stations (104 and Packhorse). These two stations were in different control networks and in order to check our work, these stations were re-occupied between July 6th and 10th. At the same time, two other stations in the area, Northwest and Centre, together with Priddis near Calgary, were occupied. This project ran smoothly although servicing the receiver at Centre proved difficult at times. It was however, the only site in the area remotely accessible.

The second part of the Doppler Satellite Survey was initialized by the Shell Survey Section. The two surveyors arrived in Sparwood on Saturday, August 19, 1978 together with six (6) receivers, six (6) solar panels and fourteen (14) twelve (12) volt batteries. The surveyors were to establish additional control for the maps 1:2000 scale in the Line Creek area. It was decided to use Shell control point 104 - Horseshoe Ridge as a Monitor Station. The other four receivers were set up on the targeted survey control stations (78-05, 78-06, 78-15, 78-16).

During the placement of the receivers on the survey control stations, the surveyors experienced problems with the alerts for the pass programming. As it was proven later, these were one day ahead of the proper value. Surveyors switched the JMR-1 receivers on prime and disable to monitor all of the satellite passes that day.

The remaining receiver was set up on the station 78-18 the following day. All of the remaining stations were visited for the tape and battery exchange. The stations were checked again on July 22, 1978. The tape in the receiver 76-146 on Station 78-06 was jammed. The receiver was out of power and the cable from the solar panel to the battery was disconnected. The disturbance of the station was caused by the wildlife in the area. The station was put in order and was supplied with the new tape and battery. The receiver on Station 78-16 (JMR-1 76-152) was dismantled and reset on the station 78-14. However, this receiver had a problem with the sweep on the 150 KHz channel.

The survey crew visited all the stations again on August 23, 1979. They supplied all of the stations with the fresh data tapes and batteries. They found the JMR-1 receiver 74-121 on Station 78-15 and JMR-1 receiver 76-138 on Station 78-05 malfunctioning. The data tapes were jammed and systems were without power. Both surveyors concluded that the problem arose with the bad set of data tapes. This misorder was corrected and both of these stations were functioning again.

The surveyors visited the survey stations on August 24th. The JMR-1 receiver 76-152 on Station 78-14 did not work properly. The receiver locked on some other frequency and collected erroneous data and it was removed from the station. On the same day, surveyors retrieved receivers from Stations 78-18, 78-15 and Stations 78-600 and 78-16 were occupied.

The stations were visited again on August 25th and were found to be in good working condition.

Both surveyors returned to Calgary on the same day for four (4) additional receivers, three (3) solar panels and four (4) batteries. The new receivers were for the reoccupation of the Stations 78-05, 78-18, 76-06, 78-15 because of the previous receivers malfunctioning.

For the remainder of the second phase of the Doppler Satellite program, the receivers worked properly and the stations were taken down on August 28, 1978.

The third part of the Doppler Satellite Survey program included twenty (20) ground survey control points for the 1:2000 mapping areas. The stations were mainly in the Corbin and Lodgepole areas (Figure 3).

The surveyors left for Sparwood on September 12, 1978 together with twelve (12) receivers, seven (7) solar panels and twenty-four (24) batteries. All of the receivers were pass programmed and switched on in Sparwood. The two receivers (77-087) and 77-080) occupied two monitor stations, 104 Horseshoe and Northwest. During the receiver distribution on September 13th the surveyor found the discrepancy between the supplied alerts and the satellite passes. Again, the receivers were switched on prime and disable to monitor all passes for three consecutive days. Satellite receivers occupied the Stations 78-08, 78-09, 78-12, 78-13, 78-24, 78-100, 78-52, 78-54, 78-55 and 78-69.

The stations were revisited on September 14, 1978. During the landing on Northwest, the solar panel, together with the receiver 78-080, was blown over. The surveyor decided to occupy station 47 in the south as a second monitor. The surveyor experienced problems with the second monitor station. The satellite receiver 77-087 on Horseshoe Ridge locked on the Command 6 and it was replaced by receiver 76-152 from Station 78-12.

The receivers were visited daily for tape and battery exchange. The stations were pass-programmed on September 17th. The receiver 77-080 from Northwest was set on Station 78-12 and receiver 76-335 was placed on Station 78-47 Elko on September 17, 1979.

All of the previous stations 78-40, 78-40A, 78-47A, 78-80, 78-45 were established. The stations 78-43, 78-48, 78-49, 78-54 were occupied on September 18, 1978. The surveyors left for Calgary on September 18th with the data tapes and returned to Sparwood the following day. All of the receivers functioned properly for the remainder of the program.

The surveyors established another four Doppler Stations 78-800, 78-801, 78-802, 78-803 for the geophysical exploration location (drill holes). All of the stations were taken down on September 25th and 26th, 1979. The surveyors, with all of the equipment returned to Calgary on September 27, 1978.

All of the surveyors express their thanks to the staff of Kenting Helicopters for their assistance throughout the project. Also thanks to Tony Sampietro from Crows Nest Resources for help and additional assistance during the project.

C. Inertial Survey Control

INTRODUCTION

This report contains a description of field procedures and operations and provides conclusions and recommendations for improvement of the Inertial technique.

FIELD PROCEDURES AND OPERATIONS

The Inertial Survey System and electronic support equipment was transported by station wagon to Fernie, B.C. on July 3rd, 1978. Other equipment, including a diesel generator, batteries, fuel and accessories were transported by truck earlier the same day.

The following day (July 4th), the ISS was installed in Kenting Helicopter's Bell 206B C-GXDI at the J & T Industries compound in Sparwood, B.C. Due to inclement weather and difficulties with this prototype installation of the cargo platforms, installation took most of the day. After the system was run up and functional, checks were made; the pilot, Leroy Dean, made a flight test to comply with Ministry of Transport regulations.

On July 5th, poor flying weather in the morning enabled the Vehicle Reference Point survey to be carried out. Improving weather in the afternoon allowed three lines (Lines 1, 2, 3, each with two passes) to be run. At this stage of the project alignments took place at the beginning, at the turnaround point (unless it was a short line), and at the end of the line.

NOTE: A description of the lines flown and points visited is located in Figures 3, 4 and Table 12. Table 13 shows an outline of helicopter time.

On July 6th, Pilot Ed Krahn replaced the previous pilot. He adapted quickly to the flight requirements for successful inertial operations, enabling the surveying of Lines 4, 5 and 6.

On July 7th, weather restricted flying to the afternoon but four lines (Line 7, 8, 9, & 10) were flown.

On July 8th the weather was poor again, but a reconnaissance flight revealed clear weather on the south-west edge of the project and Lines 11, 12, 13 and 14 were flown. Line 15 was attempted, but the Inertial unit would not align. This was the first instance of the ISS overheating problem, although it was not recognized as such at the time.

On July 9th, two lines were run in the south-west (Lines 15 and 16) then a data transfer problem developed in the O.C.U. By mid-afternoon, this fault was corrected and a further three lines were completed (Lines 17, 18 and 19.

The weather was very poor on July 10th and although reconnaissance flights were made in the morning and afternoon, scattered rain and clouds obscured all of the areas of operation.

On July 11th, three lines (Lines 20, 21 and 22) were flown. The previous days rain made the mountain air masses turbulent and caused some unavoidable buffeting of the helicopter on Line 20 which paralleled the B.C. - Alberta border.

The following day (July 12th) four lines were flown (Lines 23, 24, 25 and 26).

Lines 27, 28, 29, 30 and 31 were flown on July 13th, but the as yet un-recognized overheating problem prevented completion of Line 31.

With the weather remaining clear on July 14th, Lines 31, 32, 33 and 34 were completed.

On July 15th, Lines 35 and 36 were flown and several additional targets were established for later flights.

On July 16th, Line 37 was flown to the southern boundary of the project. An extremely violent weather front intervened and prevented further operations for the remainder of the morning. Although the weather improved by early afternoon, the helicopter was required to join in a search for another helicopter which had been missing during the storm, and therefore not available for surveys.

Due to low-lying cloud covering most of the high terrain, no surveys could be carried out on July 17th. This opportunity was utilized to complete targeting of various interaction points on the lines.

Heavy rain and fog on July 18th again hindered operations, but the day was used to run static tests and calibrations with the system.

On July 19th, the system was removed from the helicopter due to failure of components in the OCU, and transported to Calgary for repairs. The system was reinstalled on July 22nd and Line 37, Pass 2 was attempted. However, a mid-air shutdown of the FILS prevented completion of this line. On July 23rd and 24th similar problems were encountered. By the evening of the 24th, the problem was isolated to mechanical damage of the height channel card which had occurred during testing and inspection of the card.

On July 25th a successful day finished Line 37 and 38, Pass 1 with good performance from the ISS. High air temperatures by the afternoon again caused overheating, but this problem was now recognized.

July 26th was a good day with Lines 38, Pass 2 and Lines 39, 40, 41 and 42 completed. The continuing hot weather caused shutdown by 14:30.

July 28th was a slightly cooler day and allowed Lines 46, 47, 48, 49, 50, and 51 for a full day's work. However, on the last line, the tailrotor was damaged.

The Kenting engineering staff responded well and had a replacement tailrotor flown down by the evening and installed by 10:00 the following day.

With a late start on July 29th, Lines 52, 53, 54 and 42, Pass 2 were flown.

A great deal of short lines remained to be cleared up on July 30th and Lines 55, 56, 57, 58, 59, 60 and 53, Pass 2 were flown.

The rain, with its associated low-flying clouds in the mountains, complicated operations on July 31st. Lines 61, 62, 63, 64 and 45, Pass 2 were flown.

Despite the continuing scattered rain and turbulence, August 1st saw the completion of the program with Lines 66, 68, 69 and 70. The equipment was removed in the afternoon and returned to Calgary later the same day.

CONCLUSIONS AND RECOMMENDATIONS

This project gave valuable experience in Inertial operations in the mountain environment. Problems that arose in operations were directly attributable to a lack of ventilation in the rear cabin due to the fisheye windows fitted in the doors. Without the air circulation, the Inertial unit overheated when the outside air temperature reached 28^{o}C. The field solution to the problem was to fly at first light and have a day's operation completed by early afternoon. Because of long hours of continuous flying with no relief, it is recommended that the possibility of having two pilots be considered.

D. Referencing of the Points

All of the surveyed stations were monumented using standard Shell survey posts. The Doppler Satellite Survey stations were referenced either by the steel bars or by the bearing trees. This was accomplished during the time period from September 24 - 27, 1978. All of the stations were photographed in the same time span.

The future re-occupation of the survey station is assured by the supplied station descriptions, together with the site sketches and the photographs.

DATA PROCESSING

A. Doppler Satellite Survey Control

The processing of the information recorded on digital cassettes by JMR-1 Satellite Receivers, involves five operations:

1) Data Validation and Majority Voting
2) PREDOP
3) MERGE
4) GEODOP
5) GDLSAT

1) Data Validation and Majority Voting

The majority vote process reads each recorded satellite pass from field digital cassettes. Redundant information and passes with insufficient or erroneous data are rejected. The remaining data is re-formatted and transferred to magnetic tape cartridges for later input into the Univac 1100/40 system.

At the same time, data quality is further confirmed by solving single passes using the SP-7 program.

2) PREDOP

Reads and decodes the formatted Majority Voted input data (a series of satellite passes). A first order ionospheric refraction correction is done on the Doppler counts and variable and fixed parameters are decoded. A curve is fitted to each of the three variable parameters; then these smoothed functions and fixed parameters are used to compute the satellite orbit which is transformed into a terrestrial coordinate system. An eighth order polynomial is fitted to represent the x, y, z's. Finally, the Dopplers were computed to theoretical values and edited appropriately before being written out with the interpolated meteorological data.

3) MERGE

In the mode used on this project, consolidated PREDOP outputs from stations that were occupied, were added successively to the multistation file to be used as input to GEODOP.

4) GEODOP

Accepts satellite receiver data in the form of Doppler counts and associated satellite positions. Eight stations were processed simultaneously in one figure for a solution of station position, frequency offsets, receiver delays, orbital and refraction biases. The program GEODOP was designed to yield the most reliable relative positions for groups of stations occupied simultaneously and this is the mode in which it was used. GEODOP employs a phase adjustment approach whereby each pass is added to the cumulative solution of all preceding passes after surviving the built-in statistical tests.

5) GDLSAT

The purpose of this program is to combine blocks of station coordinates with their variance-covariance matrix as output by GEODOP runs into one large system of adjusted coordinates with a full variance-covariance matrix. This program provides the facility to apply scaling and rotations to the observed coordinates as well as a system shift and individual block shifts. Constraints can be placed on stations in the form of X, Y and Z constraints; phi and lambda constraint and height constraints. Following the total adjustment, the chord lengths, sea level distances, forward and back azimuths between stations are printed out. The absolute and relative error ellipsoids scaled to the 95% confidence level, along with a classification system are printed. A summary of the number and distribution of the relative error ellipsoids is printed following their calculation.

Constants and Constraints

The GEODOP system of processing Doppler Satellite observations require manual input of some constants and constraints. The constants and constraints used on this project are given below:

1) Passes with maximum elevation less than 14.5 degrees are not used.

2) Dopplers below 7.5 degrees from horizon are not used.

3) Passes with less than 3 dopplers are not used.

4) Hopfield refraction model is used.

5) Apriori variance factor for statistical testing = 1.4 cycles.

6) Orbital constraints - along track = 26m
- across track = 5m (1σ)
- out of plane = 10m

7) Standard deviation of a 30 second Doppler count 0.17m (1σ).

8) Receiver delay - each receiver was calibrated by JMR and the delay at -135 dbm., was used.

9) Meteorological data - barometric pressure, dry temperature and wet temperature were entered as mean values over the project's duration.

10) Reference Ellipsoid = 1927 N.A.D.

11) Datum shifts applied to convert WGS 72 to 1927 N.A.D. datum;

$\Delta X = -15$ $\Delta Y = 165$ $\Delta Z = 175$

B. Inertial Survey Control

The data obtained from the Inertial Survey System unit is recorded on Tektronix cartridges. The data processing involves the use of two programs; the Inertial Survey Adjustment Program (ISCAP) and the Position Adjustment Program (DIFFADJ-2). The ISCAP program is the series of seven sub-programs.

1) DATA EDIT
2) SEPT
3) EDIT
4) NORTH
5) EASTHT (EAST HEIGHT)
6) CORR
7) POSI

1) DATA EDIT

The program EDIT serves as a data quality control. It reads the raw data from the Tektronix cartridge and checks it for bad characters or data which is outside the expected bounds.

2) SEPT

The refined data from DATA EDIT is separated into three files; file #3, #18 and #29. File #3 contains the update velocities and associated positions, file #18 is a store for the 10 second velocities and position samples and file #29 is for the alignment and station data, and contains station information as listed below:

a) Station Number
b) Offsets from Vehicle Reference Point to Survey Point (V.R.P. to S.P.).
c) Time of update
d) Roll, pitch and azimuth of the Inertial Measuring Unit (I.M.U.).
e) One velocity and geographical position sample.
f) One IMU (Inertial Measuring Unit) U.T.M. Position sample corrected for error up to last update position.

3) EDIT

This program reads file #3 from SEPT and applies a straight line fit on North and East velocities per update block and edits out the velocities which fall outside the specified constraints.

Two straight line fits on the height velocity are done per update. The first is on the 10 seconds of velocity prior to velocity zeroing by the Inertial System, the second on the next 10 seconds. The difference between these two lines at the time of zeroing (known as a REF time) is calculated as the jump per block. The sum of these to a given time, is used to stack the height velocity so as to obtain a relatively smooth changing curve. A similar procedure is used for the height. These stacked values along with the North and East values are output to file #4.

4) NORTH

Only North velocities from file #4 are used. A two degree polynomial is used to fit three update velocity samples. The co-efficients a, b and c in the equation $y = a\ t^2 + b\ t + c$ are solved for each subsequent group of three updates and are output to file #15.

5) EAST HT (EAST HEIGHT)

This program reads the East and Height velocities from file #4. It performs a two degree polynomial fit on these velocities as described in the NORTH

program. The cross product accelerations due to heights which are not presently removed by Inertial System are calculated here and applied to the velocity curves. Following these corrections to the observed velocities the East and Height velocities are again fitted with a least squares two degree polynomial fit. These co-efficients are merged with the previous North co-efficients and output to file #11.

6) CORR

This program reads file #4 and file #11 and calculates the correction for the position using co-efficients a, b and c from the two degree polynomials and applies them to the uncorrected positions. The results are output to file #16 with corrected position of the IMU centre at updates.

7) POSI

The purpose of program POSI is to match and apply the IMU update positions read from file #16 to the station name and offset information obtained from file #29. The values are meaned for each update which gives us the correct survey point position and output to the print file and file #29 (input file for adjustment to external control).

8) GENERAL ADJUSTMENT EQUATION

This adjustment program is made up of eleven basic unknowns plus three additional unknowns for each observed station, for which coordinates are desired.

The UNKNOWNS are:

1. SYV = The scaling of the north velocity curve (additional to unity).

2. SXV = The scaling of the east velocity curve (additional to unity).

3. SZV = The scaling of the height velocity curve (additional to unity).
4. $D\phi$ = Displacement scaling in the latitude.
5. $D\lambda$ = Displacement scaling in the longitude (west).
6. Dz = Displacement scaling in the height.
7. DHVPDN = Change in height velocity due to change in latitude $\frac{(ft/sec)}{deg\ \phi}$
8. DHVPDW = Change in height velocity due to change in west longitude $\frac{(ft/sec)}{deg\ \lambda}$.
9. α = Misalignment angle between geodetic north and the north accelerometer at the start of the run. (Radians)
10. $\Delta\alpha$ = The linear rate of change of α
11. β = The fixed angle between the north and east accelerometer.
12. ΦU_1 = Unknown coordinates of the first station.
13. ΛU_1 = " " " " " " (west).
14. HU_1 = " " " " " "

ΦU_m = Unknown coordinates of the m th station

ΛU_m = " " " " " " " (west)

HU_m = " " " " " " "

ϕ_i = Observed i th value of latitude

λ_i = " " " " " longitude

h_i = " " " " " height

Φ_j = j th known true value of latitude

Λ_j = " " " " " " longitude (west)

H_j = " " " " " " height

$\Delta^t{}_i$ = The time in seconds from the start time at the first update to half way between the i th and the i th^{-1} update. NOTE: for i = 1 $\Delta^t{}_i = 0$

RADP = The radius of curvature in the meridian in metres for the average position.

RADPF = The radius of curvature in the meridian in feet for the average position.

RADL = The radius of curvature in the parallel of latitude in metres for the average position.

RADLF = The radius of curvature in the parallel of latitude in feet for the average position.

CONV1 = RADL/RADP

CONV2 = RADP/RADL

ODEG = The value of one degree in radians.

$CD\phi_1$ = The area under the latitude error curve up to the i th update in feet.

$CD\lambda_i$ = The area under the longitude error curve up to the i th update in feet.

CDh_i = The area under the height error curve up to the i th update in feet.

HTD_i = The accumulated height displacement at the i th update due to the removal of height velocity from the first height error curve to get the second height error curve.

ED_i = The accumulated east displacement at the i th update due to the removal of the east velocity from the first east curve which is a result of the omitted cross product into the east channel from a change in true height.

NOTE: DANG 1 = The angle between geodetic north and the north accelerometer sensitive axis.

DANG 1 = $(\alpha + \Delta\alpha\, \Delta^t{}_i - \{(ED_i+CD\lambda_i)/RADLF\})$

DANG 2 = The angle between geodetic north and the east accelerometer sensitive axis.

DANG 2 = (DANG 1 + β).

NOTE: The following equations assume that the first observed latitude, longitude and height are equal to the true value.

Equations used:

$$F_{1_K} = -\frac{CD\phi_i}{RADPF} * S_{YV} + D_\phi * \{\sum_{j=1}^{i} [(\phi_j - \phi_{j-1})\cos(\alpha + \Delta\alpha\Delta t_j - ((ED_j + CD_{\lambda j})/RADLF))]\}$$

$$- D\phi * CONV1 * \{\sum_{j=1}^{i} [(\lambda_j - \lambda_{j-1})\sin(\alpha + \Delta\alpha\Delta t_j - ((ED_j + CD_{\lambda j})/RADLF))]\}$$

$$+ \phi_1 - \Phi U_K = 0$$

where i = the number of updates required to get to the K th latitude equation.

$$F_{2_K} = -\frac{(ED_i + CD_{\lambda i})}{RADLF} * S_{XV} - D_\lambda * CONV2 * \{\sum_{j=1}^{i} [(\phi_j - \phi_{j-1})\cos(\alpha + \Delta\alpha\Delta t_j - ((ED_j + CD_{\lambda j})/RADLF) + \alpha)]\}$$

$$+ D_\lambda * \{\sum_{j=1}^{i} [(\lambda_j - \lambda_{j-1})\sin(\alpha + \Delta\alpha\Delta t_j - ((ED_j + CD_{\lambda j})/RADLF) + \alpha)]\}$$

$$+ \lambda_1 - \Lambda U_K = 0$$

where i = the number of updates required to get to the K th longitude equation.

$$F_{3_K} = -(HTD_i + CD_{hi}) * 0.3048 * S_{ZV} + D_Z * (h_i - h_1)$$

$$- DYVPDN * \frac{0.3048}{\square DEG} * \{\sum_{j=1}^{i} [(\phi_j - \phi_{j-1}) * (t_j - t_{j-1}) \div 2]\} * S_{ZV}$$

$$- DGVPDW*\frac{0.3048}{DEG}* \left\{ \left[\sum_{j=1}^{i} (\lambda_j - \lambda_{j-1})*(t_j - j-1) \div 2 \right] \right\}*S_{ZV}$$

$$+ h_1 - HU_K = 0$$

where z = the number of updates required to get to the K th height equation

$$F_{4_K} = \Phi K_m - U_0$$

$$F_{5_K} = \Lambda K_m - U_0$$

$$F_{6_K} = HK_m - HU_0$$

where m = the m th position constraint equation

0 = the 0 th unknown value

9) DIFFADJ-2

The program DIFFADJ-2 (used in the adjustment of the CNI data is based on the general equations previously described.

Changes to the general equations had to be made for the following reasons:

1. Lines were only flown one way.
2. Most often only two control points per line were available.

As two updates were made at each ground station, the three unknowns for velocity curve scaling were calculated. The misalignment angle α was solved for as two horizontal points were known. The system drift $\Delta\alpha$ had to be treated as a known as with only two points this could not be solved for. All other unknowns in the general equation had to be considered as constants because of insufficient control to solve for them. These constants were obtained from calibration run on the Calgary INS Baseline. In addition, the general equation described above assumes the starting point is known, both horizontally and vertically. To overcome this restriction the program DIFFADJ-2 solves as unknowns a latitude, longitude and height shift common to all observations. The misalignment angle α will remove the horizontal misclosure at the end control point.

Summary of unknowns in 5MOVE2:

1. EAST VELOCITY ERROR CURVE SCALING
2. NORTH VELOCITY ERROR CURVE SCALING
3. HEIGHT VELOCITY ERROR CURVE SCALING
4. HEIGHT ERROR WITH HORIZONTAL DISTANCE TRAVELLED
5. INITIAL MISALIGNMENT ANGLE
6. LATITUDE SHIFT
7. LONGITUDE SHIFT
8. HEIGHT SHIFT

CONSTANTS AND CONSTRAINTS

The ISCAP and DIFFADJ system of ISS Processing programs require manual input of some constants and constraints. These are summarized below:

ISCAP (With typical parameters shown)

1) Reference Ellipsoid a = 6378206.4m
   b = 6356583.8m

2) Height velocity correction with Delta: Longitude = 0.00
Latitude = 0.00

3) Offset: Latitude = 0.00
Longitude = 0.00
Height = 0.00

4) Scale correction factor:

(Static) Velocity curves	(Dynamic) Displacement On The Ground
X = 1.00	Latitude =1.00
Y = 1.00	Longitude =1.00
Z = 1.00	Height =1.00

5) Offset distances from Inertial Measuring Unit to vehicle reference point:

X = -2.23m
Y = 0.78m
Z = -0.42m

6) Angle between the Inertial Measuring Units Y axis and the protractor 0 degree line = $+11.9^{o}$

7) Window for update match = 300m
This is the flag which allows a dump of station information to be associated with one or more update dumps which are within this window horizontally.

8) Reference meridian $W117.00^{o}$

9) Factor for transforming the height output from ISS to metres;
= ISS value*$7.1688948*10^{-6}$

10) Factor of transforming the ISS time to a real time in seconds;
= ISS value*$2.0*10^{-2}$

11) Factor for transforming the ISS latitude and longitude to degrees;
= ISS value*8.381903*10^{-10}

12) ISS north and east velocity output scale factor = 2.00

13) ISS height velocity output scale factor = 1.00

DIFFADJ-2 (With typical parameters shown)

1) Fixed latitude displacement scaling = 1.000006

2) Fixed longitude displacement scaling = 0.999030

3) Fixed height scaling = 0.999300

4) Accumulated height velocity with north displacement
= -1.403450 (feet/sec)/DEGREE

5) Accumulated height velocity with west displacement
= 0.334480 (feet/sec)/DEGREE

6) Drift rate of the misalignment angle
= -0.0000036207055 radians/SECOND

7) Fixed Beta angle in radius
= 1.571183164890 radians

RESULTS

Table 1 on page 33 lists the three dimensional coordinates for the Doppler Satellite Stations. They were determined by fixing the geodetic station 104 Horseshoe Ridge at the value obtained from three (3) geodetic stations Northwest, Packhorse and Centre. The elevations were determined from trigonometric heights of the same geodetic stations.

Table 2 on page 36 lists the three dimensional coordinates obtained by the Inertial Survey System. These were derived from the existing Doppler Satellite Survey Stations.

Table 3 on page 37 states the Ellipsoidal and Mean Sea Level Heights together with the undulations. The undulations were obtained from the Goddard Earth Model 10B program.

Table 4 on page 40 shows the published coordinates for the trigonometric stations and the values used by Shell in the GDLSAT adjustment program.

Table 4 on page 39 compares the coordinates from the two independent surveys, one supplied by Shell (Doppler Satellite System) and the second provided by Underhill and Underhill Surveys from Vancouver (Conventional Surveys). It also shows the origin of the network used. The difference between the Shell and Underhill and Underhill is 5.0 m in north, -0.9 m in east and -0.9 m in height.

Table 5 on page 41 lists the comparison of elevations obtained from the Doppler Satellite Survey System and from the spirit levelling. It shows that the difference between the two surveys is -1.25 m.

Table 6 compares the coordinates for Station 78-49 obtained by Doppler and conventional survey techniques and shows the difference of -7.6 m in north, -5.3 m in east and -1.8 m in height.

CONCLUSIONS

The primary objectives of the project to select, target and monument ground Survey Control Stations for photogrammetric control were met. The sixty-nine (69) required targets were placed without delay.

The second objective of the Doppler and Inertial Survey Control to provide three dimensional coordinates for sixty-nine (69) ground Survey Control Points was met.

From the coordinates on Page 40, we can clearly see the discrepancies of the datum origin. This is verified by the coordinates supplied by Underhill and Underhill. The shift appears to be 7 m in Northing, 1.2 m in Easting and 1.0 m in Height. This Datum discrepancy should be further investigated by the Surveying Section in order to get one uniform datum for the whole area.

The coordinates determined by Doppler Satellite Survey System are within the sub-metre accuracy in all of the three components. This provides good photogrammetric control framework for the 1:2000 scale maps.

The coordinates obtained by Inertial Survey System are within 1 - 2 metre accuracy in all three dimensions. The lower accuracy of the I.S.S. coordinates is caused by problems with hardware and software of the system.

The obtained coordinates provide us with good survey control network for further geophysical exploration in the Fernie-Sparwood area.

TABLE 1

CROWS NEST RESOURCES LIMITED
LATITUDES, LONGITUDES, HEIGHTS
AND UTM COORDINATES
CENTRAL MERIDIAN - 117° W

STATION	LATITUDE	LONGITUDE	HEIGHT(m)	NORTHING(m)	EASTING(m)
	o ' "	o ' "			
Horseshoe	49 55 37.300	114 44 34.200	2020.8	5532740.96	662007.42
Packhorse	49 17 02.350	114 31 25.447	2409.2	5461757.42	680085.81
Northwest	49 59 21.483	114 58 15.301	2415.5	5539195.22	645450.24
Centre	49 24 45.650	114 36 23.477	2599.1	5475868.74	673612.08
78-01	50 08 42.292	114 56 40.214	1336.3	5556565.57	646866.84
78-21	49 49 18.872	114 53 05.745	1160.1	5520757.04	652139.35
78-25	49 43 02.830	114 40 32.335	1936.9	5509590.93	667551.65
78-28	49 29 10.110	114 52 25.953	1777.9	5483453.73	653990.50
78-29	49 07 10.997	114 38 32.596	1627.5	5443222.46	672026.65
78-32	49 30 33.910	115 10 32.227	1383.0	5485468.44	632074.50
78-34	49 08 11.103	114 49 00.107	1948.5	5444697.09	659255.38
78-47	49 18 30.705	115 07 19.152	1062.7	5463232.08	636512.97
78-60	50 08 24.108	114 44 06.593	2334.7	5556537.11	661840.02
78-62	49 24 08.320	114 31 28.172	1563.8	5474908.19	679599.39

TABLE 1 (Continued)

CROWS NEST RESOURCES LIMITED
LATITUDES, LONGITUDES, HEIGHTS
AND UTM COORDINATES
CENTRAL MERIDIAN - 117° W

STATION	LATITUDE	LONGITUDE	HEIGHT(m)	NORTHING(m)	EASTING(m)
	° ' "	° ' "			
78-05	50 01 49.761	114 43 13.523	1825.9	5544291.43	663265.14
78-06	50 02 57.766	114 45 39.073	1593.2	5546303.93	660306.79
78-08	49 53 24.675	114 53 26.219	1230.0	5528336.00	651516.58
78-09	49 51 51.467	114 50 51.400	1298.0	5525545.60	654688.12
78-11	49 52 09.161	114 44 57.033	2102.6	5526299.96	661745.46
78-12	49 55 27.691	114 44 47.745	1925.4	5532436.09	661746.32
78-13	49 53 29.165	114 50 02.241	1277.5	5528590.83	655582.16
78-14	49 49 52.109	114 48 58.293	1312.4	5521925.17	657053.36
78-15	50 01 18.046	114 47 12.964	2130.5	5543168.85	658530.96
78-16	50 00 01.254	114 44 57.525	2427.1	5540877.95	661297.14
78-18	49 58 47.134	114 48 56.485	1914.7	5538447.98	656607.40
78-600	49 56 49.247	114 47 01.388	2181.0	5534875.01	659007.33

TABLE 1 (Continued)

CROWS NEST RESOURCES LIMITED
LATITUDES, LONGITUDES, HEIGHTS
AND U.T.M. CO-ORDINATES

Central Meridian 117° W

STATION:	LATITUDE: ° ' "	LONGITUDE: ° ' "	HEIGHT(m)	NORTHING (m)	EASTING (m)
78-24	49 42 39.041	114 50 01.448	1184.02	5508515.51	656178.02
78-40	49 16 05.215	115 06 54.361	892.59	5458752.06	637125.58
78-40A	49 15 41.515	115 04 45.129	1193.04	5458085.99	639755.58
78-42	49 15 33.238	114 41 22.420	1620.10	5458623.90	668111.29
78-43	49 21 59.891	114 46 44.899	2007.22	5470367.40	661242.89
78-44	49 20 55.444	114 40 49.711	1556.55	5468592.94	668466.81
78-45	49 16 25.177	114 59 13.758	1156.82	5459608.42	646416.03
78-46	49 18 21.711	114 47 36.114	1967.63	5463600.22	660406.99
78-47A	49 17 17.458	115 05 41.632	1186.24	5461019.64	638538.99
78-48	49 17 34.668	114 43 37.158	1680.18	5462290.74	665275.45
78-49	49 18 41.354	114 44 41.908	1843.43	5464310.63	663906.27
78-52	49 28 37.841	114 38 16.790	1778.60	5482966.26	671104.48
77-54	49 20 55.747	114 42 48.374	2029.16	5468529.25	666072.69
78-55	49 30 04.594	114 40 51.805	1518.50	5485548.11	667903.01
78-64	49 29 15.412	114 38 50.352	1696.08	5484105.24	670392.96
78-69	49 28 18.562	114 40 34.160	1578.66	5482285.00	668358.87
78-80	49 18 24.509	115 05 03.780	917.10	5463109.39	639251.06
78-100	49 42 42.393	114 46 21.784	1392.47	5508747.73	660573.70

TABLE 2

CROWS NEST RESOURCES LIMITED
LATITUDES, LONGITUDES, HEIGHTS
AND UTM COORDINATES

CENTRAL MERIDIAN 117° W

STATION	LATITUDE	LONGITUDE	HEIGHT(m)	NORTHING(m)	EASTING(m)
	° ' "	° ' "			
78-02	50 07 51.6037	114 50 24.0408	1553.11	5555211.18	654377.62
78-03	50 00 45.231	114 54 54.096	1250.31	5541891.67	649384.07
78-04	50 01 28.7228	114 49 42.6446	1500.72	5543411.22	655543.23
78-07	49 55 49.834	114 53 58.188	1221.31	5532800.70	650752.95
78-10	49 53 50.3155	114 50 26.4946	1264.45	5529230.01	655079.45
78-17	49 54 01.484	114 41 16.304	2558.90	5529896.46	665844.47
78-19	49 46 33.685	114 50 54.120	1630.20	5515730.92	654915.36
78-20	49 47 43.917	114 52 58.860	1147.02	5517828.72	652359.65
78-22	49 49 54.1809	114 43 24.1410	1931.04	5522187.81	663726.19
78-23	49 50 26.997	114 41 45.798	1890.33	5523261.19	665659.33
78-27	49 34 12.7253	114 58 51.3303	1024.30	5492584.93	645987.05
78-29A	49 37 59.867	114 51 26.262	2234.92	5499846.05	654725.37
78-31	49 29 16.462	115 03 44.658	1025.15	5483281.61	640331.50
78-33	49 38 29.727	114 47 01.686	1268.15	5500921.99	660004.79
78-35	49 08 59.938	114 38 00.630	1929.47	5446606.35	672569.31
78-36	49 09 47.594	114 46 50.832	1616.44	5447752.58	661787.17
78-37	49 07 45.502	114 44 11.544	1698.86	5444078.29	665125.37
78-38	49 15 55.203	114 32 36.462	1421.44	5459637.33	678718.59
78-39	49 13 53.851	114 32 50.154	1362.44	5455881.43	678563.55
78-41	49 13 53.025	114 37 41.623	2380.15	5455667.88	672670.66
78-50	49 15 48.607	114 50 47.964	1966.9	5458760.96	656667.98
78-51	49 33 15.589	114 39 34.158	1920.93	5491494.00	669281.08
78-53	49 24 02.644	114 50 58.638	1928.71	5474009.57	656017.82
78-66	49 37 40.087	114 37 59.322	1454.94	5499720.81	670929.15
78-70	49 29 46.639	114 37 31.272	1940.55	5485119.38	671953.30
78-101	49 29 14.987	114 57 59.814	1160.38	5483418.92	647269.96
78-102	49 29 03.094	114 46 13.428	1654.75	5483453.76	661491.04
78-103	49 34 46.486	114 51 23.424	2093.84	5493876.27	654952.58
78-104	49 24 20.0469	115 01 42.9755	954.21	5474192.18	643018.80

TABLE 3

CROWS NEST RESOURCES LIMITED
TABLE OF ELLIPSOIDAL AND SEA LEVEL ELEVATIONS

STATION	ELLIPSOID ELEVATION (m)	UNDULATION* (m)	SEA LEVEL ELEVATION (m)
78-01	1342.7	6.4	1336.3
78-05	1832.3	6.4	1825.9
78-06	1599.6	6.4	1593.2
78-08	1236.3	6.3	1230.0
78-09	1304.3	6.3	1298.0
78-11	2109.0	6.4	2102.6
78-12	1931.8	6.4	1925.4
78-13	1283.6	6.1	1277.5
78-14	1318.9	6.5	1312.4
78-15	2136.8	6.3	2130.5
78-16	2433.5	6.4	2427.1
78-18	1921.1	6.4	1914.7
78-21	1166.4	6.3	1160.1
78-24	1190.4	6.2	1189.2
78-25A	1943.4	6.5	1936.9
78-28	1784.4	6.5	1777.9
78-29	1634.3	6.8	1627.5
78-32	1389.1	6.1	1383.0
78-34	1955.1	6.6	1948.5
78-40	898.8	6.2	892.6
78-40A	1199.2	6.2	1193.04
78-42	1626.7	6.6	1620.1
78-43	2013.7	6.5	2007.2
78-44	1563.2	6.6	1556.5
78-45	1163.1	6.3	1156.8
78-46	1974.1	6.5	1967.6
78-47	1068.9	6.2	1062.7
78-47A	1192.4	6.2	1186.2

TABLE 3

(Continued)

STATION	ELLIPSOID ELEVATION (m)	UNDULATION (m)	SEA LEVEL ELEVATION
78-48	1686.8	6.6	1680.2
78-49	1850.0	6.6	1843.4
78-52	1785.2	6.6	1778.6
78-54	2035.8	6.6	2029.2
78-55	1525.0	6.5	1518.5
78-60	2341.3	6.6	2334.7
78-62	1570.6	6.8	1563.8
78-64	1702.7	6.6	1696.1
78-69	1585.2	6.5	1578.7
78-80	923.3	6.2	917.1
78-100	1398.9	6.4	1392.5
78-600	2187.3	6.3	2181.0

*Undulations are derived from Goddard Earth Model 10-B (GEM 10-B).

TABLE 4

COMPARISON OF UTM COORDINATES
FOR COMMON* POINTS IN THE
FERNIE - SPARWOOD AREA
SHELL, UNDERHILL & UNDERHILL

STATION NO.	NORTHINGS (m)	EASTINGS (m)	HEIGHT (m)
Shell 48	5462290.74	665275.45	1680.18
U & U 14	5462286.577	665275.367	1681.37
Difference**	+4.16	+0.083	-1.190
Shell 44	5468592.94	668466.81	1556.55
U & U 42	5468586.945	668468.153	1557.65
Difference**	+5.995	-1.343	-1.10
Shell 54	54681529.25	666072.69	2029.16
U & U 43	5468523.315	666072.928	2029.72
Difference**	+5.935	-0.238	-0.560
Shell 49	5464310.63	663906.27	1843.43
U & U 45	5464306.378	663908.316	1844.22
Difference**	+4.252	-2.046	-0.79

*The coordinates supplied by Underhill and Underhill were obtained by conventional surveying from the trigonometric stations Northwest, Brule and Coulthard on these UTM Coordinates:

	NORTHING (m)	EASTING (m)
Northwest	5539198.367	645449.823
Brule	5518735.967	647674.117
Coulthard	5492115.029	676238.058

TABLE 4 (Continued)

**The Doppler Satellite Coordinates were obtained from the trigonometric stations Packhorse, Northwest and Centre on these UTM coordinates:

	NORTHING (m)	EASTING (m)	HEIGHT (m)
Packhorse	5461757.42	680085.81	2409.2
Northwest	5539195.22	645450.24	2415.5
Centre	5475868.74	673612.08	2599.1

The official Government UTM Coordinates for the trigonometric stations in the area are:

	NORTHING (m)	EASTING (m)	HEIGHT (m)
Packhorse	5461764.93	680086.04	2410.97
Northwest	5539195.15	645451.46	2416.15
Centre	5475875.25	673612.91	2600.86
Brule	5518735.39	647678.09	2416.45
Coulthard	5492116.90	675241.130	2953.03

TABLE 5

COMPARISON OF ELEVATIONS
FOR DOPPLER SATELLITE STATIONS
FERNIE - SPARWOOD AREA

STATION	DOPPLER ELEVATION (m)	GEODETIC ELEVATION (m)	DIFFERENCE (m)
78-24	1184.02	*1185.27	-1.25
78-80	917.10	**919.84	-2.74
78-08	1230.0	**1226.02	+3.98

*Derived from First Order Geodetic Bench Mark

**Derived from Topographical Point, Trigonometric Leveling.

TABLE 6

COMPARISON OF COORDINATES FOR
DOPPLER SATELLITE STATION NO. 78-49

STATION 49	NORTHINGS (m)	EASTINGS (m)	HEIGHT (m)
Doppler Survey *	5464310.63	663906.27	1843.43
Conventional Survey **	5464318.27	663911.61	1845.206
Difference	-7.64	-5.34	-1.776

* Based on trigonometric station Packhorse, Northwest and Centre.

** Based on trigonometric station Quest.

TABLE 7

COMPARISON OF ELEVATIONS
OF THE DRILL HOLES
IN THE LODGEPOLE AREA

STATION	ELEVATION FROM CNI (m) *	SHELL CONVENTIONAL SURVEY (m) **	DIFFERENCE (m)
5	2039.04	2039.9	-0.86
7	2043.13	2043.3	-0.17

* Elevations obtained from old C.N.I. Surveys

** Elevations obtained by conventional survey techniques from trigonometric station Quest.

TABLE 8

DOPPLER SATELLITE SURVEY CONTROL

CROWS NEST RESOURCES LIMITED

FERNIE - SPARWOOD, B.C.

	JUNE '78											JULY '78									
	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10
Packhorse	*	*	*	*	*	*	*	*	*	*	S							o	o	o	R
Shell 104	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	I							✓	✓	✓	E
Shell 103	Δ										T										T
78-1	x	x	x	x							E										U
78-21	o	o	o	o							S										R
78-25	.	.	.	.																	N
78-32	-	-	-	-					o	o											
78-60		Δ	Δ	Δ					.	.	D										
78-47					o	o	o	o			I										C
78-34					x	x	x	x	x	x	S										A
78-29					Δ	Δ	Δ	Δ	Δ	Δ	M										L
78-62					.	.	.	.			A										G
78-28						-	-	-	-	-	N										A
											T										R
Northwest											L							-	-	-	Y
Centre											E							∇	∇	∇	
Priddis											D						Δ	Δ	Δ	Δ	Δ

76-237	*	76-153	Δ	76-152	o	76-238	-	
74-160	✓	75-137	x	74-121	.	76-138	∇	

GRAPH SHOWING RECEIVER USED AND DAYS OCCUPIED FOR THE STATONS

TABLE

DOPPLER SATELLITE SURVEY CONTROL
CROWS NEST RESOURCES LIMITED
FERNIE - SPARWOOD, B.C.

AUGUST '78

	19	20	21	22	23	24	25	26	27	28	29	30
Shell 104	*	*	*	*	*	*						
78-15	Δ	Δ	Δ	Δ	Δ			x	x	x		
78-06	o	o	o	o	o							
78-05	-	-	-	-	-			&	&	&		
78-16	✓	✓	✓	✓	✓							
78-18		.	.	.	.			+	+	+		
78-14					✓	-	-	-	-	-		
78-600						Δ	Δ	Δ	Δ	Δ		
78-11						o	o	o	o	o		

76-061	*	76-138	-	75-342	x		76-007	&
74-121	Δ	76-152	✓	75-238	+			
76-146	o	76-153	.	75-244	/			

GRAPH SHOWING RECEIVER USED AND DAYS OCCUPIED FOR THE STATIONS

TABLE 10

DOPPLER SATELLITE SURVEY CONTROL
CROWS NEST RESOURCES LIMITED
FERNIE - SPARWOOD, B.C.

SEPTEMBER '78

	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Shell 104	*	*	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
Northwest	.	.	.	.										
78-47					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
78-13	o	o	o	o										
78-09	-	-	-	-										
78-06	✓	✓	✓	✓										
78-12	Δ	Δ	Δ		.	.	.							
78-24	x	x	x	x										
78-100	+	+	+	+										
78-52	/	/	/	/	/									
78-64	&	&	&	&	&									
78-55	v	v	v	v	v									
78-69	α	α	α	α	α									
78-40					*	*	*	*	*					
78-40A					+	+	+	+						
78-47A					x	x	x	x						
78-80					o	o	o	o						
78-45					-	-	-	-	-					
78-43						/	/	/						
78-48						α	α	α	α					
78-49						&	&	&	&					
78-54						v	v	v	v					
78-42									o	o	o	o	o	
78-800										v	v	v	v	
78-801										α	α	α	α	
78-802										/	/	/	/	
78-803										-	-	-	-	

78-087	*	74-120	-	76-348	x	75-244	&
76-152	Δ	76-335	✓	74-160	+	75-137	v
75-342	o	77-080	.	76-153	/	75-238	α

GRAPH SHOWING RECEIVER USED AND DAYS OCCUPIED FOR THE STATIONS

TABLE 11

CROSS INDEX OF POINTS

INERTIAL #:	to	DOPPLER #:	DOPPLER #:	to	INERTIAL #:
1		78-01	Horseshoe		12
2		78-02	Packhorse		
3		78-60	Northwest		
4		78-03	Centre		
5		78-04	78-01		1
6		78-15	78-02		2
7		78-06	78-03		4
8		78-05	78-04		5
9		78-16	78-05		8
10		78-17	78-06		7
11		78-07	78-07		11
12		Horseshoe	78-08		14
13		78-12	78-09		88
14		78-08	78-10		15
15		78-10	78-11		18
16		78-13	78-12		13
17		78-18	78-13		16
18		78-11	78-14		20
19		78-21	78-15		6
20		78-14	78-16		9
21		78-22	78-17		10
22		78-23	78-18		17
23		78-23 A	78-19		25
24		78-20	78-20		24
25		78-19	78-21		19
26		78-24	78-22		21
27		78-100	78-23		22
28		78-25	78-23 A		23
29		78-29 A	78-24		26
30		78-33	78-25		28
31		78-25 B	78-25 B		31
32		78-66	78-26		None
33		78-27	78-27		33
34		78-103	78-28		40

CROSS INDEX OF POINTS

INERTIAL #:	to	DOPPLER #:
35		
36		78-51
37		78-32
38		78-31
39		78-101
40		78-28
41		78-102
42		78-55
43		78-70
44		78-64
45		78-66
46		78-52
47		78-104
48		78-53
49		
50		78-62
51		78-43
52		78-54
53		78-44
54		
55		78-47
56		78-80
57		
58		
59		78-46
60		78-49
61		78-48
62		78-38
63		78-47 A
64		78-40
65		78-40 A
66		78-45
67		78-50
68		78-42

DOPPLER #:	to	INERTIAL #:
78-29		83
78-29 A		29
78-30		None
78-31		38
78-32		37
78-33		30
78-34		81
78-35		79
78-36		77
78-37		82
78-38		62
78-39		71
78-40		64
78-40 A		65
78-41		70
78-42		68
78-43		51
78-44		53
78-45		66
78-46		59
78-47		55
78-47 A		63
78-48		61
78-49		60
78-50		67
78-51		36
78-52		46
78-53		48
78-54		52
78-55		42
78-56		None
78-57		None
78-58		None
78-59		None
78-60		3

TABLE 11 (Continued)

CROSS INDEX OF POINTS

INERTIAL #:	to	DOPPLER #:	DOPPLER #:	to	INERTIAL #:
69			78-61		None
70		78-41	78-62		50
71		78-39	78-63		None
72		Butte North	78-64		44
73			78-65		None
74			78-66		32
75			78-67		None
76		Butte South	78-68		None
77		78-36	78-69		45
78			78-70		43
79		78-35	78-80		56
80			78-100		27
81		78-34	78-101		39
82		78-37	78-102		41
83		78-29	78-103		34
84			78-104		47
85			78-600		None
86					
87					
88		78-09			
501					
502					

TABLE 12

INERTIAL SURVEY LINES AND POINTS VISITED

LINE #:	PASS #:	DESCRIPTION:
1	1	1, 2, 3
2	1	1, 4, 11, 14, 19, 24, BASE
3	1	1, 4, 5, 6, 7, 8
4	1 S	19, 24, BASE
5	1	19, 24, 25, 26, BASE
6	1	19, 20, 18
7	1	BASE - 19, 88, 16
8	1	19, 20, 18, 17
9	1 S	19, 24, BASE
10	1 *	28, 22, 17, 8, 3
11	1	55, 63, 65
12	1	55, 64
13	1	55, 56
14	1	65, 64
15	1	65, 63, 56
16	1 S	65, 55
17	1 *	19, 20, 21, 22
18	1 S	19, 14
19	1 *	14, 15, 16, 17
20	1 *	3, 7, 9, 13, 18, 21, 27
21	1 *	28, 27, 26
22	1 *	27, 20, 16, 10, 7, 2
23	1 *	28, 29, 33, 37
24	1	4, 10, 13, 17
25	1	11, 10, 9, 8
26	1 *	28, 31, 36, 4), 50
27	1	28, 32, 36
28	1 S	28, 29
29	1	29, 30, 31, 32
30	1	33, 34, 35, 36
31	1 *	37, 38, 39, 40, 41, 45, 43 (Incomplete
31	2 *	37, 38, 39, 40, 41, 45, 43 (Incomplete
32	1 *	29, 35, 42, 44, 46, 50
33	1	43, 42, 41
34	1	43, 46, 45

TABLE 12 - (continued)

INERTIAL SURVEY LINES AND POINTS VISITED

LINE #:	PASS #:	DESCRIPTION:
35	1 S	37, 38
35	2 *	38, 47, 48, 51, 52, 53, 54
36	1 *	55, 63, 66, 67, 61, 68, 62
37	1 *	26, 29, 34, 40, 48, 67, 81
37	2 S	26, 29, 34, 40
37	4 S	40, 48, 67
37	5 S	26, 29
37	6 *	26, 29, 34, 40, 48, 67, 81
38	1 S	27, 30, 35, 41, 49, 51, 59, 58; 67, 73
38	2 S	27, 30, 35, 51, 49, 51, 59, 58; 67, 73
39	1	81, 82, 83
40	1 *	81, 77, 74, 68
41	1	81, 73, 66
42	1 S	55, 56, 57, 59, 60
43	1 *	36, 42, 45, 53, 68, 74, 82
44	1 *	50, 54, 62, 71, 79, 83
45	1 S	19, 14, 11, 4, 1
46	1 *	43, 44, 45, 49, 48, 57, 66
47	1 S	48, 60, 61, 68, 70, 71
48	1	82, 77, 73
49	1	82, 79
50	1	74, 70, 62
47	2 S	71, 70, 68, 61, 60, 48
51	1 S	60, 52
52	1 *	28, 32, 36, 43, 50
53	1 S	29, 33, 38, 47, 55
42	2 S	55, 56, 57, 59, 60
54	1	64, 65, 66
55	1 *	28, 22, 17, 8, 3
56	1 S	28, 502
57	1 S	37, 38, 39, 40
58	1	55, 63, 65
53	2 S	55, 47, 38, 33, 29
59	1 *	19, 24, 25, 501, 26

TABLE 12- (continued)

INERTIAL SURVEY LINES AND POINTS VISITED

LINE #:	PASS #:	DESCRIPTION:
60	1	27, 502, 30
45	2	19, 14, 11, 4, 1
61	1	1, 2, 3
62	1 S	4, 5, 6, 7, 8
63	1 S	14, 88, 20
64	1 S	8, 9, 10, 11
65	None	
66	None	
67	1 S	19, 20, 21, 22
68	1 S	17, 18, 20
69	1 S	9, 18
70	1 S	18, 16, 15, 14

NOTE: Under PASS #: (1) n Indicates a run out through the listed points and return.

(11) n* Indicates a run through the listed points and return after realignment.

(111) n s Indicates a single run through the listed points.

TABLE 13

HELICOPTER AND ISS TIME SUMMARY

DATE	HELICOPTER TIME h	SURVEY TIME h	TRAVEL TIME h	SYSTEM ON TIME h	LINE DISTANCE kms	POINTS OCCUPIED
July 4	-	-	-	1:30	-	-
5	5:00	3:50	1:10	9:50	144	16
6	4:54	3:30	1:24	8:10	68	11
7	6:30	5:35	0:55	10:20	164	16
8	6:00	4:05	1:55	7:35	30	9
9	6:00	4:45	1:15	7:40	76	15
10	0:30	-	0:30	8:00	Weather	
11	8:12	7:00	1:12	10:00	212	16
12	8:24	6:50	1:34	10:10	237	18
13	8:00	6:30	1:30	10:20	182	21
14	8:30	7:00	1:30	11:40	142	19
15	9:00	5:40	3:20	13:30	200	16
16	8:42*	1:30	3:00	6:50	63	7
17	1:36	-	1:36		Weather/Targeting	
18	-	-	-	3:00	Weather Day	
19	1:00	-	1:00	4:30	System Repairs + Tests	
20	2:30	-	-	-	" " " "	
21	5:12	-	-	-	" " " "	
22	2:06	1:30	0:36	3:15	37	5
23	2:18	1:05	1:13	5:00	30	3
24	0:54	0:40	0:14	4:15	15	2
25	6:06	5:16	0:50	7:20	184	17
26	8:00	6:50	1:10	10:00	186	33
27	7:42	5:55	1:47	11:00	194	30
28	9:48	7:45	2:03	12:45	207	40
29	6:48	5:30	1:18	8:00	165	24
30	9:12	7:45	1:27	12:30	225	38
31	5:42	4:42	1:00	9:00	107	21
Aug 1	4:12	2:55	1:17	7:30	54	14
TOTALS	152:48					
ISS USE	140:54	106:08	34:46	213:40	2982	391

*4:12 h used on search for missing aircraft

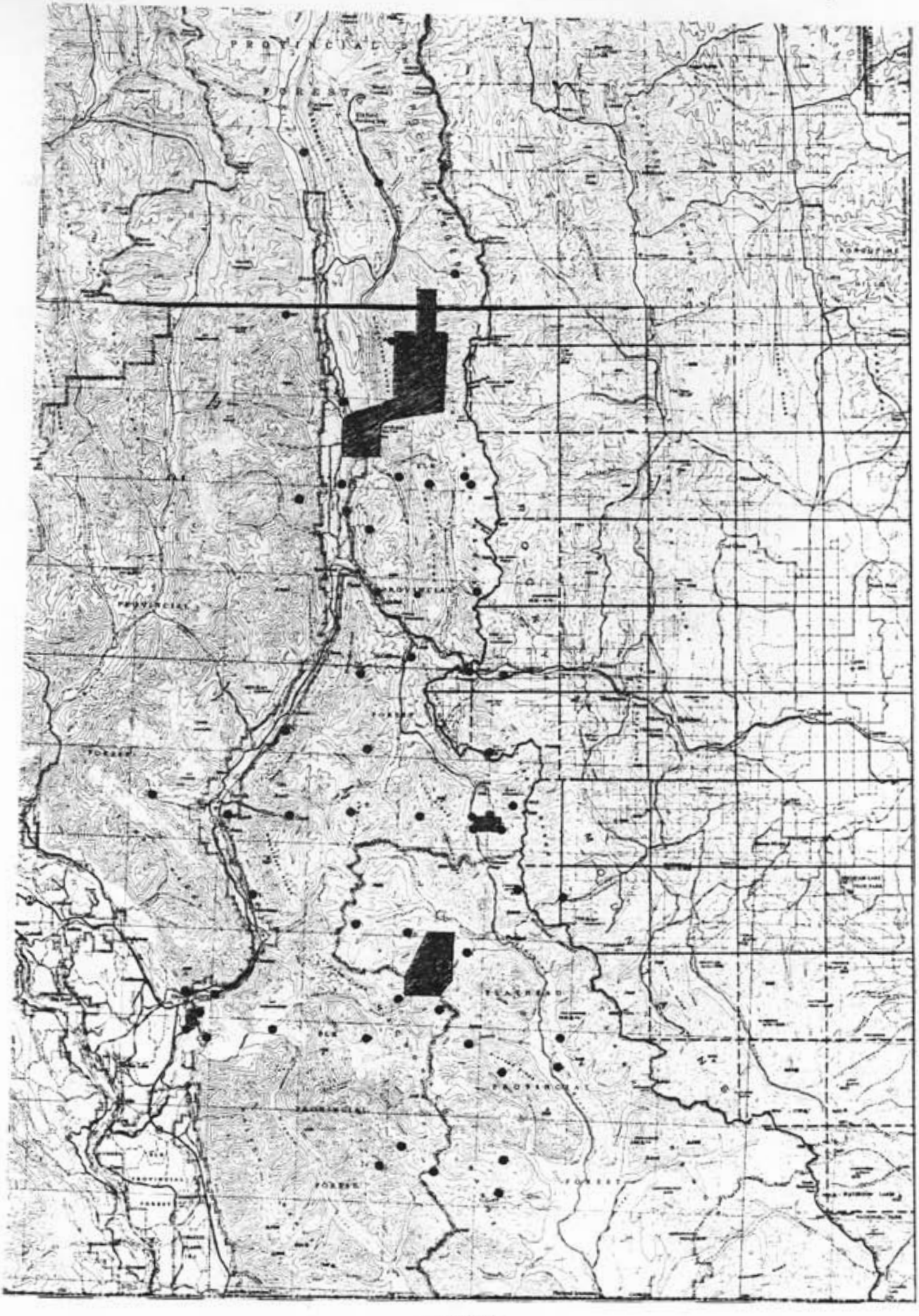
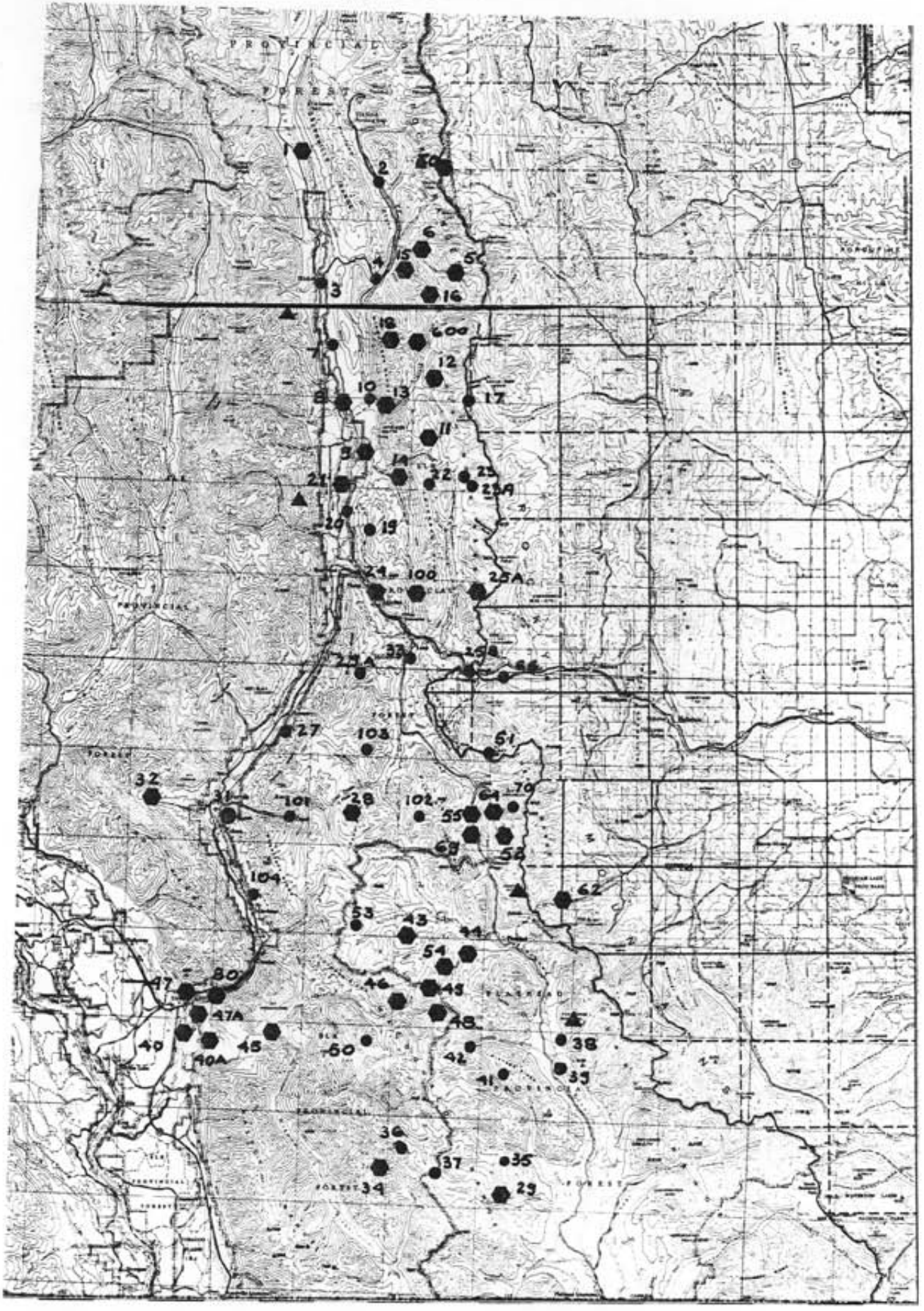


FIGURE 1

FERNIE-SPARWOOD
1:2000 MAPPING AREAS

FIGURE 3

SURVEY CONTROL NETWORK
FERNIE-SPARWOOD AREA



▲ - Geodetic Station

● - Doppler Station

● - Inertial Station

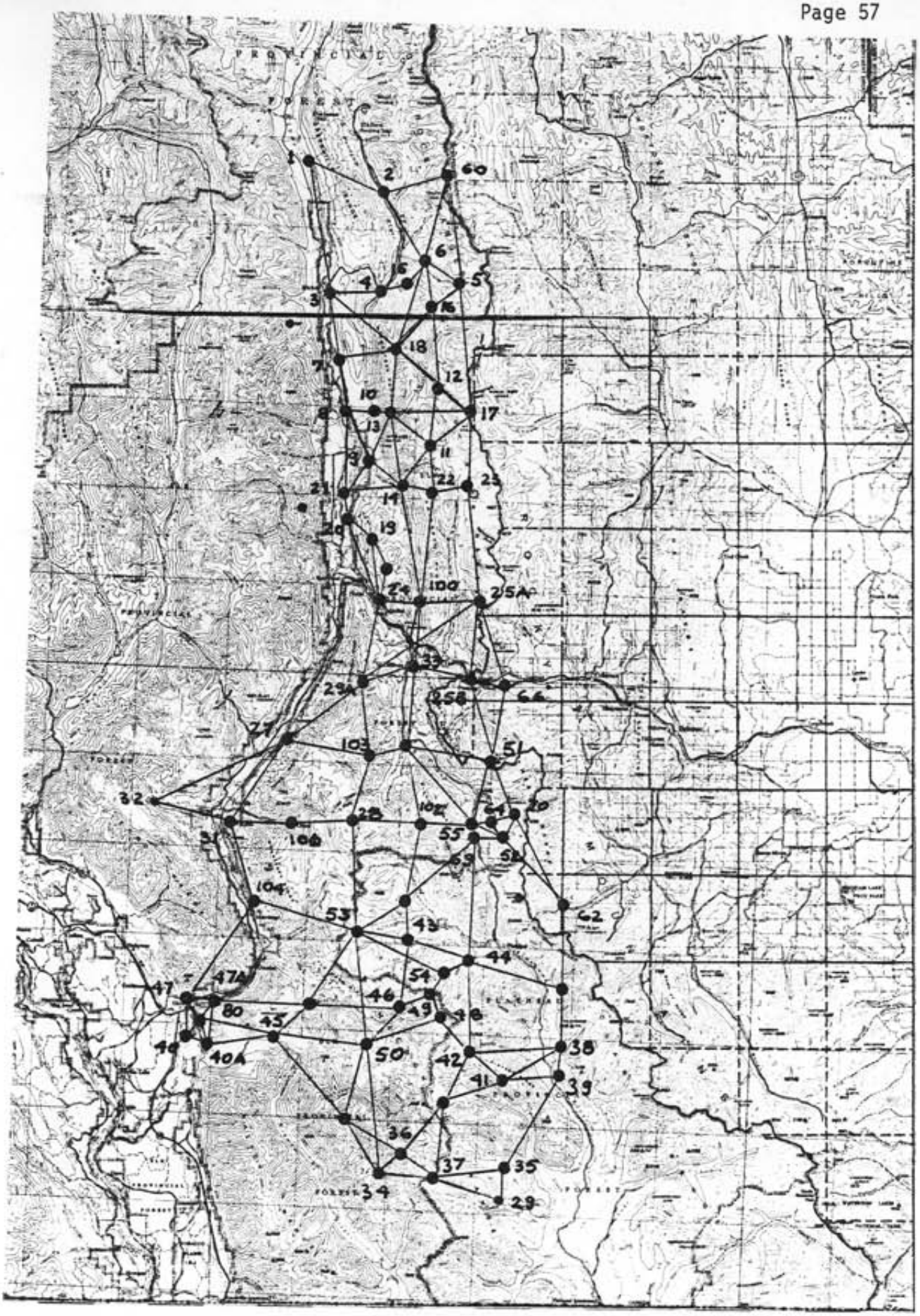


FIGURE 4
INERTIAL SURVEY NETWORK
FERNIE-SPARWOOD AREA

"APPENDIX A"

GEODOP AND GDLSAT PRINTOUT

EXPLANATION OF RESULTS PRESENTED IN THE GEODOP AND GDLSAT COMPUTER PRINTOUT

GENERAL INFORMATION

In order to determine a receiver position on the ground, it is necessary to know the positions of the N.N.S.S. satellites as they traverse the earth in their polar orbits. These satellite positions are available in a geocentric cartesian coordinates system from two sources. The first, known as broadcast ephemeris, is broadcast directly from the satellite giving predicted positions for every two minute sample. These predicted positions are regularly updated at about 12 hour intervals. The second source of orbital information is known as precise ephemeris and can be obtained for certain satellites only after a delay of one to two months.

Geodetic coordinates (ie. Latitude, Longitude, and Height above mean sea level) is the system in which most control work is done. These coordinates are defined by a reference ellipsoid having a given semi-major axis, flattening, and offsets from the centre of gravity of the earth to make the ellipsoid best fit over the area which it is meant to describe. This also means minimizing the differences between the ellipsoidal surface and the geoid (the surface of equipotential defining mean sea level). Levelled heights are all referred to the geoid. As a result a transformation must be made from the gravimetric centre of the earth to the geometric centre of the local speroid in order to relate doppler satellite derived coordinates to local datum (Figure 2).

However, instruments used for both spirit levelling and astronomic observations exhibit a preference for geoid surfaces and alignment to the local gravity field.

As a result a second transformation must be made to compare Doppler derived elevations on the reference ellipsoid to spirit level (sea level) elevations

referenced to the geoid (Figure 3). This separation of the ellipsoid and geoid is referred to as geoidal undulation.

Geoidal undulation maps are available for different areas and earth models from several sources, one being the Goddard Earth Model 10B. (Wagner, 1976) (LaChappelle, 1978) as used for this project.

It should be noted that the accuracy and agreement of these models is in the 2-3 metre range on a world wide scale.

GEODOP RESULTS

Following the GEODOP pass by pass printout, the options used are repeated. Next comes the phase solution summary headed by the figure name and the computation date. Run statistics given include passes processed, rejected, the reasons for rejections, Doppler counts rejected, V'PV, degrees of freedom and standard deviation of unit-weight.

Positions for each station marker are given in both cartesian and geographic coordinate systems. The input datum shift is applied for both systems. Along with the adjusted coordinates (absolute positions) of each station, its 3 X 3 variance-covariance matrix as well as the square roots of the diagonal terms are printed. These square roots represent the standard deviations (in metres) for the absolute latitude, longitude, and ellipsoidal height at a one sigma level.

After the last 3 X 3 matrix comes the variance-covariance matrix of X,Y,Z (in metres squared) printed in upper triangular form. The first line of each row in the matrix is indented one character to facilitate reading.

Correlation coefficients are printed next, again in an upper triangular form followed by the phase weight coefficient matrix.

A pass-by-pass summary for each station follows the phase weight coefficient matrix and on one line per pass gives:

- accepted pass number (for current station only)
- accepted pass number for the run
- satellite number
- day number
- station lock-on time
- frequency offset (Hz)
- cumulative pass geometry, south going, west side, as SW, etc.
- pass elevation angle at closest approach (deg).
- X,Y, Z coordinates and their respective standard deviations (one sigma).
- radius R from Cartesian origin (m).
- standard deviation of unit weight (count).
- degrees of freedom.

Individual plots of frequency offset, X, Y, Z and R will be printed next if they were requested on the option card, (Kouba, Boal, 1975).

The output from program GDLSAT (Agarwal, 1978) lists the adjusted coordinates in X, Y, Z and ϕ,λ, H along with one sigma standard deviations.

One or more stations may be held fixed at published values on the local datum and a common block shift or shifts are applied to all the data to shift the network to its absolute position while maintaining its relative consistency.

Next, all the interstation azimuths and distances (at one sigma) are printed. Following this, the relative error ellipses at the two sigma (95%) confidence level are printed along with the orientation of the axes. From the semi-major axis and the interstation distance the points are classified as 1st, 2nd, 3rd, 4th, or 5th order control.

The orders of control specified in this report are identical to those presented in "Specifications and Recommendations for Control Surveys and Survey Markers" (1973) (Table III).

Essentially, the classification is based on the maximum dimension of the 95 percent confidence region (ellipse) between any two points in the network (after adjustment).

The formula for the maximum dimension is: $r = C(d + 0.2)$

where r = the maximum dimension (semi-major axis) in cm,

C = a constant depending on the order,

d = the distance in km between the points under consideration.

REFERENCES

AGARWAL, R. — Program GDLSAT Documentation, Geodetic Survey, 1978.

BLANKENBURGH, J.C. — Doppler-European Datum Transformation Parameters for the North Sea. The Royal Society, London, England. October 10-11, 1978.

KOUBA, J., BOAL, J.D. — Program GEODOP, Mathematical Adjustment Section, Geodetic Survey of Canada, Survey and Mapping Branch, Dept. of Energy, Mines and Resources, 615 Booth Street, Ottawa, Ontario, Canada.

LaCHAPPELLE, G. — Comparison of Doppler Derived and Gravimetric Geoid Undulations in North America. 2ND International Geodetic Symposium on Satellite Doppler Positioning, The University of Texas at Austin, January 1979.

WAGNER, C.A. — The Accuracy of Goddard Earth Models. Report TMX-71183, GSFC. Greenbelt, Md. 20771. 1976.

TABLE III

ACCURACY STANDARDS FOR HORIZONTAL CONTROL SURVEYS

		Semi-major axis of 95% Confidence Region, r = C(D + 0.2)											
	Constant	d = 0.1 km			d = 3.0 km			d = 30 km			d = 300 km		
Order	(C)	cm	ppm	ratio	cm	ppm	ratio	m	ppm	ratio	m	ppm	ratio
1	2	0.6	60	1/16700	6.4	21	1/47000	0.6	20	1/50000	6	20	1/50000
2	5	1.5	150	1/6700	16.0	53	1/19000	1.5	50	1/20000	15	50	1/20000
3	12	3.6	360	1/2800	38.4	128	1/7800	3.6	121	1/8300	36	120	1/8300
4	30	9.0	900	1/1100	96.0	320	1/3100	9.1	302	1/3300	90	300	1/3300

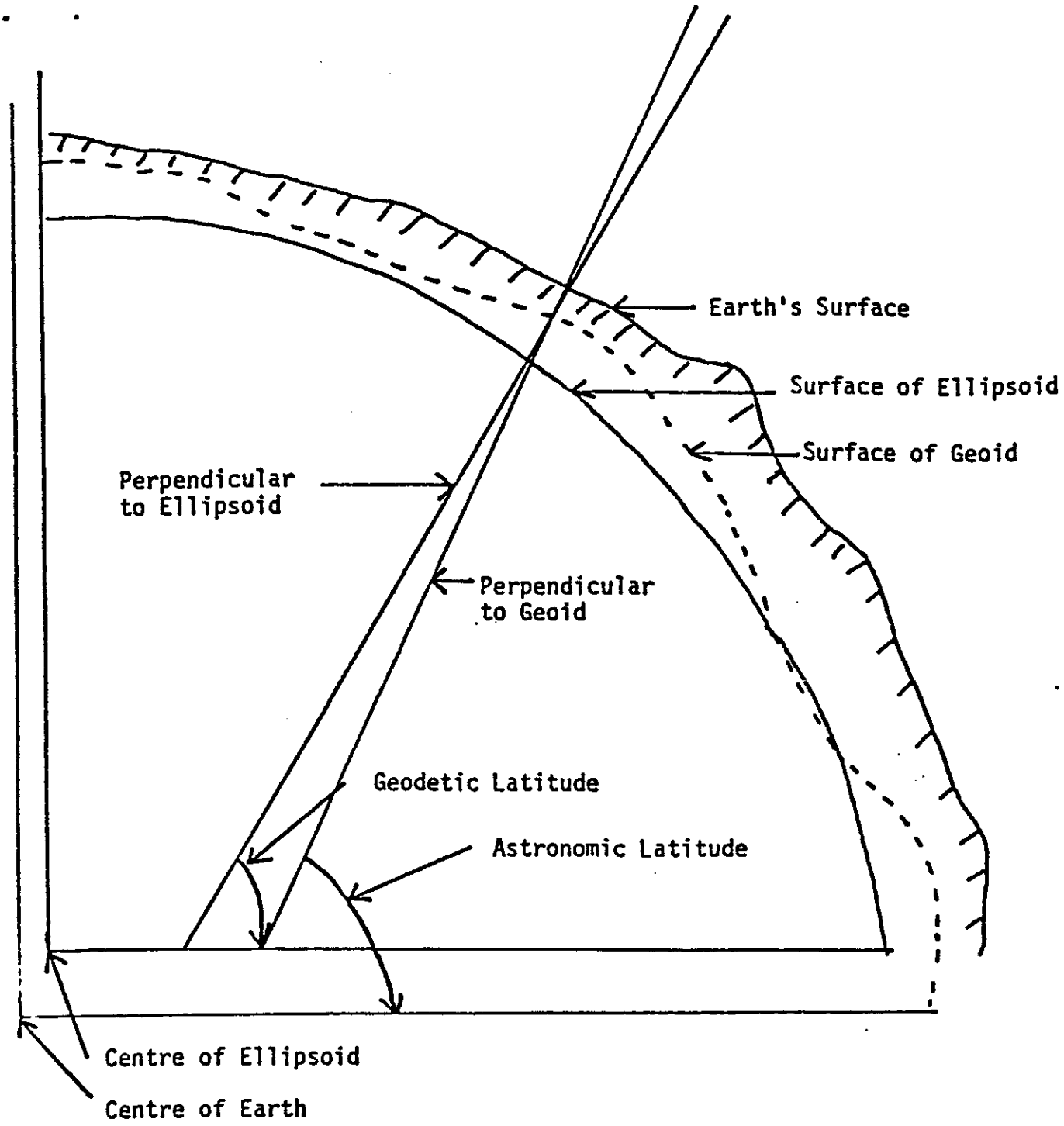

Earth's Surface
Surface of Ellipsoid
Surface of Geoid
Perpendicular to Ellipsoid
Perpendicular to Geoid
Geodetic Latitude
Astronomic Latitude
Centre of Ellipsoid
Centre of Earth

FIGURE 1

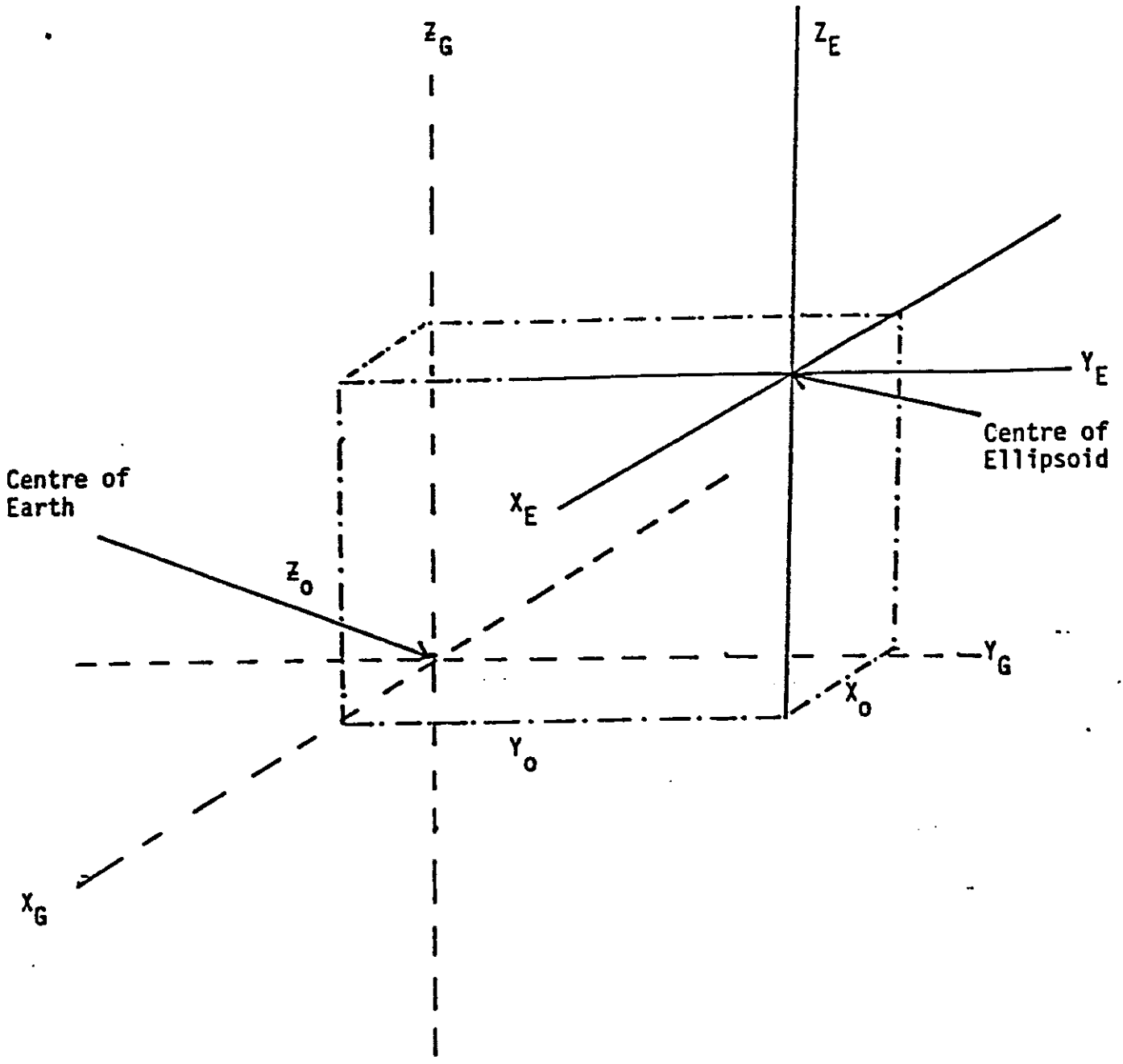


FIGURE 2

$$X_E = X_G - Xo$$

$$Y_E = Y_G - Yo$$

$$Z_E = Z_G - Zo$$

DATUM OFFSET

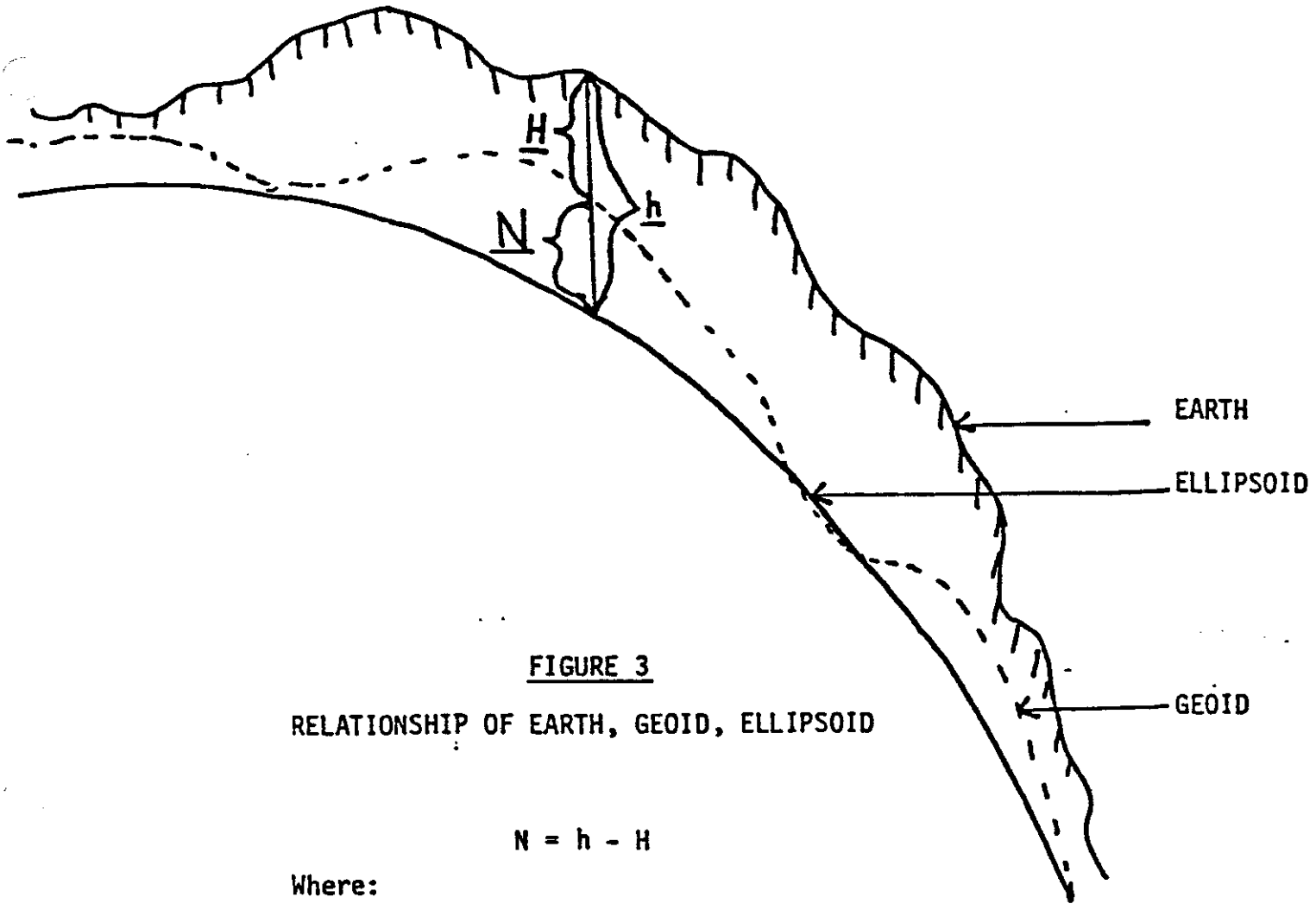


FIGURE 3

RELATIONSHIP OF EARTH, GEOID, ELLIPSOID

$$N = h - H$$

Where:

N = Geoidal Undulation

h = Ellipsoid Height

H = Geoid or Sea Level Height

```
@ADD,P RUNS.GDL-CNI-2

@MSG,N RETURN TO CRAGG  RM.744  NO DECK !!!!!!!!!!

@ASG,A CNI*GDG-CNI2B.
READY

@USE 2.,CNI*GDG-CNI2B.
READY

@XQT SURV*NEWGDLSAT.GDLSAT/TEST
```

DEPARTMENT OF ENERGY MINES AND RESOURCES
GEODETIC SURVEY OF CANADA
PROGRAM GDLSAT-UNIVAC 1110/40

NO.OF STATIONS	=	9
NO.FREE STATIONS	=	9
NO.CORR.STATIONS	=	9
SOLVE TRANSFORMATION PARAMETERS	=	0
NUMBER OF FILES TO BE READ IN	=	1
APPLY A COMMON BLOCK SHIFT	=	1
NUMBER OF SEMI-FIXED PTS. (X,Y,Z)	=	1
NUMBER OF HEIGHT OBSERVATIONS	=	0
NUMBER OF PLANIMETRIC PTS. (P,L)	=	0

REQUIRED CORE =160881 OR 472161 IN OCTAL

PARAMETERS CHOSEN FROM CONTROL CARD

COL 25 SOLVE TRANSFORMATION PARAMETERS	NO
COL 30 SUPRESS NORMALS	YES
COL 35 SUPRESS COVARIENCE MATRIX	YES
COL 40 SUPRESS INTERSTATION LENGTHS	YES
COL 45 ARBITRARY ORIGIN SHIFT	NO
COL 50 COMPUTE LATS AND LONGS	YES
COL 55 PUNCH COORDINATES AND COV MATRIX	NO
COL 60 PRINT SEALEVEL INTERSTATION DIST	NO
COL 65 PRINT INPUT FILE 9 MATRICES	NO
COL 70 ADD VARIABLE BLOCK CONSTANTS	NO
COL 75 PRT. INV. OF SCALED INPUT FILES	NO
SOLVE BLOCK SHIFT UNKNOWNS	YES

```
                GEODETIC SURVEY OF CANADA -- PROGRAM GDLSAT          DATE=082978

                CNI  ADJUSTMENT :::: 9 STATIONS : LINE CREEK:::::::


INITIAL VALUES:     DOX=     .00000     DOY=     .00000     DOZ=     .00000
                    SCALE PPM. =     .00000     KAPPA SEC =     .00000     PHI SEC =     .00000     OMEGA SEC =     .00000

        INPUT DATA

10                              .0000          .0000          .0000
21HORSE                         .0000          .0000          .0000
2178-05                         .0000          .0000          .0000
2178-06                         .0000          .0000          .0000
2178-11                         .0000          .0000          .0000
2178-14                         .0000          .0000          .0000
2178-15                         .0000          .0000          .0000
2178-16                         .0000          .0000          .0000
2178-18                         .0000          .0000          .0000
2178-600                        .0000          .0000          .0000
40                              .0000          .0000          .0000
50                              .0000          .0000          .0000

KK=     1          MAT=     1
65                              .0000          .0000          .0000         5.0000

IATPMX=  813     IAMAX=   57     KK=    1
       POSITION EQUATIONS FROM FILE

        SIGMA NAUGHT SQUARED FROM CONTINUATION FILE =     .69023

60                              .0000          .0000          .0000          .0000
61HORSE                -1722538.0865  -3737686.7939   4858931.9259
6178-05                -1717337.0749  -3730238.7818   4866185.2882
6178-06                -1719231.5599  -3727427.4231   4867356.7722
6178-11                -1725033.8348  -3742012.5009   4854850.7955
6178-14                -1730554.5322  -3742468.3186   4851515.8004
6178-15                -1722063.0663  -3729102.3127   4865788.9612
6178-16                -1720455.1895  -3732056.8367   4864490.9106
6178-18                -1725375.8592  -3731354.8098   4862625.6173
6178-600               -1724534.6085  -3735005.1552   4860485.6884
        ARBITRARY SCALING FACTOR =     1.00000
62                              .0000          .0000          .0000
      WEIGHT COEFFICIENT MATRIX WITH POSITION VARIENCE OF      .00000 ADDED

INPUT FILE =     1     SIZE = ( 27 X  27 )
CALL DSINV AT        18.2082 SEC.      RETURNED AT          18.2082 SEC.      DIFFERENCE =       .0000 SEC.

71HORSE                -1722534.2020  -3737695.1170   4858914.7680          .0001
99                              .0000          .0000          .0000          .0000
```

INVERSE OF NORMALS ::: SIZE (30 , 30)
DSINV CALLED AT 19.8018 SEC. RETURNED AT 19.8018 SEC. DIFFERENCE = .0000 SEC.

SOLUTION

.388449+001	-.832307+001	-.171579+002	.389819+001	-.832839+001	-.171371+002
.390763+001	-.831995+001	-.171495+002	.387669+001	-.830078+001	-.171507+002
.389491+001	-.830725+001	-.171455+002	.387716+001	-.830899+001	-.171492+002
.388185+001	-.831881+001	-.171388+002	.390099+001	-.829392+001	-.171687+002
.387069+001	-.831328+001	-.171363+002	.393442+001	-.793389+001	-.168216+002

RESIDUALS

60		.0000		.0000		.0000	
	STATION	X COORD	RESID	Y COORD	RESID	Z COORD	RESID
	HORSE	-1722538.086	-.050	-3737686.794	-.389	4858931.926	-.336
	78-05	-1717337.075	-.036	-3730238.782	-.394	4866185.288	-.316
	78-06	-1719231.560	-.027	-3727427.423	-.386	4867356.772	-.328
	78-11	-1725033.835	-.056	-3742012.501	-.367	4854850.796	-.329
	78-14	-1730554.532	-.040	-3742468.319	-.373	4851515.800	-.324
	78-15	-1722063.066	-.057	-3729102.313	-.375	4865788.961	-.328
	78-16	-1720455.190	-.053	-3732056.837	-.385	4864490.911	-.317
	78-18	-1725375.859	-.033	-3731354.810	-.360	4862625.617	-.347
	78-600	-1724534.609	-.064	-3735005.155	-.379	4860485.688	-.315
	BLKSFT	.000	3.934	.000	-7.934	.000	-16.822
71HORSE		-1722534.2020	-3737695.1170	4858914.7680		.0001	

S.D. OF UNIT WT.= 2.221 DEGREES OF FREEDOM= 3.

ADJUSTED COORDS. AND S.D.

	X(COORD)	S.D.	Y(COORD)	S.D.	Z(COORD)	S.D.
HORSE	-1722534.2020	.0001	-3737695.1170	.0001	4858914.7680	.0001
78-05	-1717333.1767	.5140	-3730247.1103	.3726	4866168.1511	.3195
78-06	-1719227.6523	.4366	-3727435.7430	.3229	4867339.6227	.2576
78-11	-1725029.9581	.4043	-3742020.8017	.3118	4854833.6449	.2444
78-14	-1730550.6373	.6405	-3742476.6258	.5426	4851498.6548	.4104
78-15	-1722059.1891	.3456	-3729110.6217	.2697	4865771.8120	.2128
78-16	-1720451.3077	.3329	-3732065.1555	.2575	4864473.7718	.2082
78-18	-1725371.9583	.6175	-3731363.1037	.4248	4862608.4486	.3243
78-600	-1724530.7378	.3796	-3735013.4685	.2982	4860468.5521	.2420

ADJUSTED BLOCK SHIFT COMPONENTS AND S.D.

FILE NO.	X-SHIFT	S.D.	Y-SHIFT	S.D.	Z-SHIFT	S.D.
1	3.934	.404	-7.934	.312	-16.822	.244

LATITUDES, LONGITUDES AND HEIGHTS				STANDARD DEVIATIONS (METRES)		
A= 6378206.400 B= 6356583.800				LAT	LONG	HT
HORSE	49 55 37.30003	114 44 34.19987	2027.200	.000	.000	.000
78-05	50 1 49.76073	114 43 13.52312	1832.310	.378	.536	.274
78-06	50 2 57.76658	114 45 39.07331	1599.574	.285	.454	.271
78-11	49 52 9.16127	114 44 57.03326	2109.016	.267	.432	.250
78-14	49 49 52.10902	114 48 58.29334	1318.857	.475	.688	.418
78-15	50 1 18.04621	114 47 12.96400	2136.843	.230	.369	.219
78-16	50 0 1.25401	114 44 57.52517	2433.475	.228	.350	.214
78-18	49 58 47.13370	114 48 56.48540	1921.064	.380	.652	.311
78-600	49 56 49.24711	114 47 1.38773	2187.353	.261	.402	.249

STATION FROM	RELATIVE TO	ERROR ELLIPSOIDS SEMI AXIS 95% CONFIDENCE			ORIENTATION OF THE AXIS W.R.T. X,Y,Z SYSTEM			ORDER
HORSE	78-05	1.50174	1.12744	.84946	.93101	.19361	.30943	4TH.
					-.36432	.54474	.75534	
					.02232	.81595	-.57768	
HORSE	78-06	1.27277	.90523	.83076	.92997	.03717	.36575	3RD.
					-.36753	.11754	.92256	
					.00869	.99237	-.12294	
HORSE	78-11	1.21059	.87477	.75846	.89060	.03339	.45357	4TH.
					-.45336	.14438	.87957	
					.03611	.98896	-.14367	
HORSE	78-14	1.94404	1.52552	1.31412	.85183	.02218	.52335	4TH.
					-.49350	.36897	.78761	
					.17563	.92918	-.32522	
HORSE	78-15	1.03437	.75551	.66004	.88835	.01554	.45890	3RD.
					-.45807	.09902	.88339	
					.03171	.99496	-.09500	
HORSE	78-16	.98050	.72272	.65171	.90916	.05157	.41325	3RD.
					-.41611	.15302	.89636	
					.01701	.98688	-.16052	
HORSE	78-18	1.82945	1.21524	.99756	.91610	.20903	.34215	4TH.
					-.39530	.32812	.85795	
					-.06707	.92122	-.38322	
HORSE	78-600	1.12515	.83637	.74760	.89811	.05401	.43645	5TH.
					-.43978	.11055	.89128	
					.00011	.99240	-.12299	

78-05	78-06	1.67909	1.20985	.96457	.94735 -.32013 .00661	.19033 .57960 .79237	.25750 .74939 -.61001	5TH.
78-05	78-11	1.71137	1.21267	.94126	.92491 -.38003 -.01065	.23675 .55382 .79827	.29747 .74085 -.60221	3RD.
78-05	78-14	2.26929	1.74276	1.44872	.89880 -.43149 .07727	.16677 .49960 .85005	.40540 .75114 -.52100	3RD.
78-05	78-15	1.50704	1.11046	.82771	.92969 -.36832 -.00392	.23239 .57828 .78204	.28578 .72797 -.62321	5TH.
78-05	78-16	1.55817	1.12310	.83366	.94024 -.33998 -.01896	.24107 .62532 .74220	.24047 .70242 -.66991	5TH.
78-05	78-18	2.08167	1.44841	1.09893	.92607 -.37642 -.02654	.22108 .48421 .84656	.30581 .78985 -.53162	4TH.
78-05	78-600	1.65231	1.19571	.91747	.92914 -.36838 -.03166	.25657 .58075 .77260	.26622 .72597 -.63410	4TH.
78-06	78-11	1.55248	1.02691	.95358	.92645 -.37603 -.01719	.18476 .41447 .89111	.32796 .82875 -.45344	3RD.
78-06	78-14	2.15343	1.62332	1.44809	.89130 -.44289 .09714	.10212 .40480 .90868	.44177 .79999 -.40602	3RD.
78-06	78-15	1.34403	.89733	.84561	.93550 -.35283 -.01878	.20437 .49698 .84335	.28823 .79280 -.53701	5TH.

78-06	78-16	1.37030	.91309	.85690	.94521	.26502	.19064	4TH.
					-.32392	.68853	.64885	
					-.04070	.67505	-.73664	
78-06	78-18	1.89894	1.28477	1.08243	.92735	.23250	.29319	4TH.
					-.36657	.40715	.83658	
					-.07513	.88328	-.46279	
78-06	78-600	1.48763	.99991	.93878	.93490	.23487	.26607	4TH.
					-.35201	.51815	.77950	
					-.04522	.82241	-.56709	
78-11	78-14	1.95141	1.51126	1.29658	.85500	.04608	.51658	5TH.
					-.49341	.37907	.78286	
					.15974	.92422	-.34682	
78-11	78-15	1.33062	.88368	.80167	.90286	.17664	.39199	3RD.
					-.42991	.36012	.82795	
					-.00508	.91603	-.40106	
78-11	78-16	1.09938	.73936	.66883	.90551	.09693	.41311	3RD.
					-.42433	.21154	.88046	
					.00205	.97255	-.23266	
78-11	78-18	2.01614	1.30726	1.08370	.91385	.23790	.32907	4TH.
					-.40097	.40090	.82371	
					-.06403	.88470	-.46175	
78-11	78-600	1.14183	.81809	.70601	.88828	.07555	.45305	4TH.
					-.45921	.16647	.87260	
					.00949	.98315	-.18253	
78-14	78-15	1.97998	1.39969	1.20623	.87616	.39730	.27295	3RD.
					-.47461	.80999	.34448	
					.08422	.43136	-.89824	

78-14	78-16	1.88160	1.33883	1.13712	.85608	.42194	.29850	3RD.
					-.50269	.81397	.29114	
					.12013	.39928	-.90892	
78-14	78-18	2.50916	1.66898	1.44257	.89662	.31028	.31590	4TH.
					-.44230	.66127	.60588	
					.02090	.68297	-.73015	
78-14	78-600	1.92588	1.36940	1.17680	.85433	.41665	.31068	4TH.
					-.50754	.79751	.32615	
					.11188	.43632	-.89281	
78-15	78-16	1.11226	.76890	.69207	.92143	.16925	.34975	5TH.
					-.38713	.32303	.86360	
					-.03318	.93113	-.36314	
78-15	78-18	1.83376	1.23217	1.00077	.90761	.21101	.36293	5TH.
					-.41716	.35626	.83609	
					-.04713	.91025	-.41137	
78-15	78-600	1.25405	.88638	.79259	.90481	.13561	.40365	4TH.
					-.42500	.22904	.87574	
					-.02631	.96392	-.26484	
78-16	78-18	1.89151	1.26022	1.04116	.92066	.23022	.31525	5TH.
					-.38267	.37270	.84538	
					-.07713	.89894	-.43122	
78-16	78-600	.99911	.77039	.64478	.91800	.09112	.38597	4TH.
					-.39253	.07017	.91706	
					-.05648	.99336	-.10013	
78-18	78-600	1.97189	1.21780	1.04130	.91596	.33390	.22255	5TH.
					-.39528	.65535	.64364	
					-.06906	.67752	-.73226	

TOTAL NUMBER OF RELATIVE ELLIPSOIDS = 36

CLASSIFICATION SUMMARY

```
FIRST  =      0
SECOND =      0
THIRD  =     11
FOURTH =     15
FIFTH  =     10
UNCLASSIFIED =      0


START OF ERROR ELLIPSE CALCULATIONS =          20.3892 SECS.
END OF ERROR ELLIPSE CALCULATIONS =          22.3912 SECS.
TIME TO CALCULATE ERROR ELLIPSES =      2.0020 SECS.
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DEPARTMENT OF ENERGY MINES AND RESOURCES
GEODETIC SURVEY OF CANADA
PROGRAM GDLSAT-UNIVAC 1110/40

NO.OF STATIONS	=	19
NO.FREE STATIONS	=	19
NO.CORR.STATIONS	=	10
SOLVE TRANSFORMATION PARAMETERS	=	0
NUMBER OF FILES TO BE READ IN	=	2
APPLY A COMMON BLOCK SHIFT	=	1
NUMBER OF SEMI-FIXED PTS. (X,Y,Z)	=	1
NUMBER OF HEIGHT OBSERVATIONS	=	0
NUMBER OF PLANIMETRIC PTS. (P,L)	=	0

REQUIRED CORE =160881 OR 472161 IN OCTAL

PARAMETERS CHOSEN FROM CONTROL CARD

COL 25 SOLVE TRANSFORMATION PARAMETERS	NO
COL 30 SUPRESS NORMALS	YES
COL 35 SUPRESS COVARIENCE MATRIX	YES
COL 40 SUPRESS INTERSTATION LENGTHS	YES
COL 45 ARBITRARY ORIGIN SHIFT	NO
COL 50 COMPUTE LATS AND LONGS	YES
COL 55 PUNCH COORDINATES AND COV MATRIX	NO
COL 60 PRINT SEALEVEL INTERSTATION DIST	NO
COL 65 PRINT INPUT FILE 9 MATRICES	NO
COL 70 ADD VARIABLE BLOCK CONSTANTS	NO
COL 75 PRT. INV. OF SCALED INPUT FILES	NO
SOLVE BLOCK SHIFT UNKNOWNS	YES

GEODETIC SURVEY OF CANADA -- PROGRAM GDLSAT DATE=100478

CNI ADJUSTMENT ;;;; 19 STATIONS ; LINE CREEK;;;;;;;

INITIAL VALUES: DOX= .00000 DOY= .00000 DOZ= .00000
SCALE PPM. = .00000 KAPPA SEC = .00000 PHI SEC = .00000 OMEGA SEC = .00000

INPUT DATA

10	.0000	.0000	.0000	
21HORSE	.0000	.0000	.0000	
2178-24	.0000	.0000	.0000	
2178-40	.0000	.0000	.0000	
2178-40A	.0000	.0000	.0000	
2178-42	.0000	.0000	.0000	
2178-43	.0000	.0000	.0000	
2178-44	.0000	.0000	.0000	
2178-45	.0000	.0000	.0000	
2178-46	.0000	.0000	.0000	
2178-47A	.0000	.0000	.0000	
2178-48	.0000	.0000	.0000	
2178-49	.0000	.0000	.0000	
2178-52	.0000	.0000	.0000	
2178-54	.0000	.0000	.0000	
2178-55	.0000	.0000	.0000	
2178-64	.0000	.0000	.0000	
2178-69	.0000	.0000	.0000	
2178-80	.0000	.0000	.0000	
2178-100	.0000	.0000	.0000	
40	.0000	.0000	.0000	
50	.0000	.0000	.0000	

KK= 1 MAT= 2

65	.0000	.0000	.0000	5.0000

IATPMX= 993 IAMAX= 63 KK= 1
POSITION EQUATIONS FROM FILE

SIGMA NAUGHT SQUARED FROM CONTINUATION FILE = .74400

60	.0000	.0000	.0000	.0000
61HORSE	-1722538.6486	-3737684.8795	4858930.9427	
6178-24	-1735957.1164	-3751133.5074	4842773.6663	
6178-40	-1770168.6806	-3776294.6253	4810561.0582	
6178-40A	-1768120.6440	-3778083.1224	4810310.8585	
6178-42	-1742584.3999	-3790449.3230	4810467.7996	
6178-43	-1744816.7758	-3779723.2803	4818550.7726	
6178-44	-1738813.9123	-3783828.7380	4816911.7036	
6178-45	-1761606.8855	-3779970.7744	4811163.7736	
6178-46	-1747889.1125	-3783909.5717	4814127.2411	

```
6178-47A          -1768200.7687  -3775559.9994   4812239.8571
        ARBITRARY SCALING FACTOR =    1.00000
62                      .0000          .0000           .0000
      WEIGHT COEFFICIENT MATRIX WITH POSITION VARIENCE OF     .00000 ADDED

INPUT FILE =     1     SIZE = ( 30 X  30 )
CALL DSINV AT       706.2836 SEC.     RETURNED AT       706.2836 SEC.     DIFFERENCE =      .0000 SEC.

KK=     2          MAT=     2
65                      .0000          .0000           .0000          5.0000

IATPMX=  993     IAMAX=   63     KK=    2
        POSITION EQUATIONS FROM FILE

        SIGMA NAUGHT SQUARED FROM CONTINUATION FILE =     .83836

60                      .0000          .0000           .0000           .0000
61HORSE           -1722537.9685  -3737684.6159   4858930.4277
6178-48           -1743886.2927  -3786762.5380   4812960.9043
6178-49           -1744465.4725  -3784892.7238   4814428.4234
6178-52           -1731544.0121  -3775384.4845   4826376.2764
6178-54           -1741115.5473  -3783100.7295   4817275.8538
6178-55           -1733459.1681  -3772076.5032   4827919.9159
6178-64           -1731767.8464  -3774251.7288   4827067.8712
6178-69           -1734192.8007  -3774523.8299   4825837.1093
6178-80           -1766766.9454  -3774302.7211   4813386.3668
6178-100          -1731984.0050  -3753030.4981   4842999.1469
        ARBITRARY SCALING FACTOR =    1.00000
62                      .0000          .0000           .0000
      WEIGHT COEFFICIENT MATRIX WITH POSITION VARIENCE OF     .00000 ADDED

INPUT FILE =     2     SIZE = ( 30 X  30 )
CALL. DSINV AT      708.3082 SEC.     RETURNED AT       708.3082 SEC.     DIFFERENCE =      .0000 SEC.

71HORSE           -1722534.2020  -3737695.1170   4858914.7680           .0001
99                      .0000          .0000           .0000           .0000

 INVERSE OF NORMALS ::: SIZE (   63 ,   63 )
DSINV CALLED AT       710.7416 SEC.  RETURNED AT       714.9760 SEC.     DIFFERENCE =     4.2344 SEC.


        SOLUTION
            .444664+001    -.102375+002    -.161747+002     .443148+001    -.102196+002    -.161500+002

            .443953+001    -.102207+002    -.161485+002     .442475+001    -.102110+002    -.161566+002

            .443636+001    -.102134+002    -.161318+002     .443995+001    -.102242+002    -.161454+002

            .440375+001    -.102060+002    -.161358+002     .437599+001    -.102239+002    -.161120+002
```

.442647+001	-.102190+002	-.161330+002	.442087+001	-.102167+002	-.161486+002
.378298+001	-.104825+002	-.156344+002	.372337+001	-.104464+002	-.156508+002
.374637+001	-.104595+002	-.156539+002	.374680+001	-.104910+002	-.156223+002
.373673+001	-.104669+002	-.156457+002	.376059+001	-.104692+002	-.156546+002
.376558+001	-.104670+002	-.156556+002	.375321+001	-.104880+002	-.156400+002
.375204+001	-.104767+002	-.156451+002	.450511+001	-.972127+001	-.157456+002
.384863+001	-.993740+001	-.151947+002			

RESIDUALS

60		.0000		.0000		.0000		.0000	
	STATION	X COORD	RESID	Y COORD	RESID	Z COORD	RESID		
	HORSE	-1722538.649	-.058	-3737684.880	-.516	4858930.943	-.429		
	78-24	-1735957.116	-.074	-3751133.507	-.498	4842773.666	-.404		
	78-40	-1770168.681	-.066	-3776294.625	-.499	4810561.058	-.403		
	78-40A	-1768120.644	-.080	-3778083.122	-.490	4810310.859	-.411		
	78-42	-1742584.400	-.069	-3790449.323	-.492	4810467.800	-.386		
	78-43	-1744816.776	-.065	-3779723.280	-.503	4818550.773	-.400		
	78-44	-1738813.912	-.101	-3783828.738	-.485	4816911.704	-.390		
	78-45	-1761606.885	-.129	-3779970.774	-.503	4811163.774	-.366		
	78-46	-1747889.113	-.079	-3783909.572	-.498	4814127.241	-.387		
	78-47A	-1768200.769	-.084	-3775559.999	-.495	4812239.857	-.403		
	BLKSFT	.000	4.505	.000	-9.721	.000	-15.746		
60		.0000		.0000		.0000			
	STATION	X COORD	RESID	Y COORD	RESID	Z COORD	RESID		
	HORSE	-1722537.968	-.082	-3737684.616	-.564	4858930.428	-.465		
	78-48	-1743886.293	-.066	-3786762.538	-.545	4812960.904	-.440		
	78-49	-1744465.472	-.125	-3784892.724	-.509	4814428.423	-.456		
	78-52	-1731544.012	-.102	-3775384.484	-.522	4826376.276	-.459		
	78-54	-1741115.547	-.102	-3783100.729	-.554	4817275.854	-.428		
	78-55	-1733459.168	-.112	-3772076.503	-.530	4827919.916	-.451		
	78-64	-1731767.846	-.088	-3774251.729	-.532	4827067.871	-.460		
	78-69	-1734192.801	-.083	-3774523.830	-.530	4825837.109	-.461		
	78-80	-1766766.945	-.095	-3774302.721	-.551	4813386.367	-.445		
	78-100	-1731984.005	-.097	-3753030.498	-.539	4842999.147	-.450		
	BLKSET	.000	3.849	.000	-9.937	.000	-15.195		
71HORSE		-1722534.2020		-3737695.1170		4858914.7680		.0001	

S.D. OF UNIT WT.= 2.208 DEGREES OF FREEDOM= 6.

ADJUSTED COORDS. AND S.D.

	X(COORD)	S.D.	Y(COORD)	S.D.	Z(COORD)	S.D.
HORSE	-1722534.2020	.0001	-3737695.1170	.0001	4858914.7680	.0001
78-24	-1735952.6849	.7450	-3751143.7269	.4799	4842757.5163	.4182
78-40	-1770164.2411	.4427	-3776304.8460	.3221	4810544.9097	.2946
78-40A	-1768116.2192	.4147	-3778093.3334	.2981	4810294.7019	.2847
78-42	-1742579.9636	.6443	-3790459.5364	.4815	4810451.6677	.4170
78-43	-1744812.3359	.4333	-3779733.5044	.3188	4818534.6273	.2974
78-44	-1738809.5086	.5828	-3783838.9439	.4120	4816895.5678	.3759
78-45	-1761602.5095	.8247	-3779980.9983	.4254	4811147.6617	.5299
78-46	-1747884.6860	.6264	-3783919.7906	.4950	4814111.1081	.4119
78-47A	-1768196.3478	.4349	-3775570.2161	.3067	4812223.7086	.2952
78-48	-1743882.5098	.9807	-3786773.0205	.6102	4812945.2700	.5792
78-49	-1744461.7491	.7060	-3784903.1703	.5619	4814412.7728	.4985
78-52	-1731540.2658	.4428	-3775394.9440	.3421	4826360.6226	.2844
78-54	-1741111.8005	.5965	-3783111.2205	.4522	4817260.2315	.4317
78-55	-1733455.4314	.4502	-3772086.9702	.3558	4827904.2702	.2896
78-64	-1731764.0858	.5993	-3774262.1980	.4439	4827052.2166	.3585
78-69	-1734189.0352	.4583	-3774534.2970	.3638	4825821.4538	.2995
78-80	-1766763.1922	.6278	-3774313.2091	.4679	4813370.7268	.4367
78-100	-1731980.2530	.4672	-3753040.9748	.3503	4842983.5018	.2873

ADJUSTED BLOCK SHIFT COMPONENTS AND S.D.

FILE NO.	X-SHIFT	S.D.	Y-SHIFT	S.D.	Z-SHIFT	S.D.
1	4.505	.412	-9.721	.376	-15.746	.825
2	3.849	.425	-9.937	.530	-15.195	.626

LATITUDES, LONGITUDES AND HEIGHTS			STANDARD DEVIATIONS (METRES)		
A= 6378206.400 B= 6356583.800			LAT	LONG	HT
HORSE	49 55 37.30003	114 44 34.19987	2027.200	.000	.000	.000
78-24	49 42 39.04105	114 50 1.44797	1190.416 1184	.484	.752	.400
78-40	49 16 5.21543	115 6 54.36142	898.787	.300	.449	.308
78-40A	49 15 41.51485	115 4 45.12948	1199.244	.285	.417	.295
78-42	49 15 33.23799	114 41 22.41952	1626.700	.448	.667	.419
78-43	49 21 59.89146	114 46 44.89946	2013.716	.307	.436	.306
78-44	49 20 55.44412	114 40 49.71107	1563.152	.399	.583	.390
78-45	49 16 25.17733	114 59 13.75825	1163.117	.446	.742	.626
78-46	49 18 21.71118	114 47 36.11376	1974.134	.442	.640	.450
78-47A	49 17 17.45858	115 5 41.63191	1192.435	.296	.429	.315
78-48	49 17 34.66794	114 43 37.15807	1686.781	.641	.930	.627
78-49	49 18 41.35413	114 44 41.90847	1850.030	.536	.733	.488
78-52	49 28 37.84069	114 38 16.79047	1785.199	.320	.464	.276
78-54	49 20 55.74704	114 42 48.37446	2035.764 2029	.457	.586	.441
78-55	49 30 4.59386	114 40 51.80482	1525.005 1518	.326	.474	.286
78-64	49 29 15.41240	114 38 50.35170	1702.683 1696	.403	.634	.348
78-69	49 28 18.56211	114 40 34.16019	1585.155 1578	.336	.482	.295
78-80	49 18 24.50894	115 5 3.78013	923.301	.483	.613	.442
78-100	49 42 42.39288	114 46 21.78388	1398.870	.321	.491	.282

ERROR ELLIPSOIDS

STATION FROM	RELATIVE TO	SEMI AXIS (95% CONFIDENCE)			ORIENTATION OF THE AXIS W.R.T. X,Y,Z SYSTEM			ORDER
HORSE	78-24	2.12972	1.41810	1.18982	.96706	.17356	.18619	3RD.
					-.25266	.56583	.78486	
					-.03087	.80605	-.59104	
HORSE	78-40	1.27119	.89368	.86506	.95296	-.08592	.29068	1ST.
					-.26899	.20227	.94165	
					-.13970	-.97555	.16972	
HORSE	78-40A	1.18565	.82488	.80935	.96063	-.11155	.25446	1ST.
					-.23290	.17592	.95643	
					-.15146	-.97806	.14317	
HORSE	78-42	1.87043	1.35539	1.24633	.93482	.05645	.35061	2ND.
					-.35136	.29037	.89008	
					.05157	.95525	-.29125	
HORSE	78-43	1.23772	.88726	.86361	.95952	.22796	.16542	1ST.
					-.24059	.35804	.90220	
					-.14644	.90545	-.39834	
HORSE	78-44	1.66005	1.15779	1.10845	.96711	.23093	.10663	2ND.
					-.21626	.52579	.82267	
					-.13391	.81866	-.55843	
HORSE	78-45	2.47561	1.19566	.78250	.92500	.01120	-.37979	2ND.
					.07819	.97256	.21911	
					-.37182	.23237	-.89875	
HORSE	78-46	1.80335	1.38251	1.32446	.93931	-.02379	.34225	2ND.
					-.31668	.32360	.89160	
					-.13196	-.94590	.29650	

HORSE	78-47A	1.23754	.85228	.83680	.97037	.02762	.24004	1ST.
					-.14873	.85122	.50323	
					-.19043	-.52409	.83015	
HORSE	78-48	2.77678	1.79533	1.56367	.98223	.13975	-.12529	2ND.
					-.03025	.77668	.62916	
					-.18524	.61419	-.76711	
HORSE	78-49	2.06849	1.58083	1.44288	.91172	.01904	.41037	2ND.
					-.36960	.47412	.79914	
					.17935	.88026	-.43928	
HORSE	78-52	1.29920	.97979	.85097	.91614	.13211	.37848	2ND.
					-.39783	.41575	.81787	
					.04931	.89983	-.43341	
HORSE	78-54	1.67969	1.29171	1.22721	.98612	.16501	.01850	2ND.
					-.12772	.68259	.71956	
					-.10610	.71193	-.69419	
HORSE	78-55	1.32912	1.01293	.88386	.90349	.11214	.41368	2ND.
					-.42411	.37341	.82506	
					.06195	.92086	-.38490	
HORSE	78-64	1.77402	1.26571	1.07541	.91015	.15041	.38601	2ND.
					-.41427	.32446	.85036	
					-.00266	.93386	-.35761	
HORSE	78-69	1.35004	1.03579	.90928	.90574	.11308	.40848	2ND.
					-.41913	.38234	.82351	
					.06306	.91707	-.39367	
HORSE	78-80	1.38281	1.79212	1.21756	.23603	-.97175	.29392	1ST.
					.49323	.12072	.78502	
					.83727	.20282	-.54531	
HORSE	78-100	1.37465	.99714	.86721	.91561	.15365	.37156	3RD.
					-.40198	.32998	.85413	
					-.00863	.93140	-.36388	

78-24	78-40	2.44486	1.59505	1.3[illegible]623	.96437	.23774	.11607	2ND.
					-.26058	.77772	.57206	
					-.04573	.58192	-.81196	
78-24	78-40A	2.40239	1.56377	1.32771	.96648	.23130	.11142	2ND.
					-.25322	.78722	.56228	
					-.04234	.57165	-.81940	
78-24	78-42	2.77839	1.87552	1.63231	.95572	.21196	.20413	3RD.
					-.29422	.70140	.64921	
					.00557	.68052	-.73270	
78-24	78-43	2.42114	1.60053	1.34732	.96569	.23285	.11495	3RD.
					-.25619	.78202	.56817	
					-.04240	.57812	-.81485	
78-24	78-44	2.64455	1.76086	1.50558	.96822	.22512	.10898	3RD.
					-.24514	.76765	.59213	
					-.04964	.60002	-.79844	
78-24	78-45	3.15890	1.79388	1.46266	.96806	.11348	-.22355	3RD.
					-.05157	.96276	.26541	
					-.24534	.24540	-.93786	
78-24	78-46	2.73794	1.88667	1.70751	.95776	.25472	.13346	3RD.
					-.28272	.74924	.59893	
					-.05256	.61136	-.78960	
78-24	78-47A	2.42563	1.57745	1.34966	.97036	.22557	.08671	2ND.
					-.23626	.81003	.53669	
					-.05082	.54127	-.83931	
78-24	78-48	3.47794	2.24561	1.94122	.98553	.16544	-.03685	3RD.
					-.11546	.81446	.56861	
					-.12408	.55613	-.82178	

78-24	78-49	2.95603	2.05984	1.84580	.95143 -.30390 .04916	.17894 .67587 .71497	.25051 .67145 -.69743	3RD.
78-24	78-52	2.49029	1.64986	1.40603	.95752 -.28811 -.01179	.22713 .72838 .64644	.17766 .62166 -.76288	3RD.
78-24	78-54	2.70853	1.86358	1.64781	.97517 -.21618 -.04817	.20427 .79382 .57283	.08559 .56844 -.81826	3RD.
78-24	78-55	2.50419	1.66690	1.43272	.95526 -.29562 -.00954	.22948 .72040 .65449	.18661 .62740 -.75601	3RD.
78-24	78-64	2.76530	1.82208	1.57074	.94787 -.31806 -.01952	.23272 .64911 .72422	.21767 .69101 -.68929	3RD.
78-24	78-69	2.51557	1.68122	1.44779	.95556 -.29467 -.00907	.22852 .72090 .65428	.18626 .62727 -.75620	3RD.
78-24	78-80	2.76517	1.92790	1.63970	.97402 -.20888 -.08749	.21941 .77477 .59295	.05607 .59674 -.80047	3RD.
78-24	78-100	2.53070	1.65701	1.41927	.95548 -.29412 -.02333	.23609 .71475 .65833	.17695 .63453 -.75237	5TH.
78-40	78-40A	1.18888	.76188	.75255	.93234 -.36041 -.02913	.35949 .93258 -.03249	.03881 .01965 .99905	5TH.
78-40	78-42	1.89929	1.32561	1.19988	.94635 -.32272 .01644	.04426 .17986 .98270	.32009 .92925 -.18448	3RD.

78-40	78-43	1.21981	.80183	.77447	.94800	.14268	.28451	2ND.
					-.30664	.16996	.93653	
					-.08526	.97507	-.20484	
78-40	78-44	1.69790	1.10416	1.05072	.96775	.20088	.15202	3RD.
					-.20837	.29919	.93117	
					-.14157	.93281	-.33139	
78-40	78-45	2.48504	1.17378	.79001	.93079	-.00488	-.36553	4TH.
					.05808	.98919	.13468	
					-.36092	.14659	-.92100	
78-40	78-46	1.82015	1.33689	1.26297	.94807	-.07029	.31019	3RD.
					-.27724	.29536	.91427	
					-.15588	-.95280	.26057	
78-40	78-47A	1.25645	.82052	.78040	.96063	.17709	.21407	5TH.
					-.25729	.85780	.44490	
					-.10484	-.48250	.86962	
78-40	78-48	3.04608	1.98919	1.78143	.98178	.15417	-.11107	3RD.
					-.06588	.82445	.56209	
					-.17823	.54454	-.81958	
78-40	78-49	2.41417	1.79042	1.68997	.93279	.08568	.35009	3RD.
					-.35090	.43760	.82788	
					.08227	.89508	-.43823	
78-40	78-52	1.81122	1.28117	1.21674	.93861	.21633	.26872	2ND.
					-.34254	.49209	.80033	
					-.04090	.84324	-.53597	
78-40	78-54	2.10341	1.54550	1.48771	.97560	.21945	-.00716	3RD.
					-.18693	.84724	.49723	
					-.11518	.48376	-.86759	

78-40	78-55	1.83113	1.30558	1.24360	.93310	.19342	.30319	2ND.
					-.35798	.41890	.83450	
					-.03440	.88719	-.46010	
78-40	78-64	2.17683	1.50857	1.38620	.92659	.18451	.32770	3RD.
					-.37355	.35075	.85874	
					-.04350	.91811	-.39392	
78-40	78-69	1.84649	1.32365	1.26133	.93399	.19526	.29922	2ND.
					-.35573	.43004	.82978	
					-.03335	.88144	-.47109	
78-40	78-80	2.18264	1.62076	1.47058	.96751	.24930	-.04216	5TH.
					-.17646	.78518	.59359	
					-.18108	.56687	-.80366	
78-40	78-100	1.86759	1.29190	1.22856	.93552	.21170	.28282	2ND.
					-.34771	.41024	.84310	
					-.06246	.88707	-.45739	
78-40A	78-42	1.90135	1.34037	1.21765	.93305	.03079	.35842	3RD.
					-.35560	.22957	.90601	
					.05439	.97280	-.22514	
78-40A	78-43	1.13268	.79273	.75669	.93720	-.03179	.34735	2ND.
					-.34704	.01467	.93773	
					-.03491	-.99939	.00281	
78-40A	78-44	1.68362	1.12930	1.08460	.96283	.17766	.20344	3RD.
					-.24754	.27914	.92780	
					-.10805	.94367	-.31272	
78-40A	78-45	2.44159	1.14682	.75434	.92560	-.00429	-.37798	5TH.
					.06939	.98487	.15879	
					-.37158	.17323	-.91210	
78-40A	78-46	1.81850	1.36464	1.28403	.93689	.00242	.34961	3RD.
					-.33296	.31117	.89011	
					-.10663	-.95035	.29238	

78-40A	78-47A	1.10554	.75958	.72268	.96682	.12738	.22143	5TH.
					-.23211	.80007	.55310	
					-.10670	-.58622	.80315	
78-40A	78-48	3.01443	1.96853	1.75979	.98174	.15357	-.11225	3RD.
					-.05717	.80105	.59586	
					-.18142	.57856	-.79521	
78-40A	78-49	2.36955	1.77499	1.66560	.93451	.06070	.35073	3RD.
					-.34438	.40326	.84781	
					.08998	.91307	-.39774	
78-40A	78-52	1.75081	1.25983	1.18305	.94244	.18302	.27983	2ND.
					-.33174	.40716	.85099	
					-.04181	.89483	-.44443	
78-40A	78-54	2.05426	1.51980	1.46497	.97824	.20717	.01128	3RD.
					-.16841	.76106	.62644	
					-.12119	.61470	-.77939	
78-40A	78-55	1.77121	1.28572	1.20978	.93666	.16193	.31056	2ND.
					-.34851	.34300	.87230	
					-.03473	.92527	-.37768	
78-40A	78-64	2.12653	1.49193	1.35561	.92858	.17109	.32933	3RD.
					-.36846	.31890	.87324	
					-.04438	.93222	-.35916	
78-40A	78-69	1.78711	1.30392	1.22813	.93759	.16354	.30690	2ND.
					-.34613	.35376	.86894	
					-.03353	.92093	-.38827	
78-40A	78-80	2.13607	1.59764	1.44494	.96870	.24423	-.04431	5TH.
					-.16001	.75091	.64072	
					-.18976	.61358	-.76649	

78-40A	78-100	1.80904	1.27191	1.19399	.93868	.18542	.29068	2ND.
					-.33849	.33521	.87924	
					-.06559	.92372	-.37741	
78-42	78-43	1.73475	1.11346	1.02752	.92227	.26825	.27833	4TH.
					-.37923	.76735	.51706	
					.07488	.58242	-.80943	
78-42	78-44	1.53968	1.00615	.91592	.88177	.05678	.46825	4TH.
					-.44193	.44642	.77809	
					.16485	.89302	-.41872	
78-42	78-45	2.51889	1.43529	1.17016	.96269	.05433	.26511	3RD.
					-.05947	.99816	.01142	
					-.26400	-.02676	.96415	
78-42	78-46	1.74789	1.28517	1.17706	.84421	-.14429	.51621	4TH.
					-.49517	.15877	.85417	
					.20521	.97671	-.06254	
78-42	78-47A	1.92634	1.26143	1.19516	.94187	.31064	.12804	3RD.
					-.33470	.90075	.27682	
					.02934	.30357	-.95235	
78-42	78-48	3.31335	2.20000	1.99891	.98509	.16418	-.05141	5TH.
					-.12023	.87069	.47691	
					-.12306	.46362	-.87745	
78-42	78-49	2.78494	2.00327	1.87771	.92535	.17180	.33797	5TH.
					-.36412	.65101	.66604	
					.10560	.73937	-.66496	
78-42	78-52	2.27684	1.57697	1.46167	.92920	.25976	.26290	3RD.
					-.36701	.73236	.57356	
					.04355	.62943	-.77583	
78-42	78-54	2.50193	1.80676	1.70504	.96385	.24866	.09572	4TH.
					-.26607	.87921	.39523	
					-.01411	.40640	-.91358	

78-42	78-55	2.29345	1.59444	1.48557	.92528	.25695	.27899	3RD.
					-.37634	.71348	.59104	
					.04719	.65187	-.75686	
78-42	78-64	2.57665	1.75737	1.61661	.92350	.22036	.31400	3RD.
					-.38293	.57810	.72053	
					.02275	.78565	-.61825	
78-42	78-69	2.30573	1.60948	1.50023	.92588	.25613	.27776	3RD.
					-.37482	.71511	.59003	
					.04751	.65039	-.75810	
78-42	78-80	2.56033	1.86937	1.70544	.96539	.25078	.07169	3RD.
					-.25136	.82112	.51242	
					-.06964	.51270	-.85574	
78-42	78-100	2.32035	1.58364	1.47625	.92870	.26088	.26355	2ND.
					-.36990	.70186	.60874	
					.02617	.66282	-.74832	
78-43	78-44	1.49268	.98263	.92812	.95526	.17341	.23961	4TH.
					-.27974	.26659	.92233	
					-.09606	.94808	-.30315	
78-43	78-45	2.35838	1.12345	.73522	.93060	.01472	-.36573	4TH.
					.05640	.98149	.18300	
					-.36166	.19093	-.91255	
78-43	78-46	1.62919	1.24078	1.14134	.92340	.00732	.38378	4TH.
					-.37101	.27340	.88745	
					-.09042	-.96187	.25523	
78-43	78-47A	1.17665	.81791	.79687	.95199	.17468	.25138	2ND.
					-.29876	.70935	.63829	
					-.06682	-.68287	.72759	

78-43	78-48	3.03448	1.99447	1.77609	.98207	.15198	-.11149	5TH.
					-.05912	.81001	.58342	
					-.17898	.56637	-.80448	
78-43	78-49	2.39601	1.79767	1.68784	.93496	.08773	.34372	5TH.
					-.34397	.46118	.81793	
					.08676	.88296	-.46135	
78-43	78-52	1.78673	1.29304	1.21219	.94228	.21906	.25321	3RD.
					-.33226	.51853	.78787	
					-.04129	.82652	-.56138	
78-43	78-54	2.08444	1.55302	1.48353	.97815	.20789	.00274	5TH.
					-.17196	.80154	.57267	
					-.11685	.56063	-.81978	
78-43	78-55	1.80675	1.31682	1.23984	.93660	.20407	.28484	3RD.
					-.34867	.46223	.81534	
					-.03472	.86296	-.50406	
78-43	78-64	2.15622	1.51779	1.38362	.92862	.19375	.31644	4TH.
					-.36839	.37971	.84860	
					-.04426	.90459	-.42397	
78-43	78-69	1.82233	1.33480	1.25753	.93752	.20446	.28153	4TH.
					-.34632	.47036	.81169	
					-.03354	.85846	-.51176	
78-43	78-80	2.16473	1.62906	1.46457	.96917	.24231	-.04467	3RD.
					-.16355	.76825	.61890	
					-.18428	.59251	-.78420	
78-43	78-100	1.84382	1.30335	1.22446	.93857	.22310	.26328	2ND.
					-.33906	.45409	.82393	
					-.06427	.86257	-.50182	
78-44	78-45	2.40552	1.27267	.96236	.94747	.03507	-.31793	3RD.
					.01247	.98916	.14629	
					-.31961	.14256	-.93676	

78-44	78-46	1.44090	1.14987	1.00048	.89364	.05355	.44557	4TH.
					-.44874	.11884	.88572	
					-.00553	-.99147	.13030	
78-44	78-47A	1.71575	1.12047	1.07251	.96871	.23845	-.06886	3RD.
					-.22155	.95583	.19314	
					-.11187	.17184	-.97875	
78-44	78-48	3.22741	2.11972	1.88971	.98269	.15418	-.10273	5TH.
					-.07380	.83435	.54626	
					-.16994	.52923	-.83129	
78-44	78-49	2.63173	1.92411	1.82567	.94809	.15066	.28005	5TH.
					-.31517	.56252	.76436	
					.04237	.81294	-.58079	
78-44	78-52	2.09827	1.47018	1.38189	.95496	.25948	.14394	4TH.
					-.29019	.71542	.63559	
					-.06194	.64873	-.75849	
78-44	78-54	2.35972	1.71082	1.61321	.97786	.20877	-.01447	5TH.
					-.17633	.85922	.48026	
					-.11270	.46707	-.87701	
78-44	78-55	2.11455	1.48901	1.40962	.95147	.26026	.16424	4TH.
					-.30227	.69004	.65763	
					-.05782	.67535	-.73522	
78-44	78-64	2.41885	1.66328	1.54597	.94145	.23687	.23993	4TH.
					-.33198	.52711	.78227	
					-.05883	.81612	-.57488	
78-44	78-69	2.12795	1.50511	1.42492	.95199	.25875	.16359	4TH.
					-.30079	.69135	.65693	
					-.05689	.67459	-.73599	

3-44	78-80	2.43004	1.77890	1.59851	.97201	.23146	-.04024	3RD.
					-.16879	.80718	.56565	
					-.16341	.54303	-.82366	
3-44	78-100	2.14705	1.47730	1.39479	.95143	.26900	.14972	3RD.
					-.29818	.68419	.66556	
					-.07660	.67788	-.73117	
8-45	78-46	2.50885	1.53690	1.46884	.91440	.40475	.00694	4TH.
					-.02211	.03281	.99922	
					-.40421	.91384	-.03895	
8-45	78-47A	2.49221	1.20476	1.08721	.90276	.24920	-.35059	5TH.
					.06849	.72140	.68913	
					-.42465	.64613	-.63418	
8-45	78-48	3.71134	2.18847	1.94125	.95196	.18973	-.24036	4TH.
					.02012	.74448	.66735	
					-.30555	.64012	-.70490	
8-45	78-49	3.11834	2.05388	1.96730	.95535	-.28096	.09148	4TH.
					-.05649	.13024	.98987	
					-.29003	-.95084	.10856	
8-45	78-52	2.75867	1.57239	1.49754	.92656	.28611	-.24420	3RD.
					.00553	.63876	.76938	
					-.37611	.71423	-.59027	
8-45	78-54	2.98698	1.79488	1.67495	.93029	.23493	-.28173	4TH.
					.03357	.71027	.70313	
					-.36529	.66357	-.65287	
8-45	78-55	2.76745	1.59017	1.52959	.92640	.29552	-.23335	3RD.
					.00122	.61735	.78669	
					-.37654	.72907	-.57155	
8-45	78-64	2.97252	1.75854	1.71187	.93823	.34395	-.03785	3RD.
					-.06066	.27117	.96062	
					-.34066	.89898	-.27528	

78-45	78-69	2.77736	1.60538	1.54418	.92683	.29620	-.23077	3RD.
					.00111	.61243	.79053	
					-.37548	.73294	-.56728	
78-45	78-80	3.05025	1.86096	1.64595	.92748	.23049	-.29436	5TH.
					.02416	.74876	.66240	
					-.37308	.62148	-.68890	
78-45	78-100	2.79256	1.57870	1.51611	.92731	.28768	-.23944	3RD.
					-.00686	.65268	.75760	
					-.37423	.70089	-.60721	
78-46	78-47A	1.84606	1.32448	1.16332	.94751	.28542	.14409	3RD.
					-.30572	.94071	.14699	
					-.09360	-.18332	.97859	
78-46	78-48	3.29366	2.21584	1.98684	.98147	.14865	-.12090	5TH.
					-.09620	.92797	.36003	
					-.16571	.34173	-.92508	
78-46	78-49	2.72951	1.99877	1.93423	.93179	.29787	.20747	5TH.
					-.36047	.82666	.43210	
					.04280	.47740	-.87763	
78-46	78-52	2.21749	1.59559	1.49530	.93368	.35810	-.00100	3RD.
					-.35462	.92499	.13655	
					-.04982	.12714	-.99063	
78-46	78-54	2.45770	1.83982	1.70227	.96715	.24114	-.08051	5TH.
					-.23288	.96737	.09982	
					-.10195	.07780	-.99174	
78-46	78-55	2.23386	1.61145	1.52114	.92951	.36879	-.00233	3RD.
					-.36599	.92318	.11740	
					-.04545	.10827	-.99308	

78-46	78-64	2.52513	1.74364	1.67811	.92520	.35314	.13893	3RD.
					-.37629	.80626	.45646	
					-.04918	.47458	-.87883	
78-46	78-69	2.24645	1.62608	1.53577	.93020	.36706	.00099	3RD.
					-.36432	.92291	.12449	
					-.04478	.11616	-.99222	
78-46	78-80	2.52385	1.88772	1.70787	.96374	.25450	-.08020	3RD.
					-.21912	.92633	.30642	
					-.15228	.27774	-.94851	
78-46	78-100	2.26388	1.60006	1.50919	.93187	.36228	-.01943	3RD.
					-.35725	.92563	.12481	
					-.06320	.10936	-.99199	
78-47A	78-48	3.03814	1.97858	1.77133	.98145	.14737	-.12265	3RD.
					-.04745	.80650	.58933	
					-.18577	.57257	-.79853	
78-47A	78-49	2.38768	1.78545	1.69551	.94341	.05475	.32709	3RD.
					-.32337	.37080	.87061	
					.07362	.92710	-.36750	
78-47A	78-52	1.77938	1.27332	1.22007	.95404	.18847	.23302	2ND.
					-.29247	.41579	.86116	
					-.06542	.88972	-.45179	
78-47A	78-54	2.08521	1.53360	1.48321	.98095	.19107	-.03503	3RD.
					-.13776	.81140	.56802	
					-.13695	.55238	-.82227	
78-47A	78-55	1.79862	1.29899	1.24716	.94903	.16279	.26990	2ND.
					-.30966	.32202	.89467	
					-.05873	.93263	-.35599	
78-47A	78-64	2.14858	1.50330	1.39046	.93698	.17265	.30375	3RD.
					-.34432	.30885	.88660	
					-.05926	.93531	-.34882	

78-47A	78-69	1.81434	1.31699	1.26489	.94980	.16507	.26578	2ND.
					-.30756	.33687	.88991	
					-.05737	.92697	-.37069	
78-47A	78-80	2.16698	1.61120	1.46129	.97092	.22749	-.07455	5TH.
					-.13278	.77086	.62301	
					-.19920	.59500	-.77865	
78-47A	78-100	1.83682	1.28512	1.23067	.94915	.18907	.25173	2ND.
					-.30277	.32903	.89447	
					-.08629	.92520	-.36953	
78-48	78-49	2.87672	1.80642	1.56857	.98797	.15438	.00901	UNCL
					-.11621	.70273	.70190	
					-.10202	.69451	-.71222	
78-48	78-52	3.00721	2.00312	1.73799	.98513	.15722	-.06928	4TH.
					-.09108	.81983	.56532	
					-.14568	.55060	-.82196	
78-48	78-54	2.57909	1.48453	1.23991	.98056	.13790	-.13959	5TH.
					-.02383	.78983	.61287	
					-.19476	.59763	-.77776	
78-48	78-55	3.01851	2.01805	1.76360	.98466	.16128	-.06659	4TH.
					-.09629	.82053	.56344	
					-.14551	.54839	-.82347	
78-48	78-64	3.21864	2.14690	1.89989	.97989	.19796	-.02484	4TH.
					-.14329	.78491	.60281	
					-.13883	.58713	-.79750	
78-48	78-69	3.01850	2.03030	1.77522	.98468	.16101	-.06699	4TH.
					-.09604	.82133	.56231	
					-.14556	.54726	-.82421	

78-48	78-80	2.97197	1.98900	1.63369	.98478	.13480	-.10968	3RD.
					-.05520	.84108	.53809	
					-.16478	.52385	-.83572	
78-48	78-100	3.03719	2.01236	1.74973	.98328	.16839	-.06938	3RD.
					-.10111	.82161	.56101	
					-.15147	.54461	-.82490	
78-49	78-52	2.40096	1.76082	1.57434	.92241	.20912	.32470	4TH.
					-.36762	.73311	.57220	
					.11838	.64716	-.75310	
78-49	78-54	1.85945	1.27316	1.09642	.92913	.21171	.30315	5TH.
					-.35886	.71385	.60137	
					.08909	.66753	-.73923	
78-49	78-55	2.41692	1.77758	1.59811	.91740	.21018	.33794	3RD.
					-.37816	.72496	.57571	
					.12399	.65594	-.74455	
78-49	78-64	2.68544	1.92597	1.72265	.91826	.19856	.34260	4TH.
					-.38783	.62558	.67693	
					.07991	.75447	-.65145	
78-49	78-69	2.43269	1.79112	1.60818	.91731	.21299	.33643	4TH.
					-.37979	.72181	.57858	
					.11961	.65850	-.74301	
78-49	78-80	2.21253	1.65098	1.37955	.91951	.29999	.25400	3RD.
					-.38936	.78379	.48382	
					.05394	.54377	-.83750	
78-49	78-100	2.44596	1.76989	1.59242	.92015	.22042	.32363	3RD.
					-.37837	.71323	.59004	
					.10077	.66538	-.73967	
78-52	78-54	2.07145	1.56574	1.42716	.96920	.22433	.10161	4TH.
					-.24369	.81407	.52717	
					-.03554	.53569	-.84367	

78-52	78-55	1.12335	.85560	.69129	.86056	.03933	.50783	4TH.
					-.50462	.20132	.83955	
					.06922	.97874	-.19306	
78-52	78-64	1.70016	1.16706	.96587	.90566	.13854	.40072	UNCL
					-.42351	.25042	.87059	
					-.02026	.95817	-.28547	
78-52	78-69	1.15117	.87225	.70233	.87674	.03873	.47940	5TH.
					-.47603	.21222	.85344	
					.06869	.97645	-.20447	
78-52	78-80	2.14645	1.63863	1.43075	.96584	.25685	.03430	3RD.
					-.22888	.78354	.57765	
					-.12149	.56577	-.81556	
78-52	78-100	1.23031	.86049	.70383	.86650	.10316	.48840	2ND.
					-.49896	.20769	.84138	
					.01464	.97274	-.23142	
78-54	78-55	2.08818	1.60062	1.48237	.96494	.21070	.15652	4TH.
					-.26053	.69636	.66874	
					-.03191	.68607	-.72683	
78-54	78-64	2.39000	1.76423	1.61692	.95017	.22544	.21529	4TH.
					-.30789	.57071	.76125	
					-.04875	.78960	-.61168	
78-54	78-69	2.09850	1.61562	1.49890	.96526	.21360	.15050	4TH.
					-.25852	.69700	.66885	
					-.03797	.68452	-.72800	
78-54	78-80	1.84751	1.50864	1.28941	.98182	.18862	.02108	3RD.
					-.17053	.82800	.53417	
					-.08330	.52805	-.84512	

78-54	78-100	2.12064	1.59156	1.46785	.96329	.22920	.13976	3RD.
					-.26209	.69031	.67438	
					-.05809	.68625	-.72504	
78-55	78-64	1.69787	1.16841	.98207	.89801	.13139	.41990	5TH.
					-.43981	.24166	.86497	
					-.01218	.96142	-.27479	
78-55	78-69	1.17524	.88882	.74377	.84934	.06305	.52407	5TH.
					-.52287	.23650	.81896	
					.07231	.96958	-.23381	
78-55	78-80	2.16254	1.65116	1.44776	.96300	.26662	.03923	3RD.
					-.24371	.79950	.54900	
					-.11500	.53826	-.83490	
78-55	78-100	1.24107	.87031	.73284	.84797	.09624	.52123	3RD.
					-.52890	.21800	.82021	
					.03469	.97119	-.23574	
78-64	78-69	1.69556	1.10212	.97840	.89400	.23937	.37876	5TH.
					-.44771	.44398	.77617	
					-.01763	.86347	-.50409	
78-64	78-80	2.45033	1.77859	1.55334	.95030	.30319	.07079	3RD.
					-.29320	.79503	.53100	
					-.10472	.52536	-.84441	
78-64	78-100	1.74302	1.08883	.96143	.89773	.24009	.36938	3RD.
					-.44013	.45232	.77569	
					-.01915	.85893	-.51173	
78-69	78-80	2.17164	1.66493	1.46184	.96300	.26721	.03518	3RD.
					-.24204	.79998	.54904	
					-.11857	.53724	-.83505	
78-69	78-100	1.27141	.89065	.74698	.85509	.09268	.51013	2ND.
					-.51741	.21568	.82812	
					.03327	.97206	-.23236	

78-80	78-100	2.19607	1.65272	1.45758	.95950	.27763	.04775	2ND.
					-.24677	.74658	.61783	
					-.13588	.60460	-.78486	

TOTAL NUMBER OF RELATIVE ELLIPSOIDS = 171

CLASSIFICATION SUMMARY
FIRST = 5
SECOND = 34
THIRD = 72
FOURTH = 31
FIFTH = 27
UNCLASSIFIED = 2

START OF ERROR ELLIPSE CALCULATIONS = 717.0144 SECS.
END OF ERROR ELLIPSE CALCULATIONS = 722.1292 SECS.
TIME TO CALCULATE ERROR ELLIPSES = 5.1148 SECS.

@BRKPT PRINT$

GDLCNT F. (Final).

Horseshoe Fixed.

```
@ADD,P RUNS.GDL-CNI-A

@MSG,N RETURN TO KEAT  RM.744  NO DECK !!!!!!!!!!

@ASG,A CNI*GDG-CNI-C.
FACILITY WARNING  100000000000

@USE 2.,CNI*GDG-CNI-C.
READY

@XQT SURV*NEWGDLSAT.GDLSAT/TEST
```

DEPARTMENT OF ENERGY MINES AND RESOURCES
GEODETIC SURVEY OF CANADA
PROGRAM GDLSAT-UNIVAC 1110/40

NO.OF STATIONS	=	15
NO.FREE STATIONS	=	15
NO.CORR.STATIONS	=	15
SOLVE TRANSFORMATION PARAMETERS	=	0
NUMBER OF FILES TO BE READ IN	=	2
APPLY A COMMON BLOCK SHIFT	=	1
NUMBER OF SEMI-FIXED PTS. (X,Y,Z)	=	1
NUMBER OF HEIGHT OBSERVATIONS	=	0
NUMBER OF PLANIMETRIC PTS. (P,L)	=	0

REQUIRED CORE =160881 OR 472161 IN OCTAL

PARAMETERS CHOSEN FROM CONTROL CARD

COL 25 SOLVE TRANSFORMATION PARAMETERS	NO
COL 30 SUPRESS NORMALS	YES
COL 35 SUPRESS COVARIENCE MATRIX	YES
COL 40 SUPRESS INTERSTATION LENGTHS	YES
COL 45 ARBITRARY ORIGIN SHIFT	NO
COL 50 COMPUTE LATS AND LONGS	YES
COL 55 PUNCH COORDINATES AND COV MATRIX	NO
COL 60 PRINT SEALEVEL INTERSTATION DIST	NO
COL 65 PRINT INPUT FILE 9 MATRICES	NO
COL 70 ADD VARIABLE BLOCK CONSTANTS	NO
COL 75 PRT. INV. OF SCALED INPUT FILES	NO
SOLVE BLOCK SHIFT UNKNOWNS	YES

GEODETIC SURVEY OF CANADA -- PROGRAM GDLSAT DATE=071178

CNI ADJUSTMENT ;;;; 15 STATIONS;;;;;;;

INITIAL VALUES: DOX= .00000 DOY= .00000 DOZ= .00000
SCALE PPM. = .00000 KAPPA SEC = .00000 PHI SEC = .00000 OMEGA SEC = .00000

INPUT DATA

10	.0000	.0000	.0000	
21HORSE	.0000	.0000	.0000	
21PACK	.0000	.0000	.0000	
21PRIDD	.0000	.0000	.0000	
21NOR	.0000	.0000	.0000	
21CENTRE	.0000	.0000	.0000	
2178-01	.0000	.0000	.0000	
2178-21	.0000	.0000	.0000	
2178-25	.0000	.0000	.0000	
2178-28	.0000	.0000	.0000	
2178-29	.0000	.0000	.0000	
2178-32	.0000	.0000	.0000	
2178-34	.0000	.0000	.0000	
2178-47	.0000	.0000	.0000	
2178-60	.0000	.0000	.0000	
2178-62	.0000	.0000	.0000	
40	.0000	.0000	.0000	
50	.0000	.0000	.0000	

KK= 1 MAT= 2

65	.0000	.0000	.0000	5.0000

IATPMX= 1407 IAMAX= 75 KK= 1
POSITION EQUATIONS FROM FILE

SIGMA NAUGHT SQUARED FROM CONTINUATION FILE = .75063

60	.0000	.0000	.0000	.0000
61PACK	-1730951.5310	-3794045.4284	4812863.4983	
61HORSE	-1722535.6980	-3737683.7344	4858931.7459	
6178-01	-1727653.6441	-3714339.0520	4873989.7214	
6178-21	-1735329.5777	-3741009.1000	4850736.5315	
6178-25	-1725566.8689	-3755840.5853	4843824.2298	
6178-28	-1746750.7751	-3767534.7587	4827024.7893	
6178-29	-1744359.9078	-3802562.5697	4800331.4316	
6178-32	-1765621.0393	-3756269.0974	4828406.0984	
6178-34	-1755418.8264	-3796153.9393	4801789.3636	
6178-47	-1769220.1404	-3773095.9017	4813622.8502	
6178-60	-1714519.4588	-3721599.5819	4874396.1051	
6178-62	-1726627.7825	-3784436.0755	4820798.8098	

ARBITRARY SCALING FACTOR = 1.00000

```
62                              .0000          .0000          .0000
        WEIGHT COEFFICIENT MATRIX WITH POSITION VARIENCE OF      .00000 ADDED

INPUT FILE =     1     SIZE = ( 36 X  36 )
CALL DSINV AT        221.8288 SEC.      RETURNED AT         221.8288 SEC.      DIFFERENCE =       .0000 SEC.


KK=     2          MAT=     2
65                              .0000          .0000          .0000          5.0000

IATPMX=  273     IAMAX=   33     KK=    2
        POSITION EQUATIONS FROM FILE

          SIGMA NAUGHT SQUARED FROM CONTINUATION FILE =     .79082

60                              .0000          .0000          .0000          .0000
61PACK                -1730952.6277  -3794046.6953   4812865.4545
61HORSE               -1722537.4619  -3737684.0650   4858933.2425
61PRIDD               -1659631.2189  -3676879.4339   4925309.8440
61NOR                 -1735270.3397  -3726219.0491   4863693.1302
61CENTRE              -1731961.3000  -3781776.9276   4822337.2021
          ARBITRARY SCALING FACTOR =     1.00000
62                              .0000          .0000          .0000
        WEIGHT COEFFICIENT MATRIX WITH POSITION VARIENCE OF      .00000 ADDED

INPUT FILE =     2     SIZE = ( 15 X  15 )
CALL DSINV AT        225.3260 SEC.      RETURNED AT         225.3260 SEC.      DIFFERENCE =       .0000 SEC.

71HORSE               -1722534.2020  -3737695.1170   4858914.7680          .0001
99                              .0000          .0000          .0000          .0000

 INVERSE OF NORMALS ::: SIZE (   51 ,   51 )
DSINV CALLED AT        225.3260 SEC.  RETURNED AT         227.3308 SEC.      DIFFERENCE =      2.0048 SEC.


          SOLUTION
              .149597+001    -.113826+002    -.169779+002     .164041+001    -.115481+002    -.168964+002

              .257385+001    -.106010+002    -.185723+002     .301478+001    -.106898+002    -.186097+002

              .303922+001    -.107071+002    -.186037+002     .156010+001    -.114510+002    -.169447+002

              .155459+001    -.114508+002    -.169458+002     .155131+001    -.114517+002    -.169412+002

              .156357+001    -.114519+002    -.169466+002     .157972+001    -.114619+002    -.169415+002

              .155909+001    -.114477+002    -.169464+002     .156641+001    -.114608+002    -.169361+002

              .156718+001    -.114732+002    -.169262+002     .154902+001    -.114491+002    -.169387+002
```

.156613+001 -.114585+002 -.169409+002 .157208+001 -.112160+002 -.167497+002

.366564+001 -.825072+001 -.164703+002

RESIDUALS

60		.0000	.0000	.0000	.0000	
	STATION	X COORD	RESID	Y COORD	RESID	Z COORD	RESID
	PACK	-1730951.531	.068	-3794045.428	-.332	4812863.498	-.147
	HORSE	-1722535.698	-.076	-3737683.734	-.167	4858931.746	-.228
	78-01	-1727653.644	-.012	-3714339.052	-.235	4873989.721	-.195
	78-21	-1735329.578	-.017	-3741009.100	-.235	4850736.531	-.196
	78-25	-1725566.869	-.021	-3755840.585	-.236	4843824.230	-.192
	78-28	-1746750.775	-.009	-3767534.759	-.236	4827024.789	-.197
	78-29	-1744359.908	.008	-3802562.570	-.246	4800331.432	-.192
	78-32	-1765621.039	-.013	-3756269.097	-.232	4828406.098	-.197
	78-34	-1755418.826	-.006	-3796153.939	-.245	4801789.364	-.186
	78-47	-1769220.140	-.005	-3773095.902	-.257	4813622.850	-.176
	78-60	-1714519.459	-.023	-3721599.582	-.233	4874396.105	-.189
	78-62	-1726627.783	-.006	-3784436.075	-.242	4820798.810	-.191
	BLKSFT	.000	1.572	.000	-11.216	.000	-16.750
60		.0000	.0000	.0000	.0000	
	STATION	X COORD	RESID	Y COORD	RESID	Z COORD	RESID
	PACK	-1730952.628	-.929	-3794046.695	-2.031	4812865.455	-2.382
	HORSE	-1722537.462	-.406	-3737684.065	-2.801	4858933.243	-2.004
	PRIDD	-1659631.219	-1.092	-3676879.434	-2.350	4925309.844	-2.102
	NOR	-1735270.340	-.651	-3726219.049	-2.439	4863693.130	-2.139
	CENTRE	-1731961.300	-.626	-3781776.928	-2.456	4822337.202	-2.133
	BLKSFT	.000	3.666	.000	-8.251	.000	-16.470
71	HORSE	-1722534.2020	-3737695.1170	4858914.7680	.0001		

S.D. OF UNIT WT.= 2.129 DEGREES OF FREEDOM= 9.

ADJUSTED COORDS. AND S.D.

	X(COORD)	S.D.	Y(COORD)	S.D.	Z(COORD)	S.D.
HORSE	-1722534.2020	.0001	-3737695.1170	.0001	4858914.7680	.0001
PACK	-1730949.8906	.1807	-3794056.9766	.1525	4812846.6020	.1254
PRIDD	-1659628.6451	3.6541	-3676890.0349	.8062	4925291.2718	1.7305
NOR	-1735267.3250	.4213	-3726229.7389	.3152	4863674.5205	.2723
CENTRE	-1731958.2608	.5267	-3781787.6347	.2970	4822318.5984	.3026
78-01	-1727652.0840	.3694	-3714350.5030	.2925	4873972.7767	.2256
78-21	-1735328.0231	.3413	-3741020.5508	.2585	4850719.5857	.2035
78-25	-1725565.3176	.2854	-3755852.0370	.2508	4843807.2886	.1935
78-28	-1746749.2116	.2492	-3767546.2107	.2110	4827007.8426	.1605
78-29	-1744358.3281	.2902	-3802574.0316	.2049	4800314.4901	.1645
78-32	-1765619.4802	.3939	-3756280.5451	.2819	4828389.1520	.2300
78-34	-1755417.2600	.2830	-3796165.4001	.2262	4801772.4275	.1849
78-47	-1769218.5733	.3411	-3773107.3749	.3357	4813605.9240	.2495
78-60	-1714517.9098	.3829	-3721611.0310	.3788	4874379.1663	.2612
78-62	-1726626.2164	.3119	-3784447.5340	.2514	4820781.8689	.2107

ADJUSTED BLOCK SHIFT COMPONENTS AND S.D.

FILE NO.	X-SHIFT	S.D.	Y-SHIFT	S.D.	Z-SHIFT	S.D.
1	1.572	.369	-11.216	.293	-16.750	.226
2	3.666	.341	-8.251	.259	-16.470	.203

LATITUDES, LONGITUDES AND HEIGHTS				STANDARD DEVIATIONS (METRES)		
A= 6378206.400 B= 6356583.800				LAT	LONG	HT
HORSE	49 55 37.30003	114 44 34.19987	2027.200	.000	.000	.000
PACK	49 17 2.34954	114 31 25.44729	2416.013	.133	.192	.131
PRIDD	50 52 16.25500	114 17 34.32949	1265.765	.904	3.254	2.364
NOR	49 59 21.48344	114 58 15.30135	2421.707	.292	.408	.315
CENTRE	49 24 45.65001	114 36 23.47711	2605.842	.309	.490	.348
78-01	50 8 42.29162	114 56 40.21381	1342.731	.245	.405	.222
78-21	49 49 18.87180	114 53 5.74500	1166.412	.220	.368	.202
78-25	49 43 2.82986	114 40 32.33473	1943.436	.203	.316	.203
78-28	49 29 10.10964	114 52 25.95312	1784.339	.172	.273	.167
78-29	49 7 10.99707	114 38 32.59644	1634.288	.181	.306	.165
78-32	49 30 33.90970	115 10 32.22732	1389.050	.261	.419	.210
78-34	49 8 11.10307	114 49 .10675	1955.051	.207	.296	.187
78-47	49 18 30.70489	115 7 19.15229	1068.875	.251	.395	.268
78-60	50 8 24.10818	114 44 6.59280	2341.320	.295	.453	.256
78-62	49 24 8.32042	114 31 28.17255	1570.635	.242	.321	.208

ERROR ELLIPSOIDS

STATION FROM	RELATIVE TO	SEMI AXIS 95% CONFIDENCE			ORIENTATION OF THE AXIS W.R.T. X,Y,Z SYSTEM			ORDER
HORSE	PACK	.53972	.42573	.38491	.86715	-.07765	.49190	1ST.
					-.48753	.06951	.87038	
					.10178	.99455	-.02177	

ARGUMENT UNNORMALIZED OR OUTSIDE ALLOWABLE RANGE CAUSING

ERROR TERMINATION IN DSQRT ROUTINE

DSQRT CALLED AT SEQUENCE NUMBER 000307 OF ELLIPS

ELLIPS CALLED AT SEQUENCE NUMBER 001517 OF INP
INP CALLED AT SEQUENCE NUMBER 000215 OF MAIN PROGRAM
ER EABT$ ABORT ADR: 013460 BDI:000004
PROGRAM INITIATED INTERUPT: EABT$.

X		000000 315534	000000 316017	000000 314764	000000 315540	000000 315250	000000 315254	000000 314770			
	000001 316021	000002 000006	000000 057005	000231 032210	577621 061171	150556 544600	000000 000000	400000 001770			
A	577621 061171	150556 544600	000000 000000	400000 001770	777721 061171	150556 544600	000000 315252	571605 401054			
	000000 315536	672314 731624	000000 315534	000000 000740	000000 315246	000000 000000	000000 000003	000000 000001			
	000000 000000	000000 000000									
R		000000 052544	577621 061171	150556 544600	000000 000000	000000 000000	000000 000000	000000 000000			
	000000 000000	000000 000000	000000 000000	000000 000000	000000 000000	000000 000000	000000 000014	000000 000015			

ER EABT$ ABORT ADR: 013466 BDI:000004
PROGRAM INITIATED INTERUPT: EABT$.

X		000000 315534	000000 316017	000000 314764	000000 315540	000000 315250	000000 315254	000000 314770			
	000001 316021	000002 000006	000000 057005	000231 032210	000000 000000	150556 544600	000000 000000	400000 001770			
A	000000 000000	150556 544600	000000 000000	400000 001770	777721 061171	150556 544600	000000 315252	571605 401054			
	000000 315536	672314 731624	000000 315534	000000 000740	000000 315246	000000 000000	000000 000003	000000 000001			
	000000 000000	000000 000000									
R		000000 052544	577621 061171	150556 544600	000000 000000	000000 000000	000000 000000	000000 000000			
	000000 000000	000000 000000	000000 000000	000000 000000	000000 000000	000000 000000	000000 000014	000000 000015			

@BRKPT PRINT$

```
@ADD,P RUNS.GDL-CNI-3

@MSG,N RETURN TO CRAGO  RM 744  NO DECK !!!!!!!!!!

@ASG,A CNI*GDG-CNI-3B.
FACILITY WARNING  100000000000

@USE 2.,CNI*GDG-CNI-3B.
READY

@XQT SURV*NEWGDLSAT.GDLSAT/TEST
```

DEPARTMENT OF ENERGY MINES AND RESOURCES
GEODETIC SURVEY OF CANADA
PROGRAM GDLSAT-UNIVAC 1110/40

NO.OF STATIONS	=	6
NO.FREE STATIONS	=	6
NO.CORR.STATIONS	=	6
SOLVE TRANSFORMATION PARAMETERS	=	0
NUMBER OF FILES TO BE READ IN	=	1
APPLY A COMMON BLOCK SHIFT	=	1
NUMBER OF SEMI-FIXED PTS. (X,Y,Z)	=	2
NUMBER OF HEIGHT OBSERVATIONS	=	0
NUMBER OF PLANIMETRIC PTS. (P,L)	=	0

REQUIRED CORE =160881 OR 472161 IN OCTAL

PARAMETERS CHOSEN FROM CONTROL CARD

COL 25 SOLVE TRANSFORMATION PARAMETERS	NO
COL 30 SUPRESS NORMALS	YES
COL 35 SUPRESS COVARIENCE MATRIX	YES
COL 40 SUPRESS INTERSTATION LENGTHS	YES
COL 45 ARBITRARY ORIGIN SHIFT	NO
COL 50 COMPUTE LATS AND LONGS	YES
COL 55 PUNCH COORDINATES AND COV MATRIX	NO
COL 60 PRINT SEALEVEL INTERSTATION DIST	NO
COL 65 PRINT INPUT FILE 9 MATRICES	NO
COL 70 ADD VARIABLE BLOCK CONSTANTS	NO
COL 75 PRT. INV. OF SCALED INPUT FILES	NO
SOLVE BLOCK SHIFT UNKNOWNS	YES

GEODETIC SURVEY OF CANADA -- PROGRAM GDLSAT DATE=092778

CNI ADJUSTMENT :::: 6 STATIONS ; LINE CREEK;;;;;;;

INITIAL VALUES: DOX= .00000 DOY= .00000 DOZ= .00000
SCALE PPM. = .00000 KAPPA SEC = .00000 PHI SEC = .00000 OMEGA SEC = .00000

INPUT DATA

10	.0000	.0000	.0000	
21HORSE	.0000	.0000	.0000	
21NOR	.0000	.0000	.0000	
2178-08	.0000	.0000	.0000	
2178-09	.0000	.0000	.0000	
2178-12	.0000	.0000	.0000	
2178-13	.0000	.0000	.0000	
40	.0000	.0000	.0000	
50	.0000	.0000	.0000	

KK= 1 MAT= 1

65	.0000	.0000	.0000	5.0000

IATPMX= 381 IAMAX= 39 KK= 1
POSITION EQUATIONS FROM FILE

SIGMA NAUGHT SQUARED FROM CONTINUATION FILE = .70569

60	.0000	.0000	.0000	.0000
61NOR	-1735270.4217	-3726217.7305	4863692.6737	
61HORSE	-1722536.8166	-3737682.7060	4858931.0621	
6178-08	-1733277.2151	-3735609.8402	4855687.4097	
6178-09	-1731416.7344	-3738948.2004	4853883.2672	
6178-12	-1722851.8611	-3737720.2999	4858667.8435	
6178-13	-1729550.5348	-3737253.4887	4855813.1144	

ARBITRARY SCALING FACTOR = 1.00000

62	.0000	.0000	.0000

WEIGHT COEFFICIENT MATRIX WITH POSITION VARIENCE OF .00000 ADDED

INPUT FILE = 1 SIZE = (18 X 18)
CALL DSINV AT 230.7030 SEC. RETURNED AT 230.7030 SEC. DIFFERENCE = .0000 SEC.

71HORSE	-1722534.2020	-3737695.1170	4858914.7680	.0001
71NOR	-1735267.3250	-3726229.7389	4863674.5205	.0001
99	.0000	.0000	.0000	.0000

INVERSE OF NORMALS ::: SIZE (21 , 21)
DSINV CALLED AT 230.7030 SEC. RETURNED AT 230.7030 SEC. DIFFERENCE = .0000 SEC.

SOLUTION

.261463+001	-.124110+002	-.162941+002	.309669+001	-.120084+002	-.181532+002
.277598+001	-.121863+002	-.173050+002	.273968+001	-.121506+002	-.173098+002
.280319+001	-.122734+002	-.172877+002	.284276+001	-.122868+002	-.172432+002
.326508+001	-.105134+002	-.159113+002			

RESIDUALS

60		.0000		.0000		.0000		.0000	
	STATION	X COORD	RESID	Y COORD	RESID	Z COORD	RESID		
	NOR	-1735270.422	-.168	-3726217.730	-1.495	4863692.674	-2.242		
	HORSE	-1722536.817	-.650	-3737682.706	-1.898	4858931.062	-.383		
	78-08	-1733277.215	-.489	-3735609.840	-1.673	4855687.410	-1.394		
	78-09	-1731416.734	-.525	-3736948.200	-1.637	4853883.267	-1.399		
	78-12	-1722851.861	-.462	-3737720.300	-1.760	4858667.844	-1.376		
	78-13	-1729550.535	-.422	-3737253.489	-1.773	4855813.114	-1.332		
	BLKSFT	.000	3.265	.000	-10.513	.000	-15.911		
71HORSE		-1722534.2020		-3737695.1170		4858914.7680		.0001	

S.D. OF UNIT WT.= 3.089 DEGREES OF FREEDOM= 6.

ADJUSTED COORDS. AND S.D.

	X(COORD)	S.D.	Y(COORD)	S.D.	Z(COORD)	S.D.
HORSE	-1722534.2020	.0001	-3737695.1170	.0001	4858914.7680	.0001
NOR	-1735267.3250	.0001	-3726229.7389	.0001	4863674.5205	.0001
78-08	-1733274.4391	.3382	-3735622.0265	.2656	4855670.1047	.2139
78-09	-1731413.9947	.3074	-3738960.3511	.2608	4853865.9574	.2026
78-12	-1722849.0579	.6741	-3737732.5733	.6954	4858650.5559	.5532
78-13	-1729547.6920	.3748	-3737265.7754	.3517	4855795.8712	.2527

ADJUSTED BLOCK SHIFT COMPONENTS AND S.D.

FILE NO.	X-SHIFT	S.D.	Y-SHIFT	S.D.	Z-SHIFT	S.D.
1	3.265	.338	-10.513	.266	-15.911	.214

LATITUDES, LONGITUDES AND HEIGHTS

A= 6378206.400   B= 6356583.800

STANDARD DEVIATIONS (METRES)

				LAT	LONG	HT
HORSE	49 55 37.30003	114 44 34.19987	2027.200	.000	.000	.000
NOR	49 59 21.48345	114 58 15.30135	2421.707	.000	.000	.000
78-08	49 53 24.67532	114 53 26.21877	1236.277	.233	.355	.225
78-09	49 51 51.46747	114 50 51.40008	1304.324	.219	.333	.212
78-12	49 55 27.69119	114 44 47.74511	1931.766	.498	.801	.595
78-13	49 53 29.16487	114 50 2.24070	1283.850	.276	.424	.268

ERROR ELLIPSOIDS

STATION FROM	RELATIVE TO	SEMI AXIS (95% CONFIDENCE)			ORIENTATION OF THE AXIS W.R.T. X,Y,Z SYSTEM			ORDER
HORSE	NOR	.00040	.00040	.00040	.23570 .23570 .94281	.41591 .85234 -.31706	.41591 .85234 -.31706	1ST.
HORSE	78-08	.99307	.74383	.68039	.91028 -.41399 -.00332	.02953 .05693 .99794	.41295 .90851 -.06396	3RD.
HORSE	78-09	.93742	.72829	.63093	.84385 -.52721 .09987	-.04909 .10950 .99277	.53433 .84267 -.06640	3RD.
HORSE	78-12	2.49805	1.76495	1.33780	.61212 -.63870 .46624	-.28200 .37452 .88329	.73877 .67216 -.04913	UNCL
HORSE	78-13	1.24050	.95856	.76347	.73233 -.60608 .31042	-.12721 .32607 .93675	.66896 .72551 -.16163	4TH.
NOR	78-08	.99307	.74383	.68039	.91028 -.41399 -.00332	.02953 .05693 .99794	.41295 .90851 -.06396	3RD.
NOR	78-09	.93742	.72829	.63093	.84385 -.52721 .09987	-.04909 .10950 .99277	.53433 .84267 -.06640	3RD.
NOR	78-12	2.49805	1.76495	1.33780	.61212 -.63870 .46624	-.28200 .37452 .88329	.73877 .67216 -.04913	4TH.

NOR	78-13	1.24050	.95856	.76347	.73233 -.60608 .31042	-.12721 .32607 .93675	.66896 .72551 -.16163	3RD.
78-08	78-09	.99192	.73848	.62824	.89515 -.44102 .06480	-.01864 .10822 .99395	.44536 .89095 -.08860	4TH.
78-08	78-12	2.53602	1.75598	1.31265	.61898 -.64199 .45245	-.26763 .36919 .88999	.73840 .67198 -.05670	4TH.
78-08	78-13	1.28667	.97076	.77699	.78647 -.56148 .25731	-.13716 .24743 .95915	.60220 .78964 -.11755	5TH.
78-09	78-12	2.52284	1.73423	1.27466	.60615 -.64821 .46088	-.26447 .38222 .88541	.75009 .65859 -.06024	4TH.
78-09	78-13	1.24864	.93127	.70753	.72713 -.60593 .32269	-.15364 .31450 .93674	.66908 .73072 -.13555	5TH.
78-12	78-13	2.58053	1.53687	1.31917	.63711 -.67703 .36842	-.08582 .41271 .90681	.76598 .60936 -.20483	5TH.

TOTAL NUMBER OF RELATIVE ELLIPSOIDS = 15

CLASSIFICATION SUMMARY
FIRST = 1
SECOND = 0
THIRD = 5
FOURTH = 5
FIFTH = 3
UNCLASSIFIED = 1

START OF ERROR ELLIPSE CALCULATIONS = 231.8694 SECS.
END OF ERROR ELLIPSE CALCULATIONS = 232.7046 SECS.

TIME TO CALCULATE ERROR ELLIPSES = .8352 SECS.

@BRKPT PRINT$

"APPENDIX "B"

GEM 10B

PRINTOUT

APPENDIX B - GEM 10B PRINTOUT

A = 6378206.4 F =.33901-02 XNO =-30.00 DX = 15.0 DY = -165.0 DZ = -175.0 GEM10B

	244.50 115.50	244.60 115.40	244.70 115.30	244.80 115.20	244.90 115.10	245.00 115.00	245.10 114.90	245.20 114.80	245.30 114.70	245.40 114.60	245.50 114.50	245.60 114.40
50.50	5.7	5.8	5.9	6.0	6.0	6.1	6.2	6.2	6.3	6.4	6.4	6.5
50.40	5.7	5.8	5.9	6.0	6.0	6.1	6.2	6.2	6.3	6.4	6.4	6.5
50.30	5.7	5.8	5.9	6.0	6.0	6.1	6.2	6.3	6.3	6.4	6.5	6.5
50.20	5.8	5.8	5.9	6.0	6.1	6.1	6.2	6.3	6.4	6.4	6.5	6.6
50.10	5.8	5.8	5.9	6.0	6.1	6.2	6.2	6.3	6.4	6.5	6.5	6.6
50.00	5.8	5.8	5.9	6.0	6.1	6.2	6.3	6.3	6.4	6.5	6.6	6.6
49.90	5.8	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.4	6.5	6.6	6.7
49.80	5.8	5.9	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.5	6.6	6.7
49.70	5.8	5.9	6.0	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.7
49.60	5.8	5.9	6.0	6.1	6.2	6.2	6.3	6.4	6.5	6.6	6.7	6.8
49.50	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.5	6.6	6.7	6.8
49.40	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.8
49.30	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9
49.20	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9
49.10	5.8	5.9	6.0	6.1	6.2	6.4	6.5	6.6	6.7	6.8	6.9	7.0
49.00	5.8	5.9	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7.0

"APPENDIX C"

STATION DESCRIPTIONS

MONUMENT RECORD

TOPOGRAPHICAL SURVEY
SURVEYS AND MAPPING BRANCH
DEPARTMENT OF MINES AND TECHNICAL SURVEYS

FILE CODE 49-114-SW

MONUMENT - Centre

537036

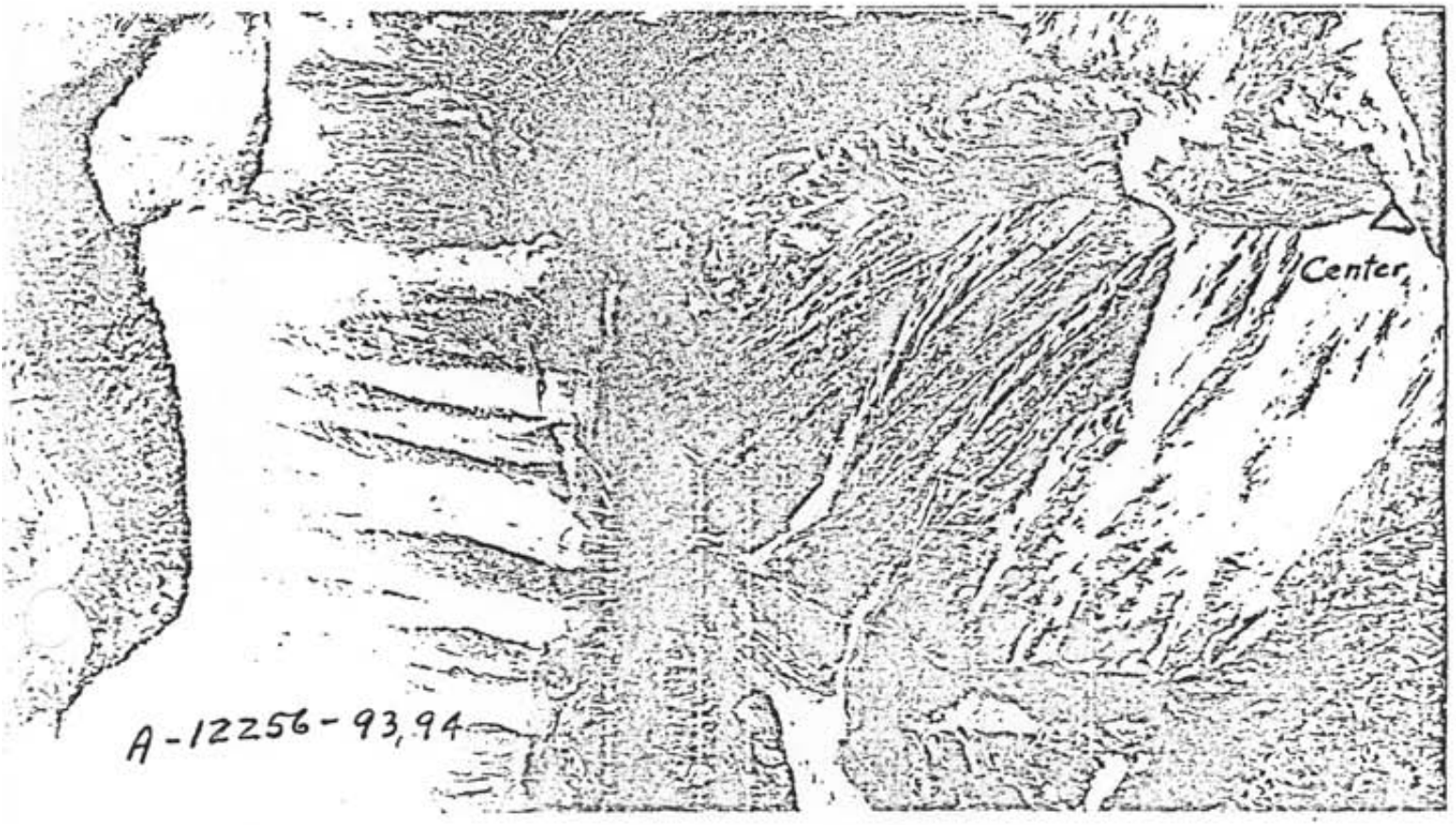
Castle-Flathead

SHEET	82-G-7				
PROVINCE	B.C.	DATE	Sept., 1961		
FIELD OFFICER	A.B. Grant	LATITUDE	49 24 45.86		
TYPE OF SURVEY	Triang.	LONGITUDE	114 36 23.43		
SOURCE	Topographic	DATUM	N.A. 1927		
MONUMENT TYPE	Cairn	UTM NORTHINGS	5,475,875.25		
DATE PLANTED	1953	UTM EASTINGS	673,612.91		
FIELD BOOK NO.	53452	ZONE	11		
AIR PHOTO NO.	A-12256-93-94	ELEVATIONS	8533'.0		
THEODOLITE		LEVELLING METHOD			

1 : 500,000	
1 : 250,000	✓

(FOR ADDITIONAL INFORMATION TURN OVER)

✓



MONUMENT RECORD

SURVEYS AND MAPPING BRANCH
DEPARTMENT OF ENERGY, MINES AND RESOURCES

FILE CODE 49-114 SW 3

#12701

MONUMENT Packhorse

MAP SHEET	82-G-7				
PROVINCE	B.C.	DATE			
FIELD OFFICER		LATITUDE	49 17 02.593		
TYPE OF SURVEY	Triangulation	LONGITUDE	114 31 25.423		
SOURCE	Geodetic	DATUM	N.A. 1927		
MONUMENT TYPE	Brass Plate	UTM NORTHINGS	5,461,764.93		
DATE PLANTED	1915	UTM EASTINGS	680,086.04		
FIELD BOOK NO.		ZONE	11		
AIR PHOTO NO.	A-11647-62,63	ELEVATIONS	7910.0'		
THEODOLITE		LEVELLING METHOD	(Trig)		

1 : 500,000	
1 : 250,000	✓

(FOR ADDITIONAL INFORMATION TURN OVER)

MONUMENT RECORD

SURVEYS AND MAPPING BRANCH

DEPARTMENT OF ENERGY, MINES AND RESOURCES

FILE CODE 49-114 NW

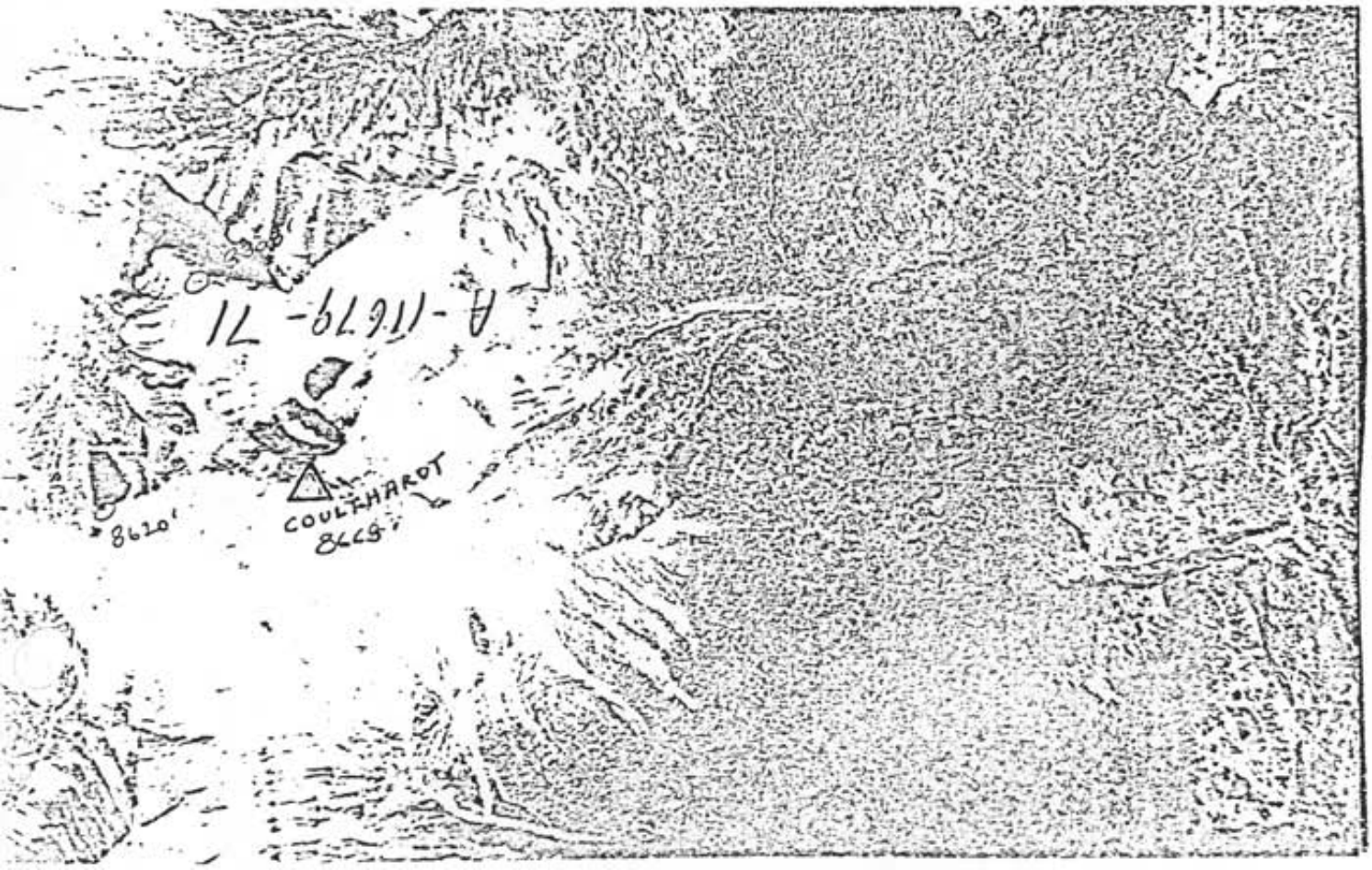
12605

MONUMENT Coulthard

MAP SHEET	82-G-10				
PROVINCE	Alberta	DATE			
FIELD OFFICER		LATITUDE	49 33 28.594		
TYPE OF SURVEY	Triangulation	LONGITUDE	114 33 47.052		
SOURCE	Geodetic	DATUM	N.A. 1927		
MONUMENT TYPE	Brass Plate	UTM NORTHINGS	5,492,116.90		
DATE PLANTED	1912 - 1915	UTM EASTINGS	676,241.13		
FIELD BOOK NO.		ZONE	11		
AIR PHOTO NO.		ELEVATIONS	8665.0'		
THEODOLITE		LEVELLING METHOD	(Trig)		

1 : 500,000	
1 : 250,000	✓

(FOR ADDITIONAL INFORMATION TURN OVER)



MONUMENT RECORD — FILE CODE [illegible]

TOPOGRAPHICAL SURVEY
SURVEYS AND MAPPING BRANCH
DEPARTMENT OF MINES AND TECHNICAL SURVEYS

15757
CAT MOUNTAIN NET

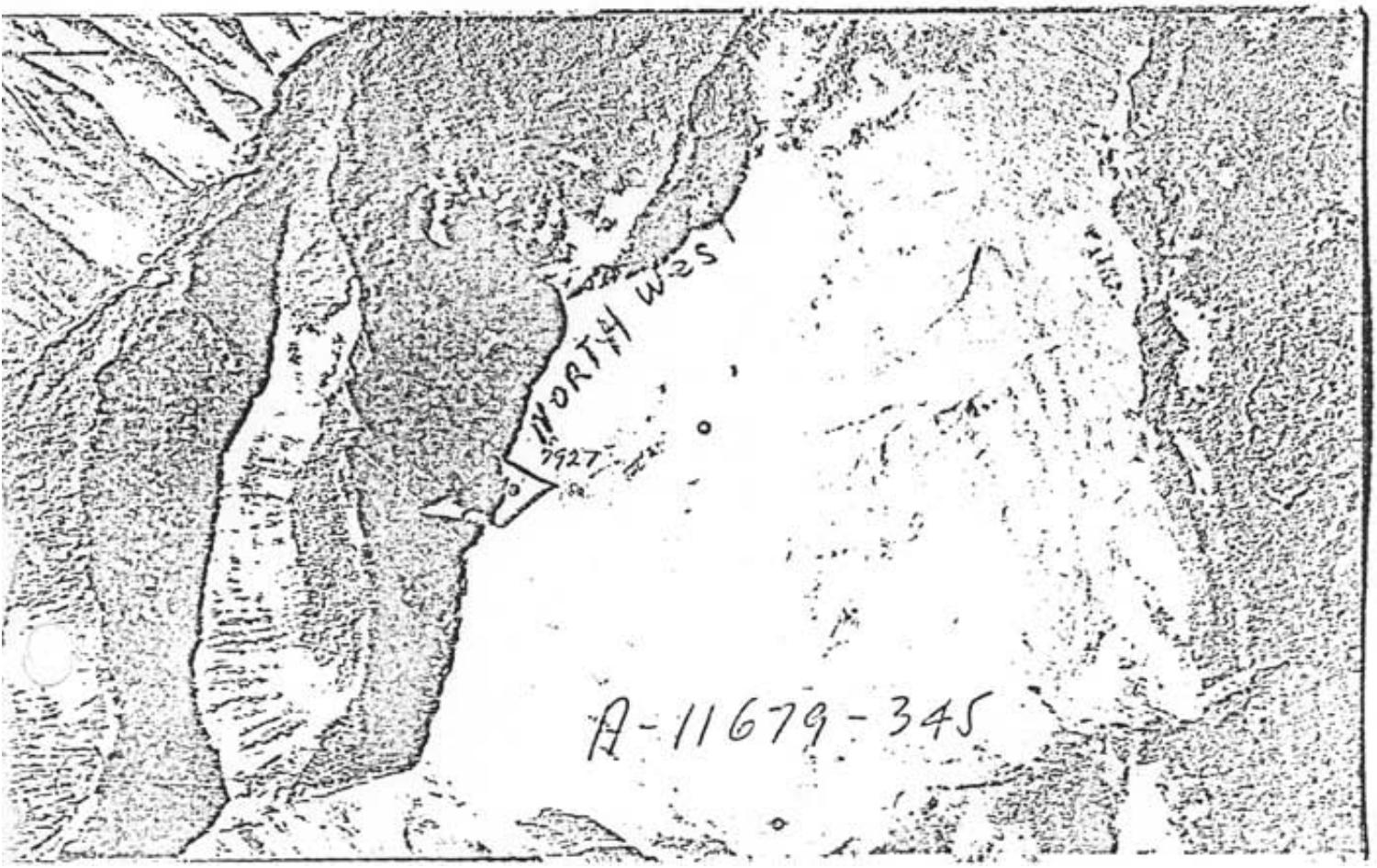
MONUMENT Northwest

MAP SHEET	82-G-15				
PROVINCE	ALTA. B.C.	DATE	June 1961		
FIELD OFFICER		LATITUDE	49 59 21.480		
TYPE OF SURVEY	Triang.	LONGITUDE	114 58 15.240		
SOURCE	Geodetic	DATUM	N.A. 1927		
MONUMENT TYPE	Brass Plate	UTM NORTHINGS	5,539,195.15		
DATE PLANTED	1915	UTM EASTINGS	645,451.46		
FIELD BOOK NO.		ZONE	11		
AIR PHOTO NO.		ELEVATIONS	7927'.0		
THEODOLITE		LEVELLING METHOD			

1 : 500.000	
1 : 250.000	✓

Note: For description see Publication 72 page 75

(FOR ADDITIONAL INFORMATION TURN OVER)



MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

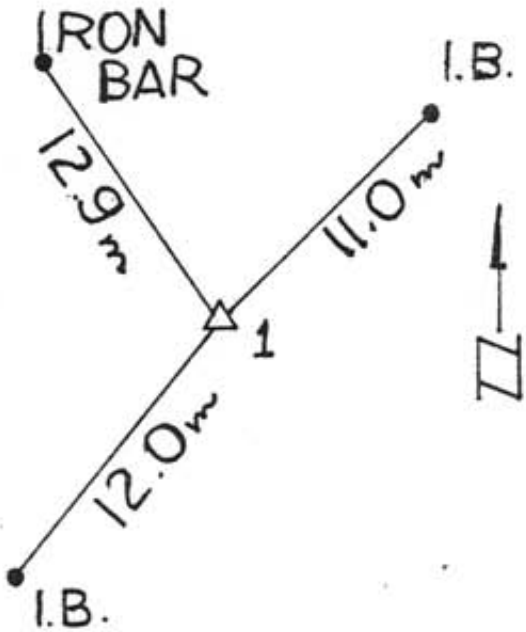
NAME: C.N.R.L.

NO.: 78-01

STATION NAME	78-01				
MAP SHEET	82-J2				
PROVINCE	B.C.	**DATE**	29-3-79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	50 08 42.292		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 56 40.214		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 556 565.57		
FIELD BOOK NO.		**UTM EASTINGS**	646 866.84		
AIR PHOTO NO.	LINE 3A-5 N.W.S. 55678	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	1336.3		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: IRON POST PLANTED IN THE SMALL OPEN FIELD 200m WEST OF THE ELKS RIVER SHARP BEND AND 8.5km NORTH OF THE ROUND PRAIRIE BRIDGE ACROSS ELK RIVER AND 6km SOUTH WEST OF FORDING COAL MINE. THE POINT IS ACCESSABLE FROM THE HELICOPTER.

LOCATION:



A.B. MIKES — **SURVEYOR**

29-3-79 — **DATE**

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

NO.: 78-02

STATION NAME	78-02				
MAP SHEET	82-J2				
PROVINCE	B.C.	**DATE**	29-3-79		
TYPE OF SURVEY	I.S.S.	**LATITUDE**	50 07 51.6037		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 50 24.0408		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 555 211.18		
FIELD BOOK NO.		**UTM EASTINGS**	654 377.62		
AIR PHOTO NO.	N.W.S. 55678 LINE 4N-84	**ZONE**	11		
INSTRUMENT	I.S.S. FERRANTI MARK 1	**ELEVATIONS**	1553.11		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: IRON POST SET IN THE SWAMP 6.5km SOUTH OF FORDING COAL ALONG THE HIGHWAY TO ELKFORD. THE POST IS LOCATED 100m EAST OF THE SAID HIGHWAY, AND 100m WEST OF THE TURN IN TO THE ELK RIVER. THE SURVEY STATION CAN BE APPROACHED FROM THE LIGHT TRUCK.

LOCATION:

SURVEYOR A.B. MIKES

DATE 29-3-79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

NO.: 78-03

STATION NAME	78-03				
MAP SHEET	82-J2				
PROVINCE	B.C.	**DATE**	29-3-79		
TYPE OF SURVEY	I.S.S.	**LATITUDE**	50 00 45.231		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 54 54.096		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 541 891.67		
FIELD BOOK NO.		**UTM EASTINGS**	649 384.07		
AIR PHOTO NO.	Line 3A S 08 N.W.S. 55678	**ZONE**	11		
INSTRUMENT	ISS FERRANTI MARK 1	**ELEVATIONS**	1250.31		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: IRON PIN LOCATED ON THE SMALL ISLAND IN THE ELK RIVER AND 300m SOUTH OF THE ELKFORD SEWAGE TREATMENT PLANT AND 75m SOUTH EAST OF THE DOMINION TOPOGRAPHYCAL POST 15.

LOCATION:

A.B. MIKES — **SURVEYOR**

29-3-79 — **DATE**

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

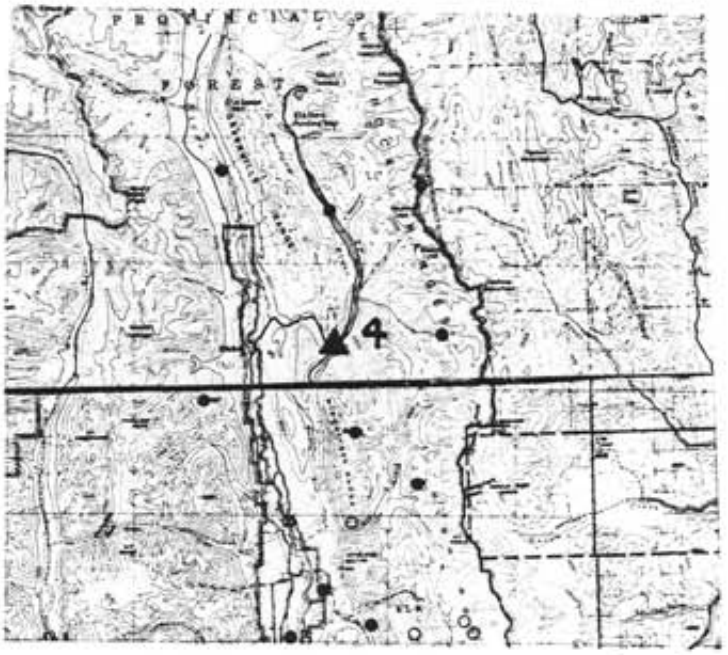
NAME: C.N.R.L.

NO.: 78-04

STATION NAME	78-04				
MAP SHEET	82-J2				
PROVINCE	B.C.	**DATE**	29-3-79		
TYPE OF SURVEY	I.S.S.	**LATITUDE**	50 01 28.7228		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 49 42.6446		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 543 411.22		
FIELD BOOK NO.		**UTM EASTINGS**	655 543.23		
AIR PHOTO NO.	N.W.S. 55.678 LINE 4N-80	**ZONE**	11		
INSTRUMENT	ISS FERRANTI MARK 1	**ELEVATIONS**	1500.72		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: IRON POST SET IN THE SANDY SOIL 8.5km EAST OF ELKFORD AND 250m EAST FROM THE WOODEN BRIDGE CROSSING THE ELK RIVER ON THE ELKFORD-FORDING HIGHWAY. THE POST IS 15m EAST OF THE CROWSNEST RESOURCES LOGGING ROAD.

LOCATION:



A.B. MIKES 29-3-79

SURVEYOR _____ **DATE** _____ **FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH**

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

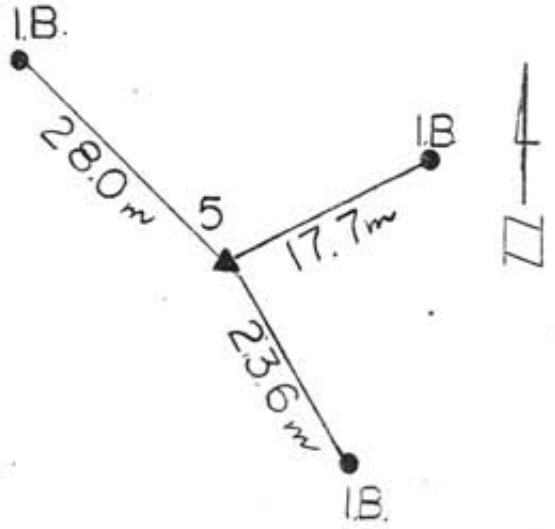
NO.: 78-05

STATION NAME	78-05				
MAP SHEET	82-J2				
PROVINCE	B.C.	**DATE**	29-3-79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	50 01 49.761		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 43 13.523		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 544 291.43		
FIELD BOOK NO.		**UTM EASTINGS**	663 265.14		
AIR PHOTO NO.	N.W.S. 55678 Line 65 92	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	1825.9		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: THE IRON POST IS PLACED ON THE WIDE SWITCHBACK ON THE OLD LOGGING ROAD IN THE EWIN CREEK VALLEY 7.5km SOUTH EAST OF THE EWIN CREEK-ELK RIVER ~~CONVERGEN~~ E.

THE TRIBUTARY OF THE EWIN CREEK TO ELK RIVER IS 12 km NORTH

LOCATION: EAST OF ELKFORD B.C. THIS POINT CAN BE REACHED BY THE TRUCK.



A.B. MIKES — **SURVEYOR**

29-3-79 — **DATE**

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

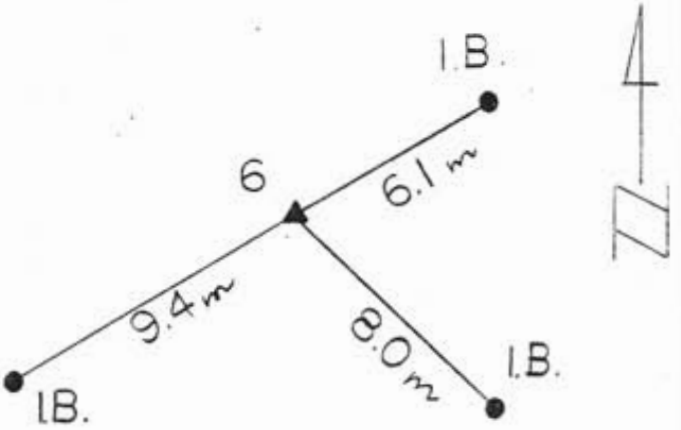
NO.: 78-06

STATION NAME	78-06				
MAP SHEET	82-J2				
PROVINCE	B.C.	**DATE**	29-3-79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	50 02 57.766		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 45 39.073		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 546 303.93		
FIELD BOOK NO.		**UTM EASTINGS**	660 306.79		
AIR PHOTO NO.	N.W.S. 55678 Line 65 - 92	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	1593.2		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: IRON PIN SUTIATED ON THE SHORE OF THE EWIN CREEK 5.5km SOUTH EAST OF THE EWIN CREEK AND ELK RIVER CONVERGENCE.

THIS POINT IS LOCATED ON THE NORTH SIDE OF THE EWIN CREEK LOGGING ROAD.

LOCATION:



A.B.MIKES — **SURVEYOR**

29-3-79 — **DATE**

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

NO.: 78-07

STATION NAME	78-07				
MAP SHEET	82-G-15				
PROVINCE	B.C.	**DATE**	2-4-1979		
TYPE OF SURVEY	I.S.S.	**LATITUDE**	49 55 49.834		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 53 58.188		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 532 800.70		
FIELD BOOK NO.		**UTM EASTINGS**	650 752.95		
AIR PHOTO NO.	N.W.S.64778 LINE 3S-10	**ZONE**	11		
INSTRUMENT	FERRANTI ISS MARK 1	**ELEVATIONS**	1221.31		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: IRON POST SITUATED ON THE EAST BANK OF ELK RIVER 18.5km NORTH OF SPARWOOD AND 100m EAST OF THE RIVER BANK. ACCESSABLE FROM THE HELICOPTER OR FROM THE C.N.R. LOGGING ROAD.

LOCATION:

SURVEYOR A.B.MIKES

DATE 4-4-1979

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

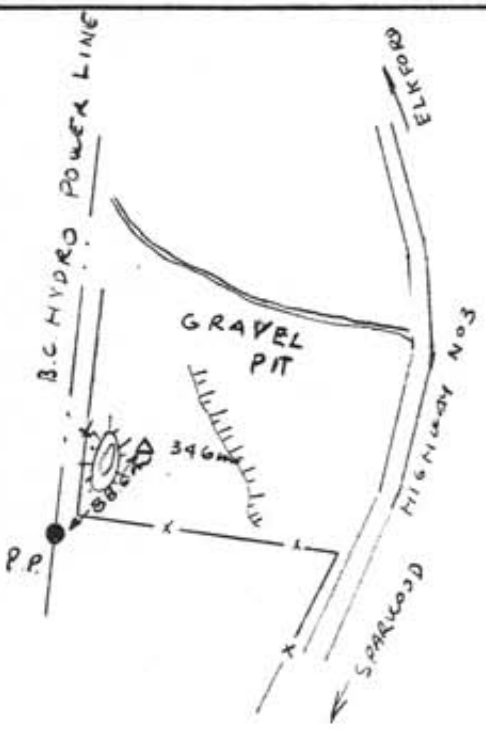
NAME: C.N.R.L.

NO.: 78-08

STATION NAME	78-08				
MAP SHEET	82-G-15				
PROVINCE	B.C.	**DATE**	2-4-79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 53 24.675		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 53 26.219		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 528 336.00		
FIELD BOOK NO.		**UTM EASTINGS**	651 516.58		
AIR PHOTO NO.	N.W.S.64778 LINE 3S-10	**ZONE**	11		
INSTRUMENT		**ELEVATIONS**	1230.0		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: ROCK CAIRN ON TOP OF THE IRON POST LOCATED IN THE LARGE GRAVEL PIT AREA 16.5 km NORTH OF THE SPARWOOD. THE POST IS 250m WEST OF THE SPARWOOD - ELKFORD HIGHWAY AND IS 23.4m FROM THE FENCE CORNER AND 85.7m FROM B.C. HYDRO POWER POLE.

LOCATION:



SURVEYOR A.B.MIKES **DATE** 4-4-79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME C.N.R.L.

NO.: 78-10

STATION NAME	78-10				
MAP SHEET	82-G-15				
PROVINCE	B.C.	**DATE**	4-4-79		
TYPE OF SURVEY	I.S.S.	**LATITUDE**	49 53 50.3155		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 50 26.4946		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 529 230.01		
FIELD BOOK NO.		**UTM EASTINGS**	655 079.45		
AIR PHOTO NO.	N.W.S.55678 LINE 4N-24	**ZONE**	11		
INSTRUMENT	FERRANTI ISS MARK 1	**ELEVATIONS**	1264.45		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: IRON PIN LOCATED 1 km NORTH EAST OF THE ENTRANCE TO THE LINE CREEK CANYON, 100m SOUTH OF THE CP SPARWOOD-FORDING RAILWAY AND 2.5km NORTH EAST OF THE FORDING RIVER TRIBUTARY TO THE ELK RIVER.

LOCATION:

A.B. MIKES — 4-4-79

SURVEYOR — **DATE** — **FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH**

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

NO.: 78-09

STATION NAME	78-09				
MAP SHEET	80-G-15				
PROVINCE	B.C.	**DATE**	2-4-1979		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 51 51.467		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 50 51.400		
DATE PLANTED	JUNE 1979	**UTM NORTHINGS**	5 525 545.60		
FIELD BOOK NO.		**UTM EASTINGS**	654 688.12		
AIR PHOTO NO.	N.W.S.64778 LINE 4N-25	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	1298.0		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: IRON POST SITUATED IN THE OPEN AREA 0.5km WEST OF GRAVE LAKE AND 260km NORTH FROM THE SOUTH END OF THE SMALL LAKE AND 0.5km FROM THE C.P. RAILWAY TO Elkford THE POINT CAN BE DRIVEN IN BY THE LIGHT TRUCK.

LOCATION:

A.B.MIKES — 2-4-1979

SURVEYOR — **DATE**

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

NO.: 78-11

STATION NAME	78-11-				
MAP SHEET	82-G-15				
PROVINCE	B.C.	**DATE**	2-4-1979		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 52 09.161		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 44 57.033		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 526 299.96		
FIELD BOOK NO.		**UTM EASTINGS**	661 745.46		
AIR PHOTO NO.	N.W.S.55678 LINE 5S-25	**ZONE**	11		
INSTRUMENT	DOPPLER	**ELEVATIONS**	2102.6		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: MONUMENT LOCATED IN THE LARGE CIRQUE 3.5km EAST FROM HARRIET LAKE AND 5.2km SOUTH WEST FROM MOUNT ERRIS IN THE ROCKY MOUNTAIN RANGE. THE MONUMENT HAS 0.8m CAIRN AND IS ACCESSABLE FROM THE HELICOPTER ONLY.

LOCATION:

A.B. MIKES — **SURVEYOR**

2-4-1979 — **DATE**

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD

SHELL CANADA RESOURCES LIMITED

SURVEYING SECTION

PROJECT: C.N.R.L.

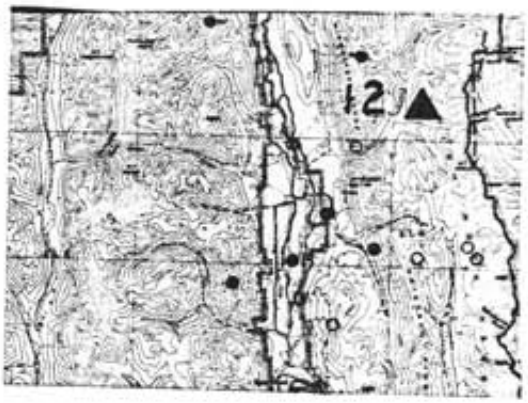
NAME: C.N.R.L.

NO.: 78-12

STATION NAME	78-12				
MAP SHEET	82-G-15				
PROVINCE	B.C.	**DATE**	2-4-1979		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 55 27.691		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 44 47.745		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 532 436.09		
FIELD BOOK NO.		**UTM EASTINGS**	661 746.32		
AIR PHOTO NO.	N.W.S.55678 LINE 5S-23	**ZONE**	11		
INSTRUMENT	DOPPLER	**ELEVATIONS**	1925.4		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: SURVEY STATION LOCATED 2.5km SOUTH FROM THE HIGHEST POINT ON THE HORSESHOE RIDGE AND 2km EAST OF THE LINE CREEK AND SOUTH LINE CREEK CONVERGENCE. THE POINT IS PROTECTED BY 0.8m ROCK CAIRN.

LOCATION:



A.B. MIKES — **SURVEYOR**

2-4-1979 — **DATE**

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

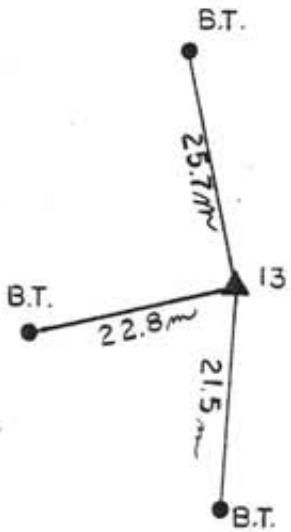
NAME: C.N.R.L.

NO.: 78-13

STATION NAME	78-13				
MAP SHEET	82-G-15				
PROVINCE	B.C.	**DATE**	2-4-1979		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 53 29.165		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 50 02.241		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 528 590.83		
FIELD BOOK NO.		**UTM EASTINGS**	655 582.16		
AIR PHOTO NO.	N.W.S.55678 LINE 5S-25	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	1277.5		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: IRON POST IN THE SMALL CLEARED AREA 100m WEST OF THE ENTRANCE TO THE LINE CREEK CANYON. THE POST IS 100m NORTH OF THE LINE CREEK ROAD AND IS ACCESSABLE BY TRUCK.

LOCATION:



A.B. MIKES — **SURVEYOR**

2-4-1979 — **DATE**

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

NO.: 78-14

STATION NAME	78-14				
MAP SHEET	82-G-15				
PROVINCE	B.C.	**DATE**	2-4-1979		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 49 52.109		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 48 58.293		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 521 925.17		
FIELD BOOK NO.		**UTM EASTINGS**	657 053.36		
AIR PHOTO NO.	N.W.S.55678 LINE 5S-25	**ZONE**	11		
INSTRUMENT	DOPPLER	**ELEVATIONS**	1312.4		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: IRON POST LOCATED 60m BELOW THE SMALL EARTH DAM ON GRACE CREEK AND 30m SOUTH FROM THE END OF CONCRETE SPILLWAY. THE DAM IS 4 km EAST OF THE CNRL ROAD AND GRACE CREEK ROAD, INTERSECTION, AND IS 2.2km SOUTH OF THE GRACE LAKE.

LOCATION:

A.B. MIKES — **SURVEYOR**

2-4-1979 — **DATE**

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

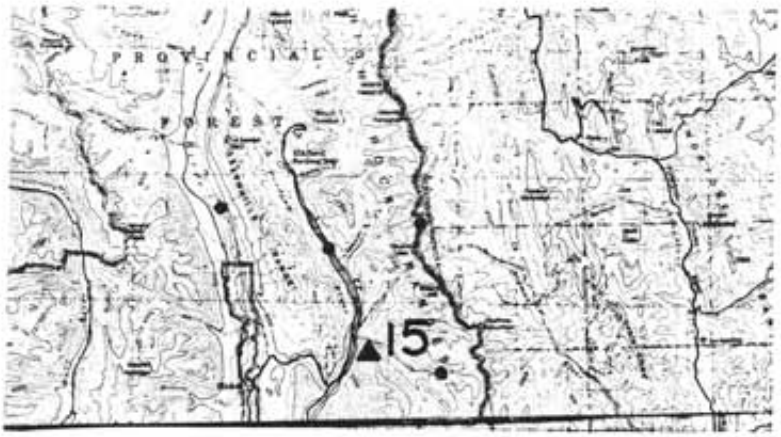
NAME: C.N.R.L.

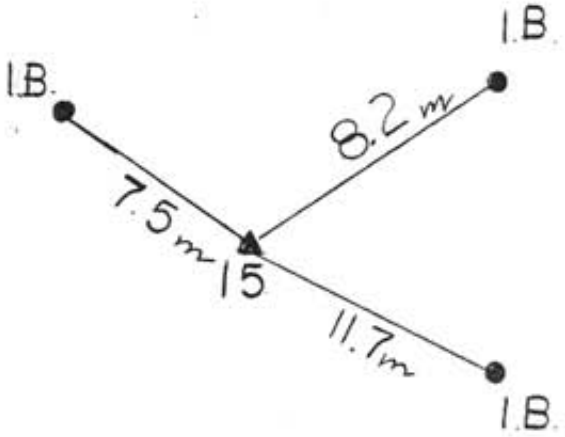
NO.: 78-15

STATION NAME	78-15				
MAP SHEET	82-J2				
PROVINCE	B.C.	**DATE**	29-3-79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	50 01 18.046		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 47 12.964		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 543 168.85		
FIELD BOOK NO.		**UTM EASTINGS**	658 530.96		
AIR PHOTO NO.	N.W.S.	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	2130.5		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: IRON POST SITUATED IN THE MIDDLE OF THE LONG RIDGE EAST 2.5km EAST OF ELKFORD AND 3km SOUTH OF THE ELK RIVER AND FWIN CREEK CONVERGENCE. THE POINT IS ACCESSABLE FROM THE HELICOPTER.

LOCATION:





SURVEYOR A.B.MIKES **DATE** 29-3-79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

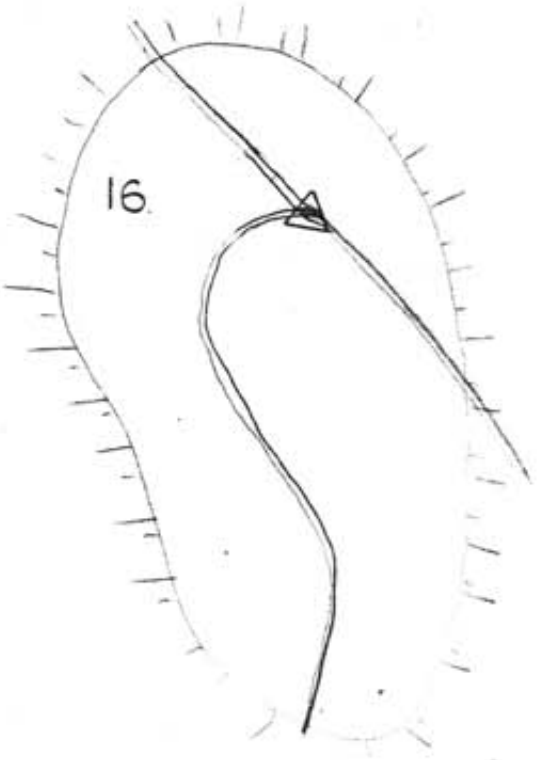
NAME: C.N.R.L.

NO.: 78-16

STATION NAME	78-16				
MAP SHEET	82-J2				
PROVINCE	B.C.	**DATE**	29-3-79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	50 00 01.254		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 44 57.525		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 540 877.95		
FIELD BOOK NO.		**UTM EASTINGS**	661 297.14		
AIR PHOTO NO.	N.W.S.	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	2427.1		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: IRON POST UNDER THE ROCK CAIRN SITUATED ON THE HIGH RIDGE 1km WEST OF THE EWIN PASS. THE POINT IS ACCESSABLE EITHER FROM HELICOPTER OR BY TRUCK FROM THE LINE CREEK ROAD.

LOCATION:



SURVEYOR A.B. MIKES **DATE** 29-3-79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

NO.: 78-17

STATION NAME	78-17				
MAP SHEET	82-G-15				
PROVINCE	B.C.	**DATE**	4-4-1979		
TYPE OF SURVEY	I.S.S.	**LATITUDE**	49 54 01.484		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 41 26.304		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 529 896.46		
FIELD BOOK NO.		**UTM EASTINGS**	665 844.47		
AIR PHOTO NO.	N.W.S.55678 LINE 6S-97	**ZONE**	11		
INSTRUMENT	ISS FERRANTI MARK 1	**ELEVATIONS**	2558.90		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: STATION IS LOCATED ON THE FLAT MOUNTAIN 1.5km NORTH OF MOUNT ERRIS IN THE HIGH ROCK RANGE AND IS 5 km SOUTH EAST OF HORSESHOE RIDGE. THE POINT IS ACCESSABLE BY THE HELICOPTER ONLY.

LOCATION:

A.B. MIKES

SURVEYOR

4-4-1979

DATE

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

NO.: 78-18

STATION NAME	78-18				
MAP SHEET	82-G-15				
PROVINCE	B.C.	**DATE**	29-3-79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 58 47.134		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 48 56.485		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 538 447.98		
FIELD BOOK NO.		**UTM EASTINGS**	656 607.40		
AIR PHOTO NO.	LINE 55-22 N.W.S.55678	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	1914.7		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: IRON POST ON THE LOGGING ROAD IN THE GRACE CREEK VALLEY 3.5Km OFF CP RAIL AND GRACE CREEK CROSSING (SPARWOOD-ELKFORD). THE POINT CAN BE REACHED BY THE LIGHT TRUCK FROM THE ELKFORD AND IS 6.5km SOUTH FROM THE WOODEN BRIDGE ON THE ELK RIVER AND ELKFORD-FORDING HIGHWAY.

LOCATION:

A.B. MIKES — 29-3-79

SURVEYOR — **DATE**

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

NO.: 78-19

STATION NAME	78-19				
MAP SHEET	82-G-15				
PROVINCE	B.C.	**DATE**	4-4-1979		
TYPE OF SURVEY	I.S.S.	**LATITUDE**	49 46 33.685		
MONUMENT TYPE	IRON PIN	**LONGTITUDE**	114 50 54.120		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 515 730.92		
FIELD BOOK NO.		**UTM EASTINGS**	654 915.36		
AIR PHOTO NO.	N.W.S.55678 LINE 4N-70	**ZONE**	11		
INSTRUMENT	ISS FERRANTI MARK 1	**ELEVATIONS**	1630.20		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: THE POINT IS LOCATED ON THE WEST SLOPE OF HAMMER RIDGE 1.2km WEST OF EAST OF THE COAL SILOS AND 4.5km NORTH EAST OF SPARWOOD

LOCATION:

A.B. MIKES — **SURVEYOR**

4-4-1979 — **DATE**

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

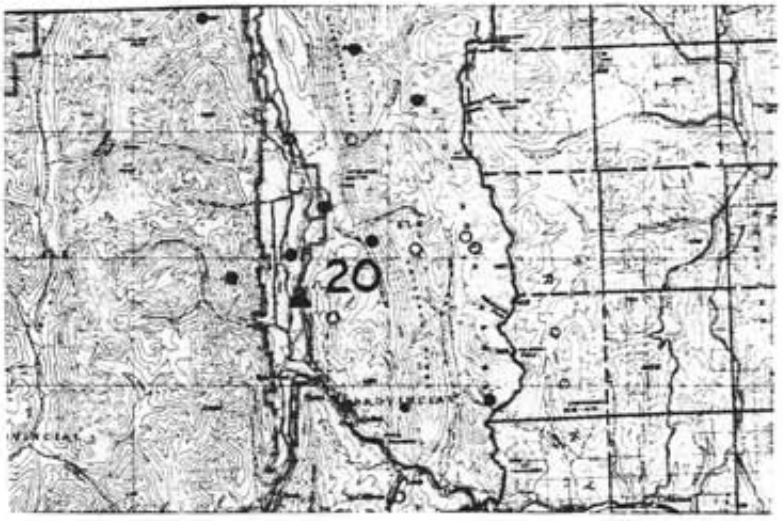
NAME: C.N.R.L.

NO.: 78-20

STATION NAME	78-20				
MAP SHEET	82-G-15				
PROVINCE	B.C. .	**DATE**	4-4-1979		
TYPE OF SURVEY	I.S.S.	**LATITUDE**	49 47 43.917		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 52 58.860		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 517 828.72		
FIELD BOOK NO.		**UTM EASTINGS**	652 359.65		
AIR PHOTO NO.	**N.W.S.** 55678 LINE 3N-145	**ZONE**	11		
INSTRUMENT	ISS FERRANTI MARK 1	**ELEVATIONS**	1147.02		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: IRON POST LOCATED ON THE WEST SHORE OF ELK RIVER 5 km NORTH OF SPARWOOD ON THE OLD PAVED HIGHWAY AND 200m EAST OF THE TRAILER PARK. ACCESSABLE BY THE TRUCK.

LOCATION:



SURVEYOR Mike **DATE** 4/4 1979 **FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH**

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

NO.: 78-21

STATION NAME	78-21				
MAP SHEET	82-G-15				
PROVINCE	B.C.	**DATE**	2/4/79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 49 18.872		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 53 05.745		
DATE PLANTED	JUNE 1979	**UTM NORTHINGS**	5 520 757.04		
FIELD BOOK NO.		**UTM EASTINGS**	652 139.35		
AIR PHOTO NO.	N.W.S. 55 678 Line 4N, 73	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	1160.1		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: Monument located on the east edge of the B.C. Hydro Sparwood - Elkford - Right-of-Way. The point is 8 km north of the Sparwood and 1 km east of the paved Sparwood-Elkford highway. It is access through the small farmhouse.

LOCATION:

SURVEYOR A.B. MIKES **DATE** 4/4/79 **FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH**

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

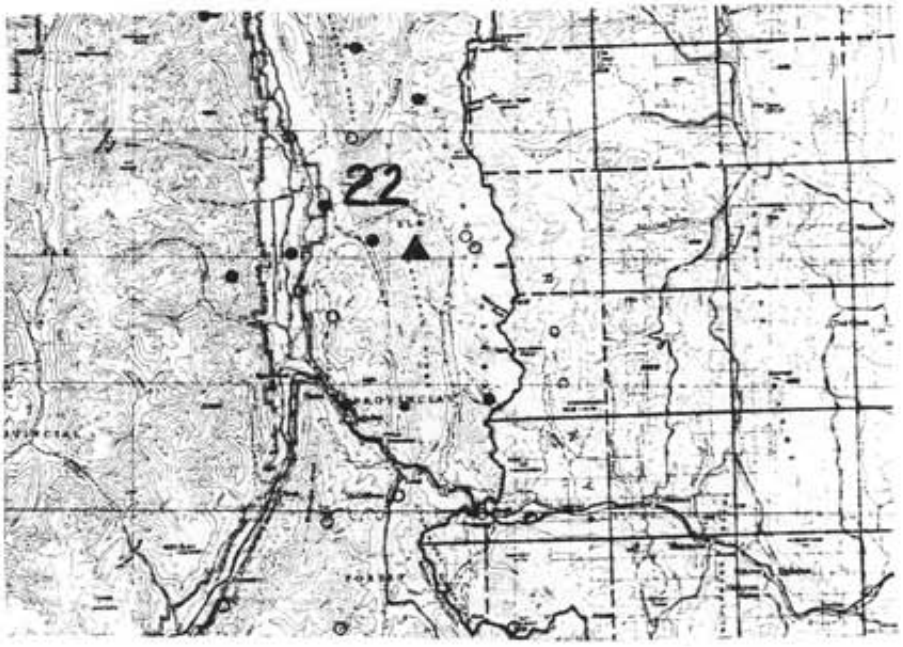
NAME: C.N.R.L.

NO.: 78-22

STATION NAME	78-22				
MAP SHEET	82-G-15				
PROVINCE	B.C.	**DATE**	4-4-79		
TYPE OF SURVEY	I.S.S.	**LATITUDE**	49 49 54.1809		
MONUMENT TYPE	IRON PIN	**LONGTITUDE**	114 43 24.1410		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 522 187.81		
FIELD BOOK NO.		**UTM EASTINGS**	663 726.19		
AIR PHOTO NO.	N.W.S.55678 LINE 6S-100	**ZONE**	11		
INSTRUMENT	ISS FERRANTI MARK 1	**ELEVATIONS**	1931.04		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: IRON POST SITUATED ON THE SMALL LANDING 0.8km EAST OF ERICKSON RIDGE AND 0.2km WEST OF THE SMALL LAKE IN THE ALEXANDER CREEK VALLEY.

LOCATION:



A.B. MIKES — **SURVEYOR**

4-4-1979 — **DATE**

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

NO.: 78-23

STATION NAME	78-23				
MAP SHEET	82-G				
PROVINCE	B.C.	**DATE**	4-4-1979		
TYPE OF SURVEY	I.S.S.	**LATITUDE**	49 50 26.997		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 41 45.798		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 523 261.19		
FIELD BOOK NO.		**UTM EASTINGS**	665 659.33		
AIR PHOTO NO.	N.W.S.55678 LINE 6S-99	**ZONE**	11		
INSTRUMENT	ISS FERRANTI MARK 1	**ELEVATIONS**	1890.33		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: MONUMENT POSTED AT THE ENTRANCE OF THE LARGE CIRQUE 2km SOUTH WEST OF THE MOUNT DOMKE IN THE HIGH ROCK RANGE. THIS POINT IS ACCESSABLE TO ENTER BY TRUCK FROM ALEXANDER CREEK OR BY THE HELICOPTER.

LOCATION:

A.B. MIKES — **SURVEYOR**

4-4-1979 — **DATE**

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

NO.: 78-24

STATION NAME	78-24				
MAP SHEET	82-G-10				
PROVINCE	B.C.	**DATE**	4-4-79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 42 39.041		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 50 01.448		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 508 515.51		
FIELD BOOK NO.		**UTM EASTINGS**	656 178.02		
AIR PHOTO NO.	NWS	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	1184.02		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: THE MONUMENT IS SITUATED ON THE HIGH COAL PILE OPPOSITE OF THE KAISER RESOURCES IN NATAL-MICHEL. THE STATION IS LOCATED 3.5km SOUTH EAST OF THE SPARWOOD, 150m SOUTH OF THE SPARWOOD-CROWSNEST HIGHWAY #3.

LOCATION:

SURVEYOR MIKEŠ **DATE** 4.4.79 **FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH**

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

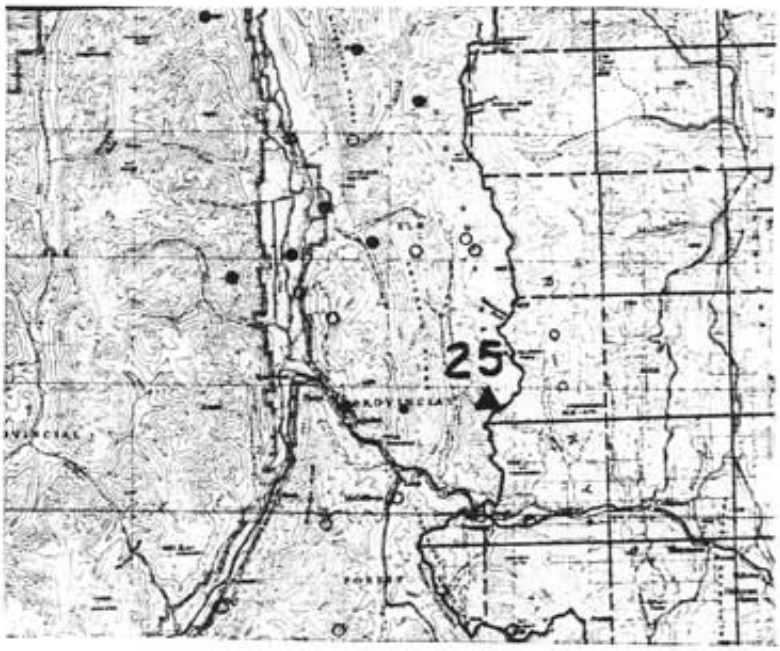
NAME: C.N.R.L.

NO.: 78-25A

STATION NAME	78-25-A				
MAP SHEET	82-G-8				
PROVINCE	B.C.	**DATE**	2/4/79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 43 02.830		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 40 32.335		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 509 590.93		
FIELD BOOK NO.		**UTM EASTINGS**	667 551.65		
AIR PHOTO NO.	N.W.S. 55678 Line 6-5 103	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	1936.9		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: Iron post on the small round hill 1.5 km northwest of Dead Man Pass and 2 m east of the Alexander Creek. The point is protected by the rock cairn 0.8 m high.

LOCATION:



SURVEYOR A. B. MIKES **DATE** 2/4/79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

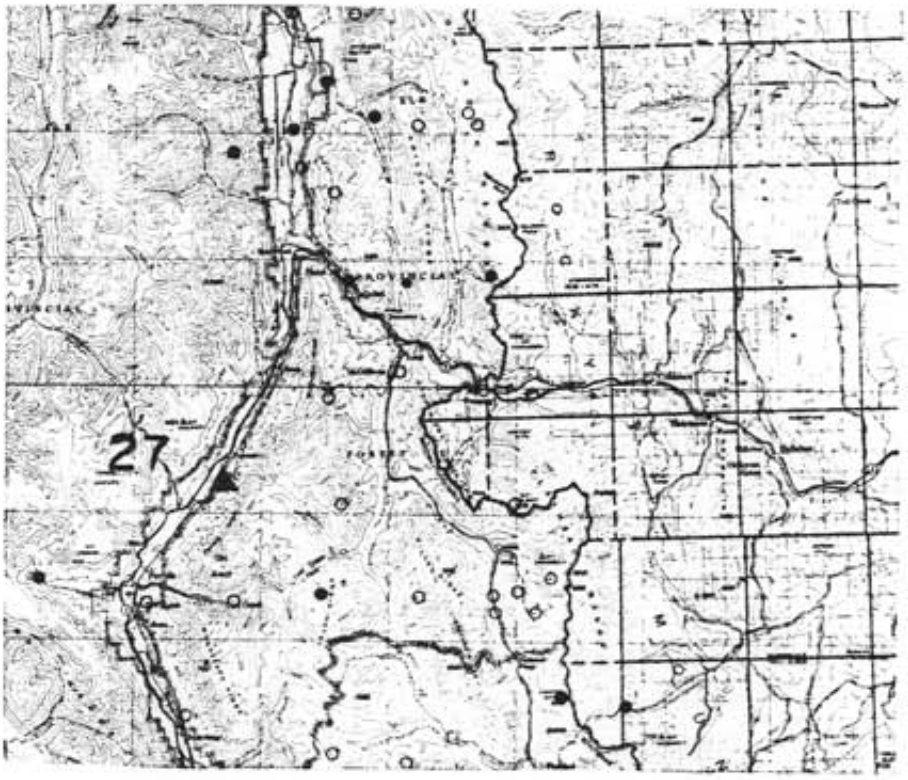
NAME: C.N.R.L.

NO.: 78-27

STATION NAME	78-27				
MAP SHEET	82-G-10				
PROVINCE	B.C.	**DATE**	4-4-1979		
TYPE OF SURVEY	I.S.S.	**LATITUDE**	49 34 12.7253		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 58 51.3303		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 492 584.93		
FIELD BOOK NO.		**UTM EASTINGS**	645 987.05		
AIR PHOTO NO.	N.W.S.55678 LINE 2N-12	**ZONE**	11		
INSTRUMENT	I.S.S.FERRANTI MARK 1	**ELEVATIONS**	1024.30		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: IRON POST LOCATED 20m EAST OF THE ELK RIVER, 20km SOUTH OF THE HIGHWAY 3 BRIDGE CROSSING THE ELK RIVER IN HOSMER AND 250m WEST OF THE C.P. RAILWAY TO SPARWOOD.

LOCATION:



A.B. MIKES

SURVEYOR

4-4-79

DATE

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

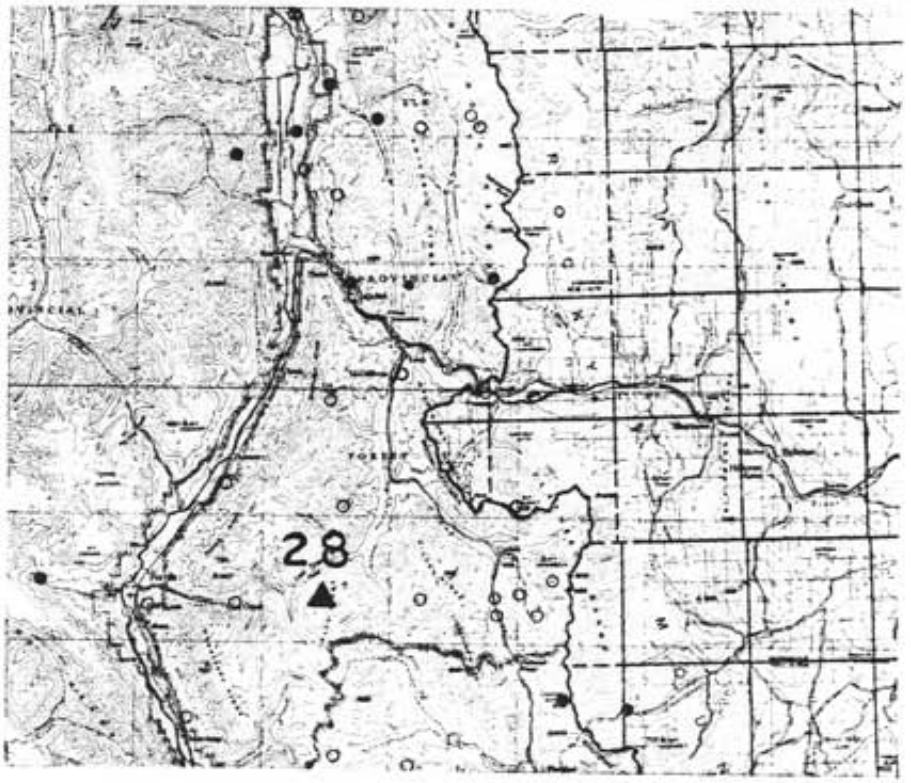
NAME: C.N.R.L.

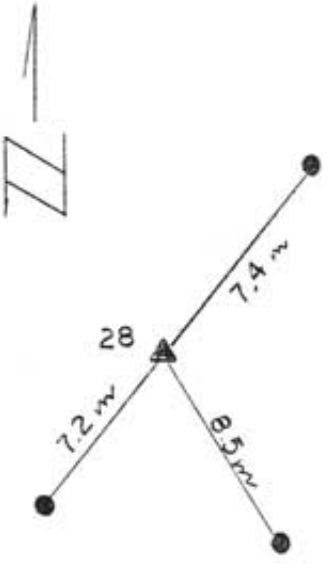
NO.: 78-28

STATION NAME	78-28				
MAP SHEET	82-G-7				
PROVINCE	B.C.	**DATE**	2/4/79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 29 10.110		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 52 25.953		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 483 453.73		
FIELD BOOK NO.		**UTM EASTINGS**	653 990.50		
AIR PHOTO NO.	N.W.S. 55 678 Line 4-N 59	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	1777.90		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: Iron post located on the old logging road 2 km west of north end of Leach Ridge, 1.5 km south of Coal Creek Pass and 13 km east of Fernie on the Coal Pass Creek road.

LOCATION:





SURVEYOR A.B. MIKES **DATE** 2/4/79 **FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH**

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

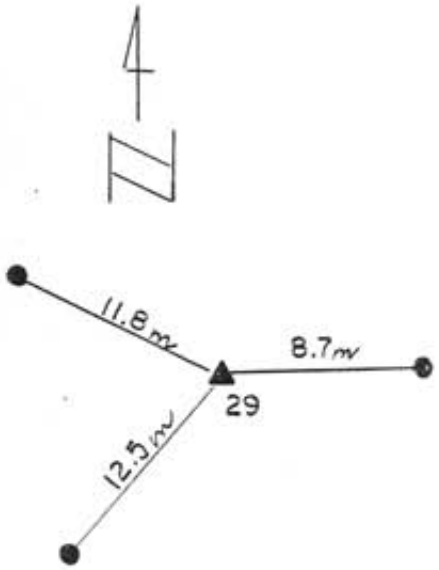
NAME: C.N.R.L.

NO.: 78-29

STATION NAME	78-29				
MAP SHEET	82-G-2				
PROVINCE	B.C.	**DATE**	2/4/1979		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 07 10.997		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 38 32.596		
DATE PLANTED	JUNE 1979	**UTM NORTHINGS**	5 443 222.46		
FIELD BOOK NO.		**UTM EASTINGS**	672 026.65		
AIR PHOTO NO.	N.W.S.55678 Line 9E 80	**ZONE**	11		
INSTRUMENT		**ELEVATIONS**	1627.5		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: Iron post located on the old Storm Creek logging road, 2 km north of a wooden bridge crossing to Cabin Creek and 8.5 km east of the Cabin Pass.

LOCATION:



SURVEYOR A.B. MIKES **DATE** 2/4/79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

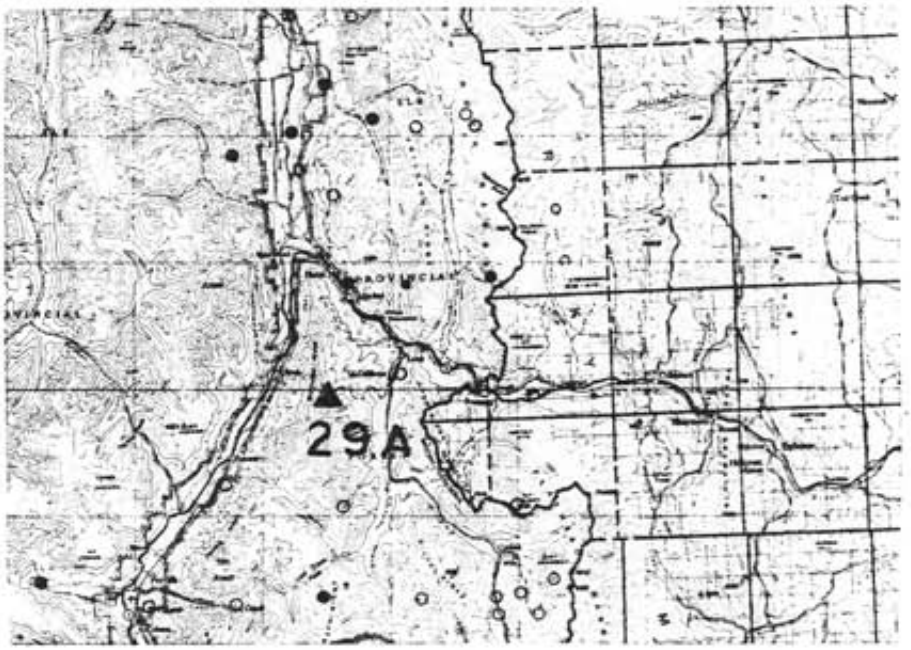
NAME: C.N.R.L.

NO.: 78-29A

STATION NAME	78-29A				
MAP SHEET	82-G-10				
PROVINCE	B.C.	**DATE**	4-4-1979		
TYPE OF SURVEY	I.S.S.	**LATITUDE**	49 37 59.867		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 51 26.262		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 499 846.05		
FIELD BOOK NO.		**UTM EASTINGS**	654 725.37		
AIR PHOTO NO.	N.W.S.55678 LINE 4N-34	**ZONE**	11		
INSTRUMENT	I.S.S.FERRANTI MARK 1	**ELEVATIONS**	2234.92		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: IRON POST LOCATED ON THE NORTH TOP OF THE SPARWOOD RIDGE 0.4km NORTH WEST OF THE FIRE LOOKOUT TOWER ON THE SAID RIDGE. ACCESSABLE BY THE TRUCK FROM THE B.C. FORRESTRY ROAD.

LOCATION:



SURVEYOR A.B. MIKES **DATE** 4-4-79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

NO.: 78-31

STATION NAME	78-31				
MAP SHEET	82-G-6				
PROVINCE	B.C.	**DATE**	4-4-79		
TYPE OF SURVEY	I.S.S.	**LATITUDE**	49 29 16.462		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	115 03 44.658		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 483 281.61		
FIELD BOOK NO.		**UTM EASTINGS**	640 331.50		
AIR PHOTO NO.	NWS 56678 LINE 2-AS-20	**ZONE**	11		
INSTRUMENT	ISS FERRANTI MARK 1	**ELEVATIONS**	1025.15		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: IRON POST LOCATED 0.5km SOUTH EAST OF FERNIE. THE POINT IS LOCATED IN THE FENCED AREA 04km SOUTH OF THE OLD FERNIE-MORRISSEY ROAD AND 60m SOUTH WEST OF THE RADIO TOWER.

LOCATION:

A.B. MIKES 4-4-79

SURVEYOR _____ **DATE** _____ **FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH**

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

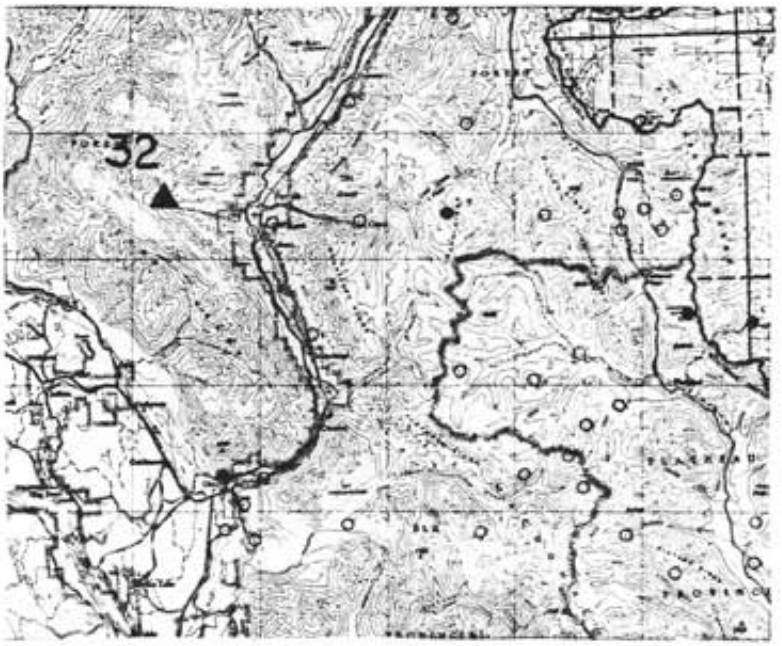
NAME: C.N.R.L.

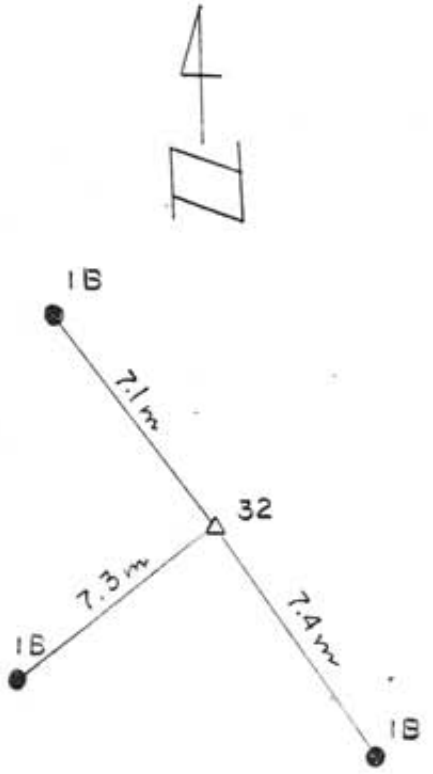
NO.: 78-32

STATION NAME	78-32				
MAP SHEET	82-G-2				
PROVINCE	B.C.	**DATE**	2/4/1979		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 30 33.910		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	115 10 32.227		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5485468.44		
FIELD BOOK NO.		**UTM EASTINGS**	632074.50		
AIR PHOTO NO.	N.W.S. 56678 Line IBE.28	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	1383.0		
		LEVELING METHOD	Doppler		

DESCRIPTION: Iron post situated on the edge of the Forestry Road 8.5 km northwest of Fernie and 100 m east of the north edge of Island Lake.

LOCATION:





SURVEYOR A.B. MIKES **DATE** 2/4/79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD

SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

NO.: 78-33

STATION NAME	78-33				
MAP SHEET	82-G-10				
PROVINCE	B.C.	**DATE**	4-4-79		
TYPE OF SURVEY	I.S.S.	**LATITUDE**	49 38 29.727		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 47 01.686		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 500 921.99		
FIELD BOOK NO.		**UTM EASTINGS**	660 004.79		
AIR PHOTO NO.	N.W.S.56678 LINE 6S-106	**ZONE**	11		
INSTRUMENT	ISS FERRANTI MARK 1	**ELEVATIONS**	1268.15		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: MONUMENT SITUATED 12km SOUTH EAST OF SPARWOOD, 3km SOUTH OF HIGHWAY JUNCTION SPARWOOD - CROWSNEST No.3 HIGHWAY AND BOWRON CREEK ROAD AND 30m NORTH WEST OF THE CP RAIL BRIDGE CROSSING THE MICHEL CREEK IN MCGILLIVRAY.

LOCATION:

A.B.MIKES — **SURVEYOR**

4-4-79 — **DATE**

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH
SEE OTHER SIDE

MONUMENT RECORD

SHELL CANADA RESOURCES LIMITED

SURVEYING SECTION

PROJECT: C.N.R .L.

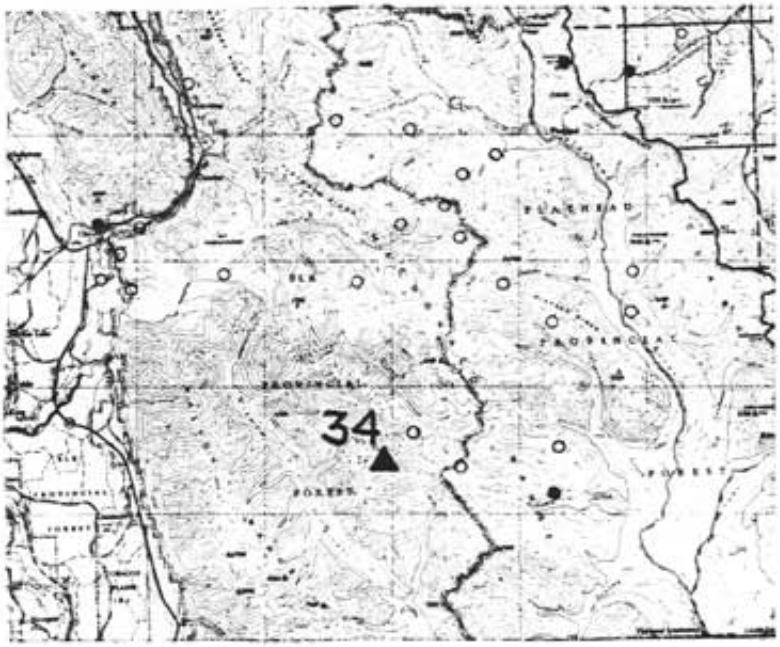
NAME: C.N.R.L.

NO.: 78-34

STATION NAME	78-34				
MAP SHEET	82-G-2				
PROVINCE	B.C.	**DATE**	3-4-79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 08 11.103		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 49 00.107		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 444 697.09		
FIELD BOOK NO.		**UTM EASTINGS**	659 255.38		
AIR PHOTO NO.	NWS 55678 LINE 9E-175	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	1948.5		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: IRON POST SITUATED 2.5km SOUTH WEST OF THE NORTH END OF THE INVERTED RANGE. THE POINT IS ACCESSABLE ONLY FROM THE HELICOPTER.

LOCATION:



SURVEYOR A.B. MIKES **DATE** 4-4-79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH
SEE OTHER SIDE

SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

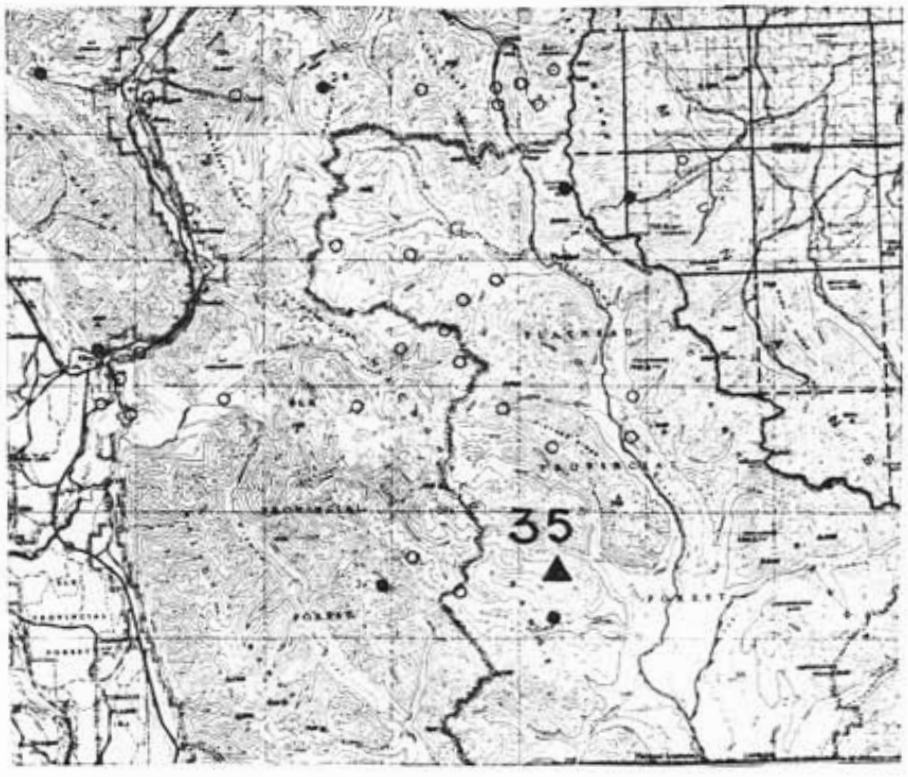
NAME: C.N.R.L.

NO.: 78-35

STATION NAME	78-35				
MAP SHEET	82-G-2				
PROVINCE	B.C. .	DATE	4-4-1979		
TYPE OF SURVEY	I.S.S.	LATITUDE	49 08 59.938		
MONUMENT TYPE	IRON POST	LONGTITUDE	114 38 00.630		
DATE PLANTED	JUNE 1978	UTM NORTHINGS	5 445 606.35		
FIELD BOOK NO.		UTM EASTINGS	672 569.31		
AIR PHOTO NO.	N.W.S.55678 LINE 9S-E-80	ZONE	11		
INSTRUMENT	ISS FERRANTI MARK 1	ELEVATIONS	1929.47		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: IRON POST LOCATED IN THE MACDONALD RANGE 1.5km SOUTH OF THE HUNGER LAKE 2km NORTH OF STORM CREEK AND 7.5km NORTH EAST OF CABIN PASS.

LOCATION:



SURVEYOR A.B.MIKES

DATE 4-4-79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH SEE OTHER SIDE

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

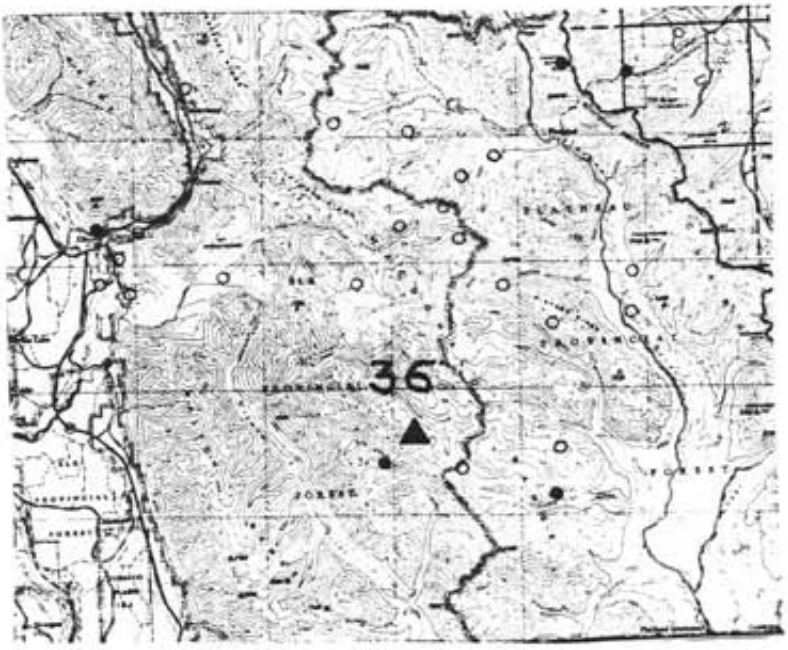
NAME: C.N.R.L.

NO.: 78-36

STATION NAME	78-36				
MAP SHEET	82-G-2				
PROVINCE	B.C.	**DATE**	4-4-79		
TYPE OF SURVEY	ISS	**LATITUDE**	49 09 47.594		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 46 50.832		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 447 752.58		
FIELD BOOK NO.		**UTM EASTINGS**	661 787.17		
AIR PHOTO NO.	N.W.S.55678 LINE 9E-176	**ZONE**	11		
INSTRUMENT	I.S.SFERRANTI MARK 1	**ELEVATIONS**	1616.44		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: IRON POST LOCATED 1.5km NORTH EAST OF NORTH END OF INVERTED RIDGE IN MACDONALD RANGE 0.3km SOUTH OF THE CABIN CREEK AND 5km NORTH WEST OF CABIN PASS.

LOCATION:



A.B.MIKES — 4-4-79

SURVEYOR _____ **DATE** _____

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH SEE OTHER SIDE

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

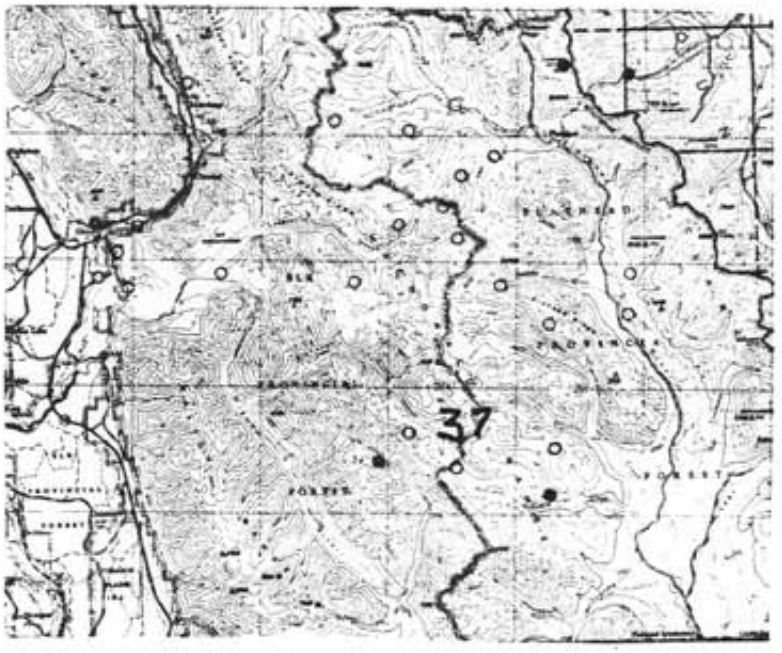
NAME: C.N.R.L.

NO.: 78-37

STATION NAME	78-37				
MAP SHEET	82-G-2				
PROVINCE	B.C.	**DATE**	4-4-79		
TYPE OF SURVEY	I.S.S.	**LATITUDE**	49 07 45.502		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 44 11.544		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 444 078.29		
FIELD BOOK NO.		**UTM EASTINGS**	665 125.37		
AIR PHOTO NO.	N.W.S. 55678 LINE 9S-177	**ZONE**	11		
INSTRUMENT	ISS FERRANTI MARK 1	**ELEVATIONS**	1698.86		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: IRON POST SITUATED 100m SOUTH OF CABIN PASS IN THE INVERTED RIDGE IN THE MACDONALD RANGE AND 1.0km NORTH EAST OF THE INVERTED RANGE.

LOCATION:



SURVEYOR A.B.MIKES

DATE 4-4-79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

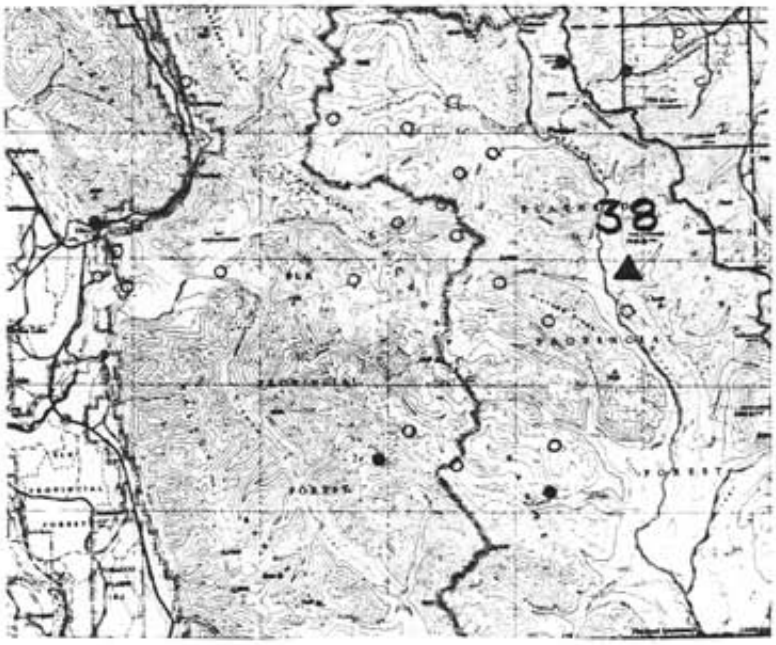
NAME: C.N.R.L. 78-38

NO.:

STATION NAME	78-38				
MAP SHEET	82-G-7				
PROVINCE	B.C.	**DATE**	4-4-79		
TYPE OF SURVEY	I.S.S.	**LATITUDE**	49 15 55.203		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 32 36.462		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 459 637.33		
FIELD BOOK NO.		**UTM EASTINGS**	678 718.59		
AIR PHOTO NO.	N.W.S. 55678 LINE 8N-169	**ZONE**	11		
INSTRUMENT	ISS FERRANTI MARK 1	**ELEVATIONS**	1421.44		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: IRON POST SITUATED 1km EAST OF FLATHEAD RIVER 2.5km SOUTH WEST OF PACKHORSE PEAK, AND 11.5km SOUTH OF THE FLATHEAD LOCALITY.

LOCATION:



SURVEYOR A.B. MIKES

DATE 4-4-79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH
SEE OTHER SIDE

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

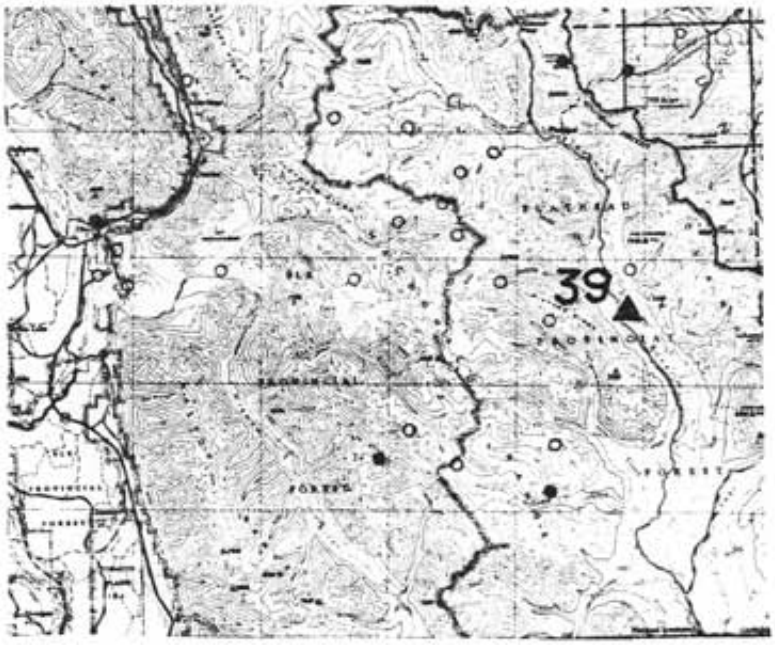
NO.: 78-39

STATION NAME	78-39				
MAP SHEET	82-G-7				
PROVINCE	B.C. .	**DATE**	4-4 -79		
TYPE OF SURVEY	I.S.S.	**LATITUDE**	49 13 53.851		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 32 50.154		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 455 881.43		
FIELD BOOK NO.		**UTM EASTINGS**	678 563.55		
AIR PHOTO NO.	N.W.S. 55678 LINE 8N-168	**ZONE**	11		
INSTRUMENT	ISS FERRANTI MARK 1	**ELEVATIONS**	1362.44		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: IRON POST LOCATED 30m WEST OF FLATHEAD RIVER, 2km SOUTH OF HARVEY CREEK TRIBUTARY TO A FLATHEAD RIVER 1.5km SOUTH OF THE FLATHEAD LOCALITY.

THE POINT IS SITUATED ON THE WEST SLOPE OF THE FLATHEAD RIVER AND 0.5km FROM THE CNRL LOGGING ROAD.

LOCATION:



A.B. MIKES — **SURVEYOR**

4-4-79 — **DATE**

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

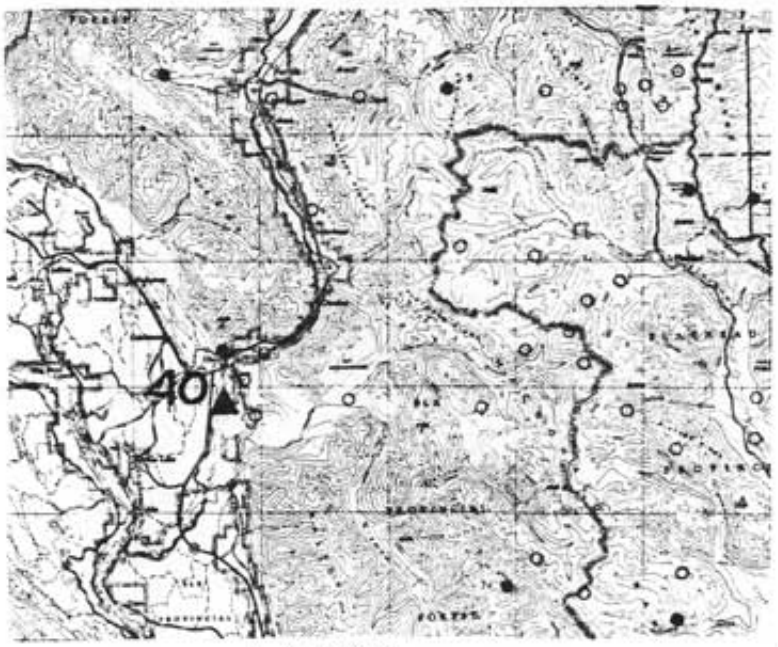
NAME: C.N.R.L.

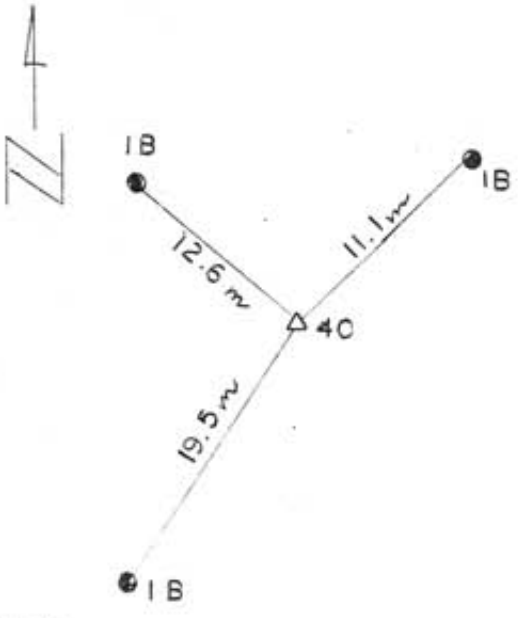
NO.: 78-40

STATION NAME	78-40				
MAP SHEET	82-G-6				
PROVINCE	B.C.	**DATE**	4-4-79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 16 05.215		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	115 06 54.361		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 458 752.06		
FIELD BOOK NO.		**UTM EASTINGS**	637 125.58		
AIR PHOTO NO.	NWS 55678 LINE 1S-25	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	892.59		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: IRON POST SET 3km SOUTH OF ELKO AND 1.2km SOUTH EAST OF CNRL SAWMILL IN ELKO. THE POST IS SITUATED 50m SOUTH EAST OF GAS PIPELINE AND CNRL LOGGING ROAD AND IS 20.5m SOUTH OF THE SAID GAS PIPE LINE.

LOCATION:





A.B.MIKES 4-4-79

SURVEYOR _____ **DATE** _____ **FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH**

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

NO.: 78-40A

STATION NAME	78-40A				
MAP SHEET	82-G-6				
PROVINCE	B.C.	**DATE**	4-4-79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 15 41.515		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	115 04 45.129		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 458 085.99		
FIELD BOOK NO.		**UTM EASTINGS**	639 755.58		
AIR PHOTO NO.	NWS 56678 LINE 1S-25	**ZONE**	11		
INSTRUMENT	JMR - 1	**ELEVATIONS**	1193.04		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: IRON POST LOCATED 3.2km south EAST OF ELKO AND 1.5km SOUTH EAST OF CNRL SAW MILL. THE POST WAS PLANTED ON THE HIGH POINT OPPOSITE OF THE SHARP BEND OF THE ELK RIVER. THE POINT CAN BE REACHED BY THE LIGHT VEHICLE FROM THE GRAVEL ROAD ON THE EAST SIDE OF THE ELK RIVER.

LOCATION: THE MONUMENT HAS ROCK CAIRN 0.5m HIGH.

SURVEYOR A.B.MIKES **DATE** 4-4-79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

NO.: 78-41

STATION NAME	78-41				
MAP SHEET	82-G-7				
PROVINCE	B.C.	**DATE**	4-4-79		
TYPE OF SURVEY	I.S.S. IRON POST	**LATITUDE**	49 13 53.025		
MONUMENT TYPE	JUNE 1978	**LONGTITUDE**	114 37 41.623		
DATE PLANTED		**UTM NORTHINGS**	5 455 667.88		
FIELD BOOK NO.	N.W.S.55678 LINE 7S-165	**UTM EASTINGS**	672 670.66		
AIR PHOTO NO.	ISS FERRANTI MARK 1	**ZONE**	11		
INSTRUMENT		**ELEVATIONS**	2380.15		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: ROCK CAIRN OVER THE IRON PIN LOCATED ON THE CENTRE PEAK OF THE PAYSOO RIDGE IN THE McDONALD RANGE. ACCESSABLE BY THE HELICOPTER ONLY.

LOCATION:

SURVEYOR A.B. MIKES

DATE 4-4-79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

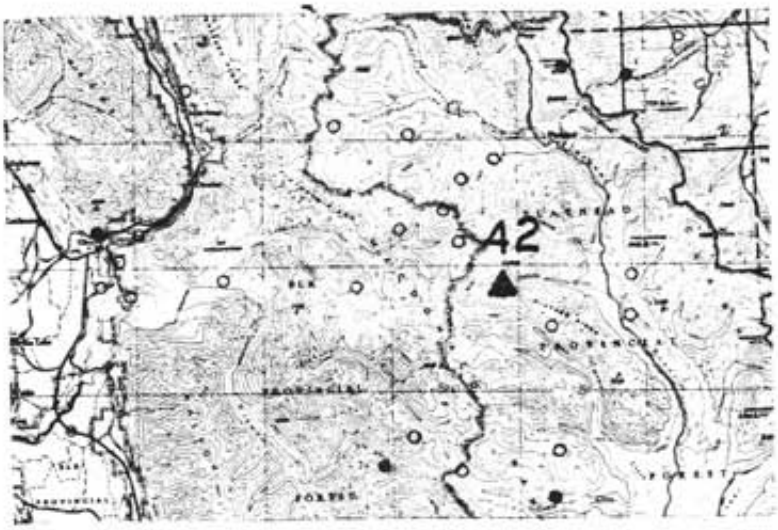
NAME: C.N.R.L.

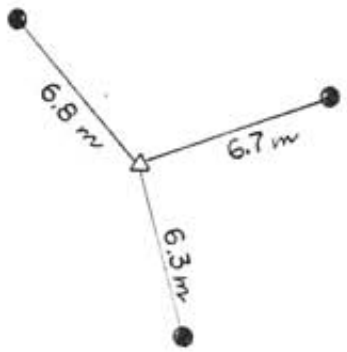
NO.: 78-42

STATION NAME	78-42				
MAP SHEET	82-G-7				
PROVINCE	B.C.	**DATE**	4-4-79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 15 33.238		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 41 22.420		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 458 623.90		
FIELD BOOK NO.		**UTM EASTINGS**	668 111.29		
AIR PHOTO NO.	NWS 55678 LINE 6S-120	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	1620.10		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: THE POINT IS SITUATED ON THE SOUTH LINE OF THE CNRL LODGEPOLE-FLATHEAD LOGGING ROAD 1.8km SOUTH WEST OF THE TRIGONOMETRIC STATION MCLACHE IN THE BORDER RANGE IN THE FLATHEAD PROVINCIAL FOREST. THE MONUMENT IS 200km SOUTH OF THE ROAD.

LOCATION:





A.B.MIKES 4-4-79

SURVEYOR _____ **DATE** _____

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD

SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

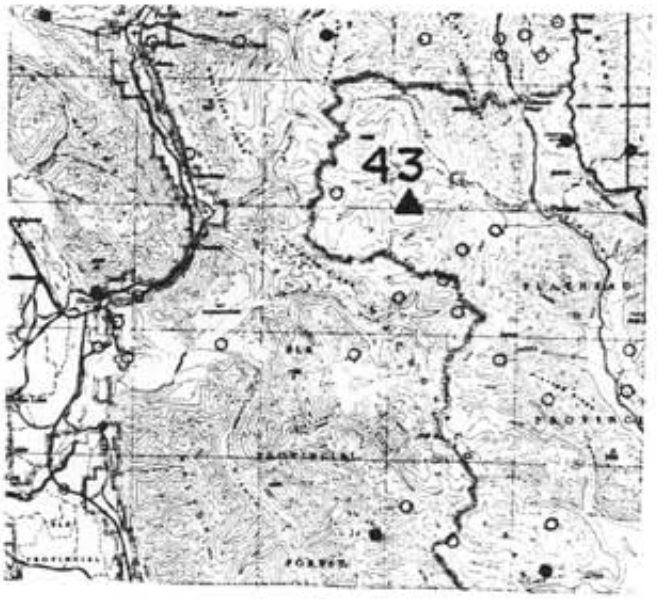
NO.: 78-43

STATION NAME	78-43				
MAP SHEET	82-G-7				
PROVINCE	B.C.	**DATE**	4-4-79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 21 59.811		
MONUMENT TYPE	RON POST	**LONGTITUDE**	114 46 44.899		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 470 367.40		
FIELD BOOK NO.		**UTM EASTINGS**	661 242.89		
AIR PHOTO NO.	NWS55678 LINE 5S-44	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	2007.22		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: IRON POST LOCATED 2km SOUTH OF FLATHEAD RIVER 7km NORTH OF THE C.N.R.L. MORRICEY - LODGEPOLE LOGGING ROAD AND 11.5km WEST OF THE FLATHEAD LOCALITY.

THIS POINT IS ACCESSABLE FROM THE HELICOPTER ONLY.

LOCATION:



A.B. MIKES 4-4-79

SURVEYOR _____ **DATE** _____

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH SEE OTHER SIDE

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

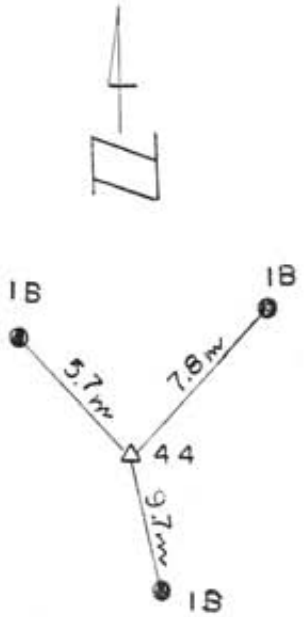
NAME: C.N.R.L.

NO.: 78-44

STATION NAME	78-44				
MAP SHEET	78-G-7				
PROVINCE	B.C.	**DATE**	4-4-79		
TYPE OF SURVEY	IRON POST	**LATITUDE**	49 20 55.444		
MONUMENT TYPE	JUNE 1978	**LONGTITUDE**	114 40 49.711		
DATE PLANTED		**UTM NORTHINGS**	5 468 592.94		
FIELD BOOK NO.	NWS 55678 LINE 7S-118	**UTM EASTINGS**	668 466.81		
AIR PHOTO NO.	JMR-1	**ZONE**	11		
INSTRUMENT		**ELEVATIONS**	1556.55		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: IRON PIN SITUATED 2km SOUTH EAST OF MCLATCHIE TRIBUTARY TO THE FLATHEAD RIVER 4.5km WEST OF FLATHEAD LOCALITY AND 80m EAST OF THE CNRL LODGEPOLE FLATHEAD LOGGING ROAD.

LOCATION:



SURVEYOR A.B.MIKES **DATE** 4-4-79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

NO.: 78-45

STATION NAME	78-45				
MAP SHEET	82-G-7				
PROVINCE	B.C.	**DATE**	4-4-79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 16 25.177		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 59 13.758		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 459 608.42		
FIELD BOOK NO.		**UTM EASTINGS**	646 416.03		
AIR PHOTO NO.	NWS56678 LINE 3N-123	**ZONE**	11		
INSTRUMENT		**ELEVATIONS**	1156.82		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: IRON PIN COVERED BY THE 0.8 HIGH ROCK CAIRN SITUATED ON THE FLAT ROCK BENCH 1.5km SOUTH OF MOUNT BROADWOOD, 0.8km NORTH OF WIGWAM RIVER AND LODGEPOLE CREEK CONVERGENCE AND 11 km EAST OF ELKO. POINT ACCESSABLE FROM THE HELICOPTER OR ON THE FOOT OF THE LOGGING ROAD.

LOCATION:

SURVEYOR A.B.MIKES

DATE 4-4-79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH SEE OTHER SIDE

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

NO.: 78-46

STATION NAME	78-46				
MAP SHEET	82-G-7				
PROVINCE	B.C.	**DATE**	4-4-79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 18 21.711		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 47 36.114		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 463 600.22		
FIELD BOOK NO.		**UTM EASTINGS**	660 406.99		
AIR PHOTO NO.	NWS 55678 LINE 55-48	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	1967.63		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: MONUMENT LOCATED ON THE TOP OF THE SOUTH END OF THE FLATHEAD RIDGE IN THE MACDONALD RANGE. THE POINT IS 1.5km NORTH OF C.N.R.L. LODGEPOLE - HARVEY CREEK LOGGING ROAD, 22.5km SOUTH EAST OF MORRISSEY AND 7.5km NORTH EAST OF OVERFOLD MOUNTAIN. THE MONUMENT IS PROTECTED BY THE ROCK CAIRN.

LOCATION:

SURVEYOR A.B.MIKES

DATE 4-4-79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

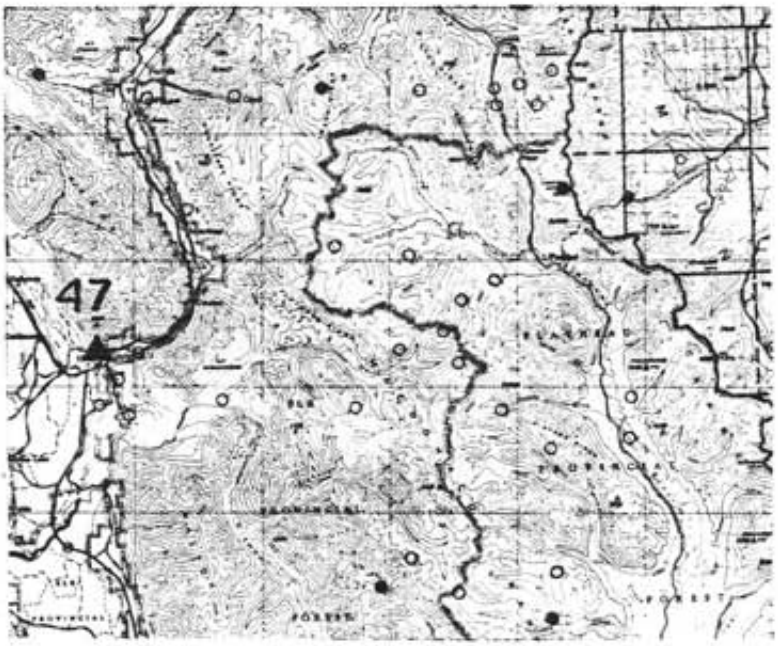
NAME: C.N.R.L.

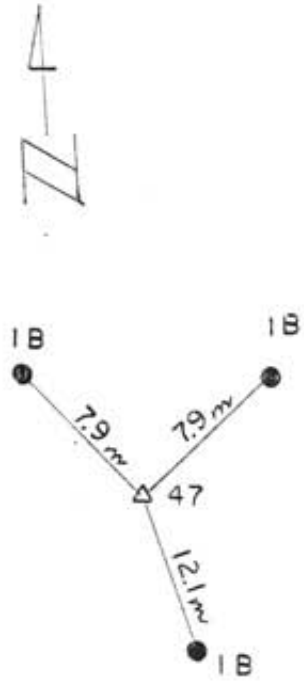
NO.: 78-47

STATION NAME	78-47				
MAP SHEET	82-G-6				
PROVINCE	B.C.	**DATE**	4-4-79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 18 30.705		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	115 07 19.152		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 463 232.08		
FIELD BOOK NO.		**UTM EASTINGS**	636 512.97		
AIR PHOTO NO.	NWS 56678 LINE 1S-23	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	1062.7		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: IRON POST PLANTED ON THE SMALL ROUNDED HILL 1.2km NORTH EAST OF ELKO AND 0.7km NORTH WEST OF OLD SAWMILL AND 0.2km NORTH OF CP RAILWAY.

LOCATION:





SURVEYOR A.B.MIKES **DATE** 4-4-79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD

SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

NO.: 78-47A

STATION NAME	78-47A				
MAP SHEET	82-G-6				
PROVINCE	B.C.	**DATE**	4-4-79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 17 17.458		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	115 05 41.632		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 461 019.64		
FIELD BOOK NO.		**UTM EASTINGS**	638 538.99		
AIR PHOTO NO.	NWS 55678 LINE 1S-25	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	1186.24		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: MONUMENT LOCATED ON THE HIGH ROCKY TERRACE 1.5km SOUTH EAST OF ELKO, 0.5km EAST OF THE HYDROELECTRIC POWER STATION AND 1.5km WEST OF THE SILVER SPRING LAKE. THE POINT IS PROTECTED BY THE ROCK CAIRN 0.8m HIGH.

LOCATION:

SURVEYOR A.B.MIKES **DATE** 4-4-79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

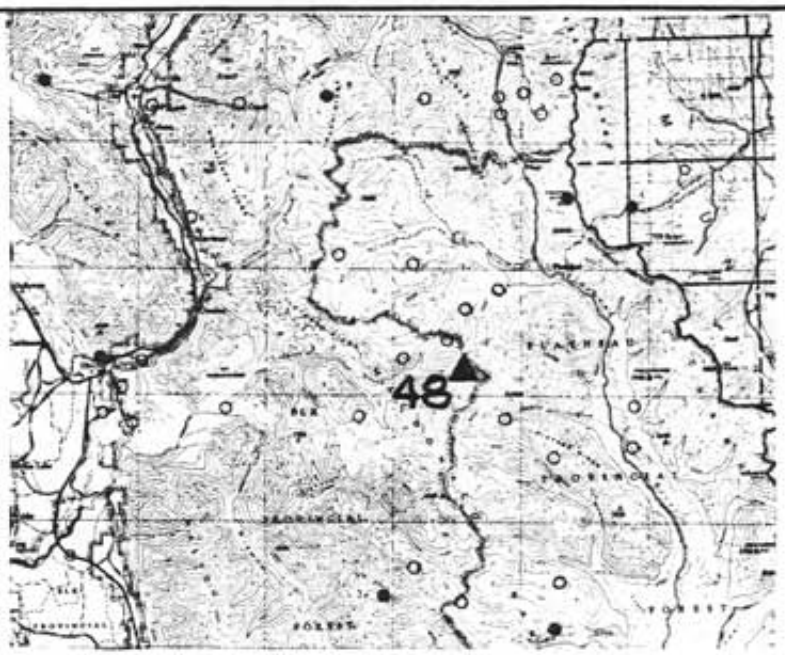
NAME: C.N.R.L.

NO.: 78-48

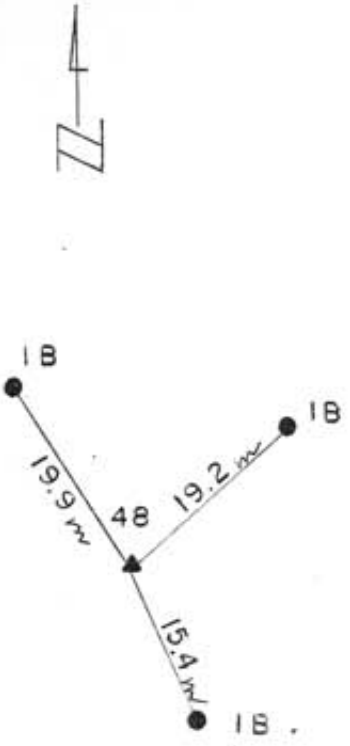
STATION NAME	78-48				
MAP SHEET	82-G-7				
PROVINCE	B.C.	**DATE**	4-4-1979		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 17 34.668		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 43 37.158		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 462 290.74		
FIELD BOOK NO.		**UTM EASTINGS**	665 275.45		
AIR PHOTO NO.	NWS 55678 LINE 6S-120	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	1680.18		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: IRON POST LOCATED ON THE FLAT LANDING 200m PAST THE HIGHEST POINT ON THE LODGE POLE - HARVEY CREEK ROAD AND 20m SOUTH OF THE BEND IN THE SIAD ROAD. ACCESSABLE BY TRUCK.

LOCATION:



A.B. MIKES 4-4-79



SURVEYOR _____ **DATE** _____

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD

SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

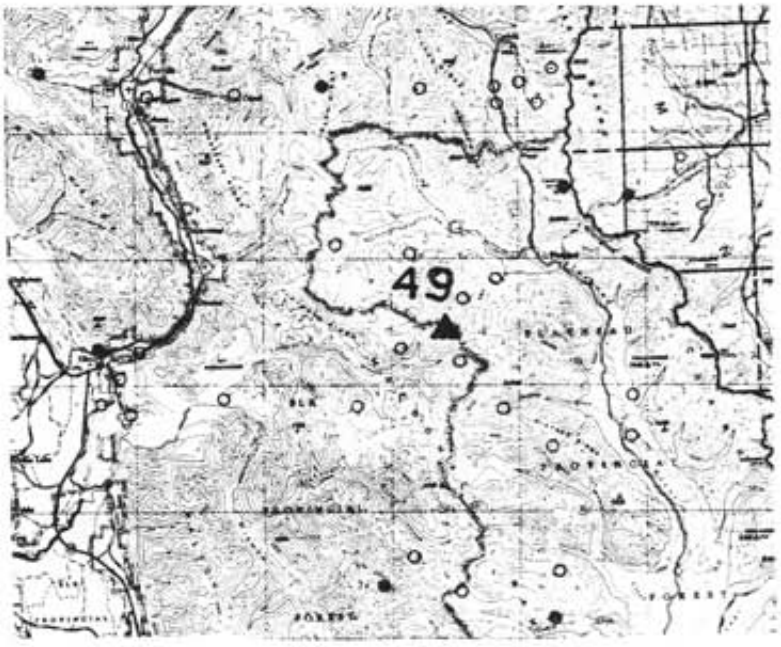
NAME: C.N.R.L.

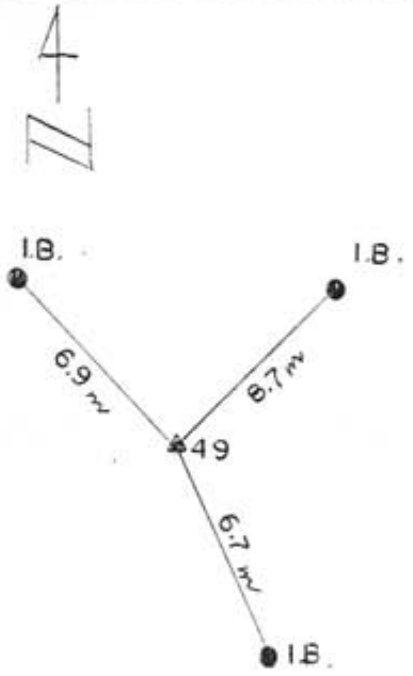
NO.: 78-49

STATION NAME	78-49				
MAP SHEET	82-G-7				
PROVINCE	B.C.	**DATE**	4/4/79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 18 41.354		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 44 41.908		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	54 643 10.63		
FIELD BOOK NO.		**UTM EASTINGS**	663 906.27		
AIR PHOTO NO.	N.W.S. 56678 Line 6S 48	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	1843.43		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: Iron pin located on the logging road 4.5 km from Lodgepole Creek, 3.0 km from McLotchie Creek and 2 km east of Faisey Creek.

LOCATION:





SURVEYOR A.B. MIKES **DATE** 4/4/79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH SEE OTHER SIDE

SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

NO.: 78-50

STATION NAME	78-50				
MAP SHEET	82-G-9				
PROVINCE	B.C.	DATE	4/4/1979		
TYPE OF SURVEY	I.S.S.	LATITUDE	48-15 48.607		
MONUMENT TYPE	IRON POST	LONGTITUDE	113 50 47.964		
DATE PLANTED	JUNE 1978	UTM NORTHINGS	5458760.46		
FIELD BOOK NO.		UTM EASTINGS	656667.98		
AIR PHOTO NO.	N.W.S. 55078 Line 4N-50	ZONE	11		
INSTRUMENT	I.S.S.FERRANTI MARK 1	ELEVATIONS	1966.9		
		LEVELING METHOD	I.S.S		

DESCRIPTION: IRON POST LOCATED ON THE SMALL LANDING IN THE CIRQUE 1 KM EAST OF WINDFALL MOUNTAIN.

LOCATION:

SURVEYOR A.B. MIKES DATE 4/4/1979

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH SEE OTHER SIDE

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

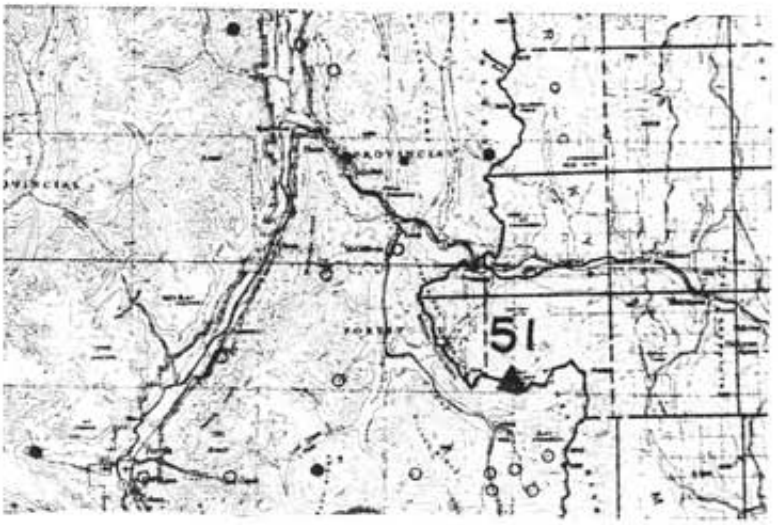
NAME: C.N.R.L.

NO.: 78-51

STATION NAME	78-51				
MAP SHEET	82-G-10				
PROVINCE	ALBERTA.	**DATE**	4-4-79		
TYPE OF SURVEY	I.S.S.	**LATITUDE**	49 33 15.589		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 39 34.158		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 491 494.00		
FIELD BOOK NO.		**UTM EASTINGS**	669 281.08		
AIR PHOTO NO.	NWS 55678 LINE 7S-154	**ZONE**	11		
INSTRUMENT	1.S.S.Ferrant MARK 1	**ELEVATIONS**	1920.93		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: IRON POST LOCATED 2.2Km NORTH WEST OF MOUNT PTOLEMY AND 1.8Km EAST OF PTOLEMY PASS.

LOCATION:



SURVEYOR A.B. MIKES **DATE** 4-479

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH
SEE OTHER SIDE

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

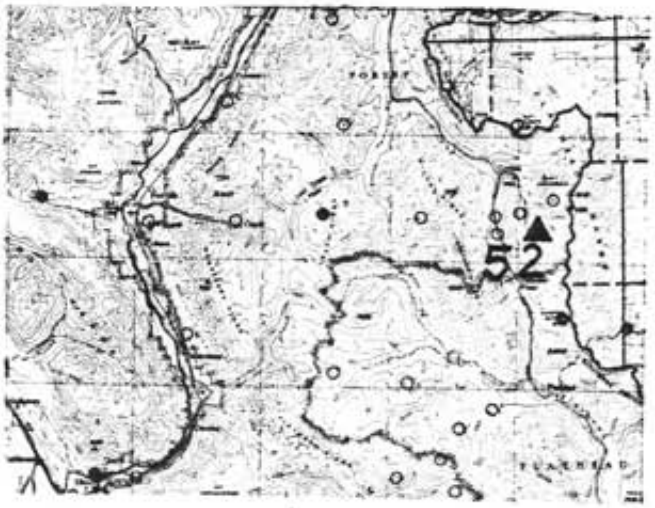
NAME: C.N.R.L.

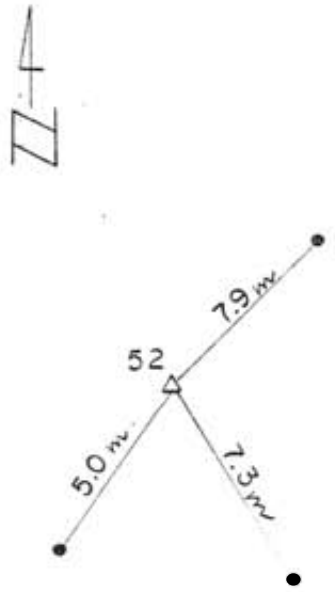
NO.: 78-52

STATION NAME	78-52				
MAP SHEET	82-G-7				
PROVINCE	B.C.	DATE	4.4.79		
TYPE OF SURVEY	DOPPLER	LATITUDE	49 28 37.841		
MONUMENT TYPE	IRON POST	LONGTITUDE	114 38 16.790		
DATE PLANTED	JUNE 1978	UTM NORTHINGS	5 482 966.26		
FIELD BOOK NO.		UTM EASTINGS	671 104.48		
AIR PHOTO NO.	N.W.S. 55678 Line 2S-156	ZONE	11		
INSTRUMENT	JMR-1	ELEVATIONS	1778.60		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: Iron post located in the swamp 2 km east of Coal Mountain, 3 km west of Mount Durrah, 3.1 km northeast of Flathead Pass and 2.8 km east of Michel Creek. The point is accessible by the helicopter only.

LOCATION:





SURVEYOR A.B. MIKES DATE 4/4/79 FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

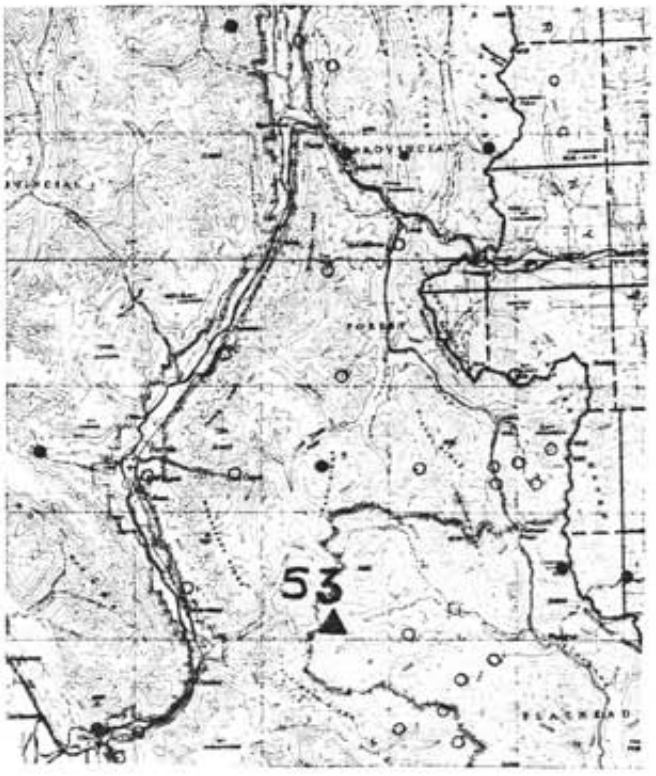
NAME: C.N.R.L.

NO.: 78-53

STATION NAME	78-53				
MAP SHEET	82-G-7				
PROVINCE	B.C.	**DATE**	4-4-79		
TYPE OF SURVEY	I.S.S.	**LATITUDE**	49 24 02.644		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 50 58.638		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5474009.57		
FIELD BOOK NO.		**UTM EASTINGS**	656017.82		
AIR PHOTO NO.	NWS 55678 LINE 4N-55	**ZONE**	11		
INSTRUMENT	I.S.S.Ferrant MARK 1	**ELEVATIONS**	1928.71		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: IRON POST LOCATED ON THE PIPE LINE RIGHT OF WAY 5 MILES EAST OF THE FLATHEAD RIDGE IN THE ELK PROVINCIAL FOREST.

LOCATION:



SURVEYOR A.B. MIKES **DATE** 4-4-79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

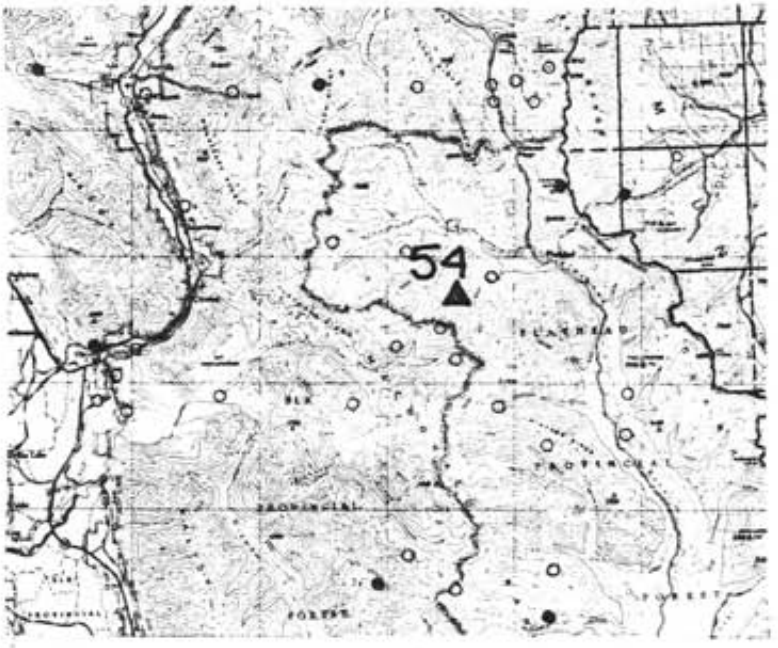
NAME: C.N.R.L.

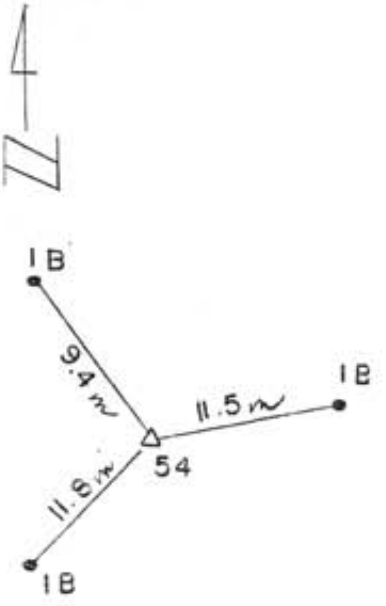
NO.: 78-54

STATION NAME	78-54				
MAP SHEET	78-G-7				
PROVINCE	B.C.	**DATE**	4/4/79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 20 55.747		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 42 48.374		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 468 529.25		
FIELD BOOK NO.		**UTM EASTINGS**	666 072.69		
AIR PHOTO NO.	N.W.S. 55678 Line 6S-118	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	2029.16		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: Iron pin situated on the road in the MacDonald range, 4.5 km south of Flathead River, 7.8 km southwest of Flathead locality, 2 km west of McLatchie Creek and 2 km east of Fosie Creek.

LOCATION:





SURVEYOR A.B. MIKES **DATE** 4/4/79 **FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH**

MONUMENT RECORD

SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

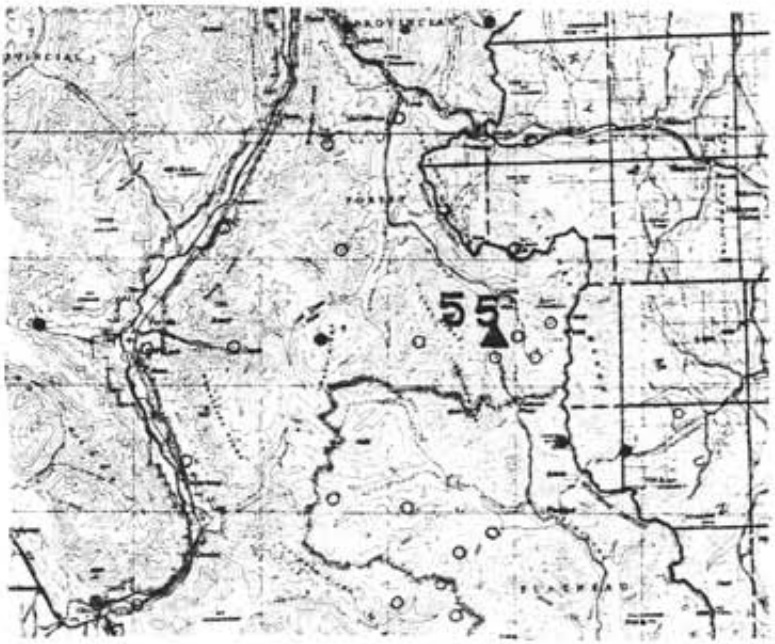
NAME: C.N.R.L.

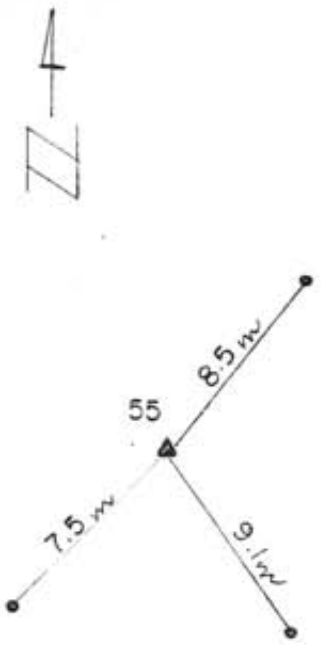
NO.: 78-55

STATION NAME	78-55				
MAP SHEET	82-G-7				
PROVINCE	B.C.	**DATE**	4/4/79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 30 04.594		
MONUMENT TYPE	Iron Post	**LONGTITUDE**	114 40 51.805		
DATE PLANTED	June 1978	**UTM NORTHINGS**	5 485 548.11		
FIELD BOOK NO.		**UTM EASTINGS**	667 903.01		
AIR PHOTO NO.	N.W.S. 55678 Line 6S-113	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	1518.50		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: Iron post located on the east side of the Michel Creek, 1.5 km west of the Coal Mountain and 2.5 km south of old Corbin locality.

LOCATION:





SURVEYOR A.B. MIKES **DATE** 4/4/79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH
SEE OTHER SIDE

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

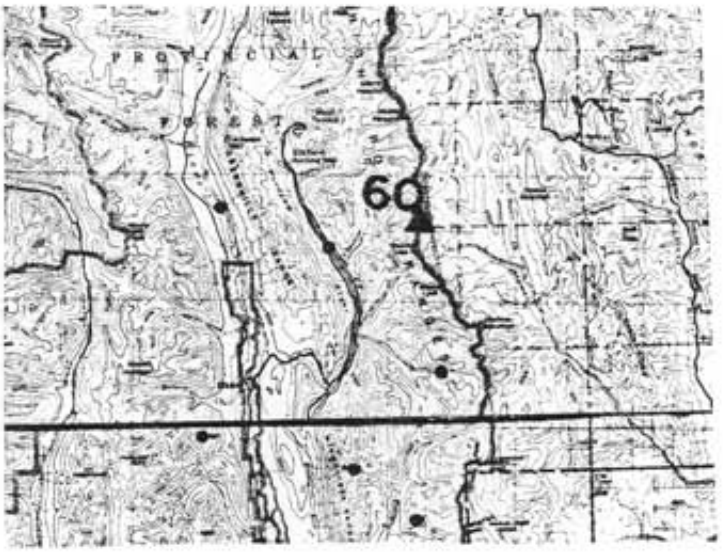
NAME: C.N.R.L.

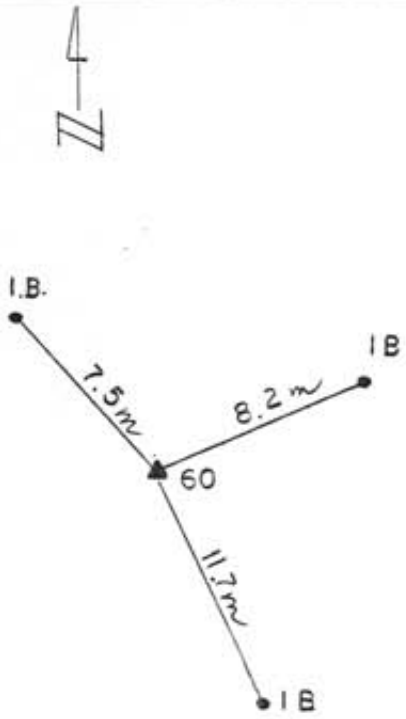
NO.: 78-60

STATION NAME	78-60				
MAP SHEET	82-J2				
PROVINCE	B.C.	**DATE**	29-3-79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	50 08 24.108		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 44 06.593		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 556 437.11		
FIELD BOOK NO.		**UTM EASTINGS**	661 840.02		
AIR PHOTO NO.	N.W.S.	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	2334.7		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: IRON POST COVERED BY THE 0.6m CAIRN, LOCATED 2km NORTH EAST OF THE MOUNT GRASS AND 12km SOUTH EAST FROM FORDING COAL. THE POINT IS ACCESSABLE BY HELICOPTER BY FOLLOWING THE ELK RIVER TO CHAUNEEY CREEK, THEN CONTINUING TO FOLLOW THE CHAUNEEY CREEK FOR 4km TO A SMALL CREEK BRANCHING TO THE EAST.

LOCATION: THE IRON POST IS IN THE CENTRE OF THE SMALL LANDING.





A.B. MIKES — 29-3-79

SURVEYOR — **DATE**

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH SEE OTHER SIDE

SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

NO.: 78-62

STATION NAME	78-62				
MAP SHEET	82-G				
PROVINCE	ALBERTA	DATE	4/41/79		
TYPE OF SURVEY	DOPPLER	LATITUDE	49-24-08-32		
MONUMENT TYPE	IRON POST	LONGTITUDE	114 31 28.172		
DATE PLANTED	JUNE 1978	UTM NORTHINGS	5474908.19		
FIELD BOOK NO.		UTM EASTINGS	679599.39		
AIR PHOTO NO.	N.W.S. 55678 Line 8N 174	ZONE	11		
INSTRUMENT	JMR-1	ELEVATIONS	1563.8		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: IRON POST PLANTED ON THE SWITCHBACK IN THE LOGGING ROAD 5 km EAST OF NORTH KOOTENAY PASS AND 4.5 km NORTHEAST OF HOLLEBEKE MOUNTAIN.

LOCATION:

SURVEYOR A.B. MIKES

DATE

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH SEE OTHER SIDE

MONUMENT RECORD

SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

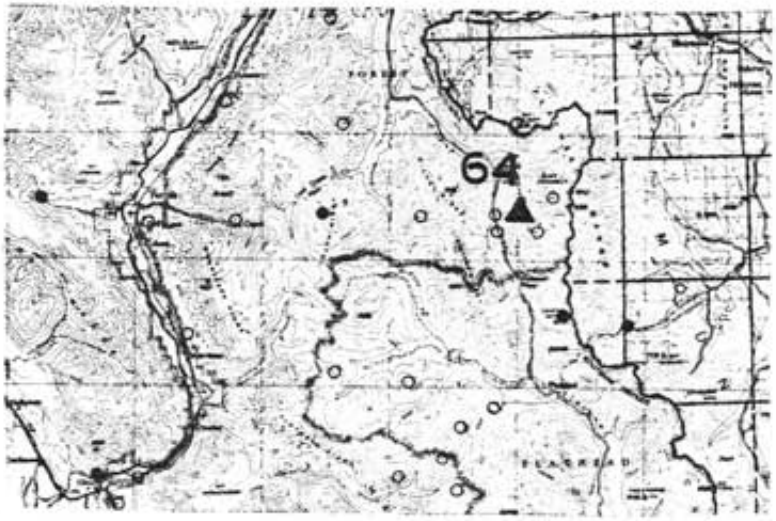
PROJECT: C.N.R.L.

NAME: C.N.R.L.
NO.: 78-64

STATION NAME	78-64				
MAP SHEET	82-G-7				
PROVINCE	B.C.	**DATE**	4/4/1979		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 29 15.412		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 38 50.352		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 484 105.24		
FIELD BOOK NO.		**UTM EASTINGS**	670 392.96		
AIR PHOTO NO.	N.W.S. 55678 Line 7S 156	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	1696.08		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: Iron post placed 1.0 km northeast of Coal Mountain, 0.5 km west of Corbin Creek 2.2 km south of the old Corbin locality. This point is accessible by truck or helicopter.

LOCATION:



SURVEYOR A.B. MIKES **DATE** 4/4/79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH
SEE OTHER SIDE

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L

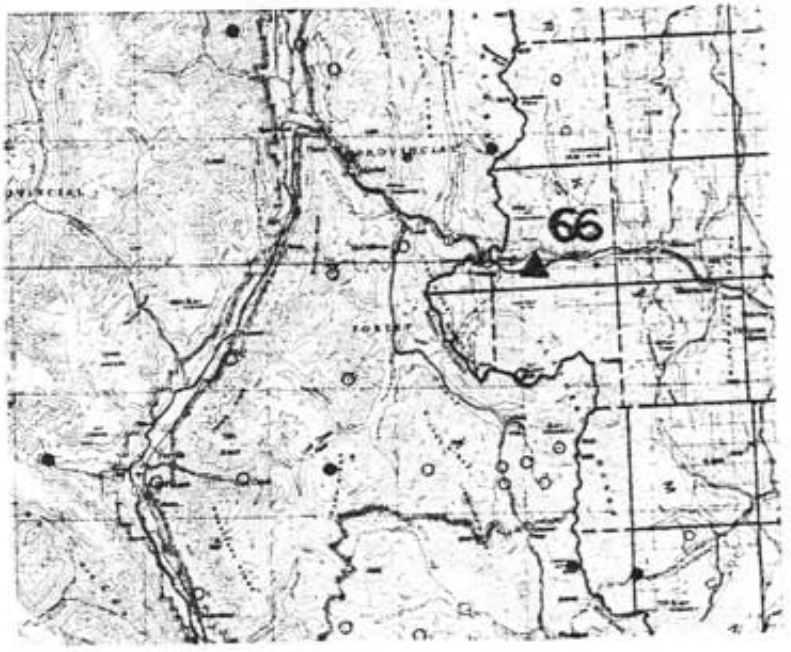
NAME: C.N.R.L.

NO.: 78-66

STATION NAME	78-66				
MAP SHEET	82-G-10				
PROVINCE	ALBERTA.	**DATE**	4-4-79		
TYPE OF SURVEY	I.S.S.	**LATITUDE**	49 37 40.087		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 37 59.322		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 499 720.81		
FIELD BOOK NO.		**UTM EASTINGS**	670 929.15		
AIR PHOTO NO.	NWS 55678 LINE 7S-151	**ZONE**	11		
INSTRUMENT	I.S.S. FERRANTI MARK 1	**ELEVATIONS**	1454.94		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: IRON POST LOCATED ON THE HIGH ROUND PEAK O.SKm SOUTH OF CROWSNEST LAKE.

LOCATION:



SURVEYOR A.B. MIKES

DATE

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH SEE OTHER SIDE

MONUMENT RECORD

SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

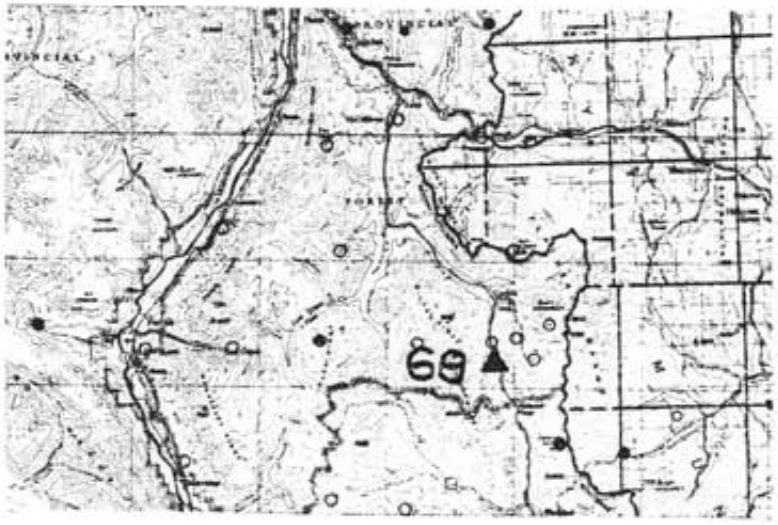
PROJECT: C.N.R.L.

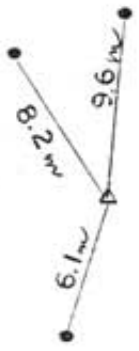
NAME: C.N.R.L.
NO.: 78-69

STATION NAME	78-69				
MAP SHEET	82-G-7				
PROVINCE	B.C.	**DATE**	4/4/79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 28 18.562		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 40 34.160		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 482 285.00		
FIELD BOOK NO.		**UTM EASTINGS**	668 358.87		
AIR PHOTO NO.	N.W.S. 55678 Line 6S-113	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	1578.66		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: Iron Post 20 m east of Michel Creek, 1.0 km southwest of Coal Mountain and 4.5 km south of old Corbin locality, accessible by truck.

LOCATION:





SURVEYOR A.B. MIKES **DATE** 4/4/79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH
SEE OTHER SIDE

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

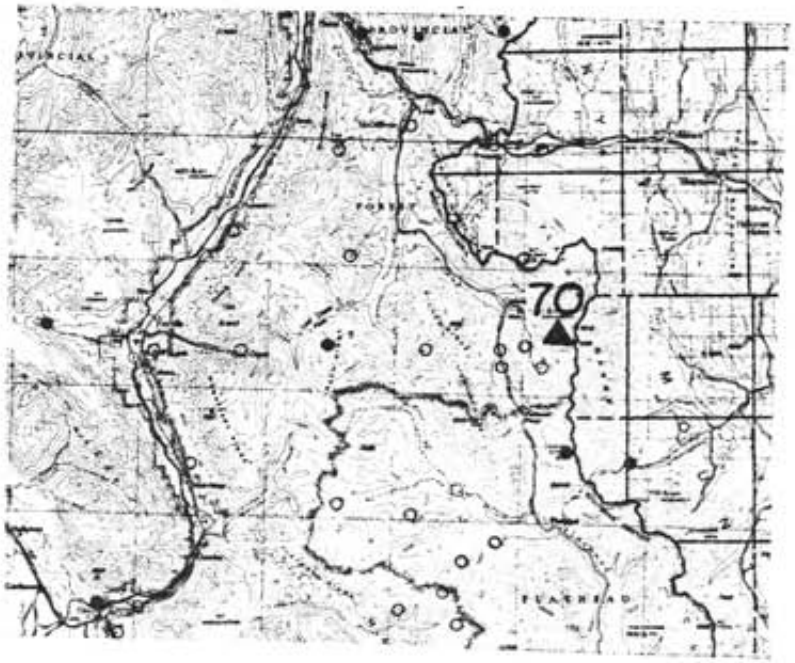
NAME: C.N.R.L.

NO.: 78-70

STATION NAME	78-70				
MAP SHEET	82-G-7				
PROVINCE	B.C.	**DATE**	4-4-79		
TYPE OF SURVEY	82-G-7	**LATITUDE**	49 29 46.639		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 3731.272		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5485 119.38		
FIELD BOOK NO.		**UTM EASTINGS**	671 953.30		
AIR PHOTO NO.	NWS 55678 LINE 7S 156	**ZONE**	11		
INSTRUMENT	T.S.S. FERRANTI MARK 1	**ELEVATIONS**	1940.55		
		LEVELING METHOD	T.S.S.		

DESCRIPTION: IRON POST SITUATED 3Km EAST OF COAL MOUNTAIN 1.8Km WEST OF MOUNT PENGELLY IN THE FLATHEAD RANGE. ACCESSIBLE IN THE HELICOPTER ONLY.

LOCATION:



SURVEYOR A.B. MIKES

DATE

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH SEE OTHER SIDE

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

NAME: C.N.R.L.

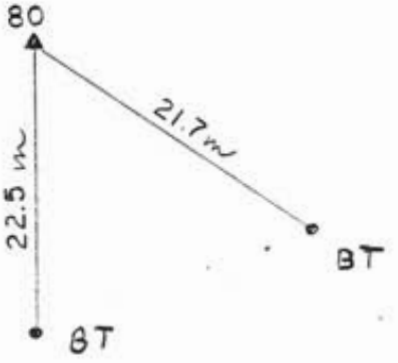
NO.: 78-80

STATION NAME	78-80				
MAP SHEET	82-G-6				
PROVINCE	B.C.	**DATE**	4/4/1978		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 18 24.509		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	115 05 03.780		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 463 109.39		
FIELD BOOK NO.		**UTM EASTINGS**	639 251.06		
AIR PHOTO NO.	N.W.S. 56678 Line 15-23	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	917.10		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: Iron post planted in the large grassy field 0.5 km south from the CP rail bridge crossing the Elk River, 2.5 km north east of Elko and 0.3 km south of the Elko-Fernie Highway No. 3. Accessibility by truck must have permission from the owner.

LOCATION:

82-G-4



SURVEYOR A.B. MIKES **DATE** 4/4/79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

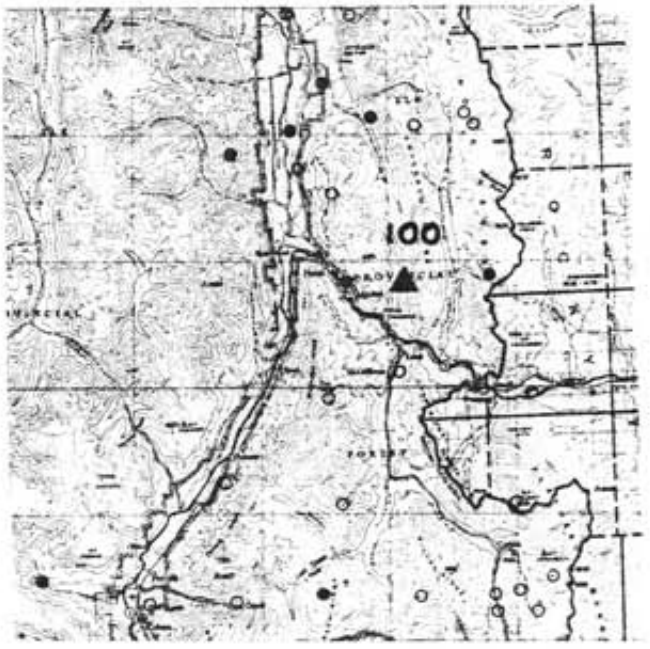
NAME: C.N.R.L.

NO.: 78-100

STATION NAME	78-100				
MAP SHEET	82-G-10				
PROVINCE	B.C. .	**DATE**	4/4/1979		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 42 42.393		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 46 21.784		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	55 508 747.73		
FIELD BOOK NO.		**UTM EASTINGS**	660 573.70		
AIR PHOTO NO.	N.W.S. 55678 Line 6S 104	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	1392.47		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: Iron post located 200 m west of the small dyke cross the Erickson Creek, 2.3 km west of the Mount Erickson and 6.5 km from Michel along the Michel-Erickson Creek logging road.

LOCATION:



SURVEYOR A.B. MIKES **DATE** 4/4/1979

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH SEE OTHER SIDE

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

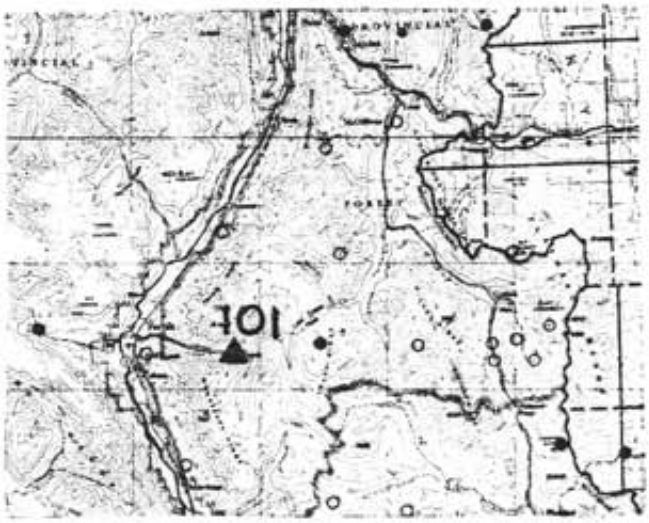
NAME: C.N.R.L.

NO.: 78-101

STATION NAME	78-101				
MAP SHEET	82-G-7				
PROVINCE	B.C.	**DATE**	4-4-79		
TYPE OF SURVEY	I.S.S.	**LATITUDE**	49 29 14.987		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 57 59.814		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 483 418.92		
FIELD BOOK NO.		**UTM EASTINGS**	647 269.96		
AIR PHOTO NO.	NWS 55678 LINE 3N 133	**ZONE**	11		
INSTRUMENT	I.S.S. FERRANTI MARK 1	**ELEVATIONS**	11 60.38		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: IRON POST SITUATED 6Km EAST OF FERNIE. ON THE NORTH SIDE OF THE COAL CREEK ROAD 160m WEST OF THE WOODEN BRIDGE CROSSINGTHE COAL CREEK IN THE EAST POST OF THE COAL CREEK LOCALITY.

LOCATION:



SURVEYOR A.B. MIKES **DATE** 4-4-79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH SEE OTHER SIDE

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

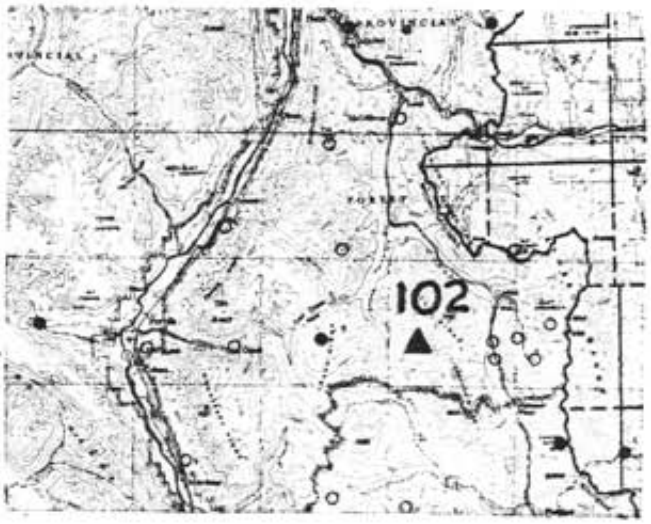
NAME: C.N.R.L.

NO.: 78-102

STATION NAME	78-102				
MAP SHEET	82-G-9				
PROVINCE	B.C.	**DATE**	4-4-79		
TYPE OF SURVEY	T.S.S.	**LATITUDE**	49 29 03.094		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 46 13.428		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 483 453.76		
FIELD BOOK NO.		**UTM EASTINGS**	661 491.04		
AIR PHOTO NO.	NWS 55678 LINE 6S-113	**ZONE**	11		
INSTRUMENT	T.S.S.FERRANTI MARK 1	**ELEVATIONS**	1654.75		
		LEVELING METHOD	T.S.S.		

DESCRIPTION: IRON POST SITUATED ON THE NORTH BANK OF THE SMALL CREEK IN THE MICHEL RIDGE 2Km NORTH OF LEACH CREEK AND 7Km EAST OF COAL MOUNTAIN.

LOCATION:



SURVEYOR A.B. MIKES **DATE** 4-4-78

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH SEE OTHER SIDE

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

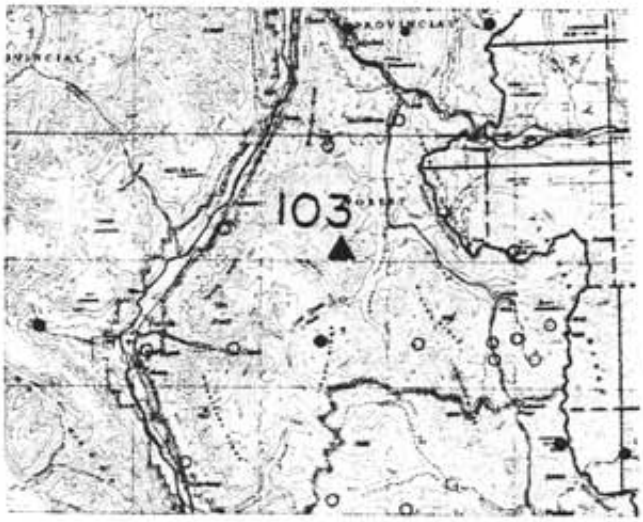
NAME: C.N.R.L.

NO.: 78-103

STATION NAME	78-103				
MAP SHEET	82-G-10				
PROVINCE	B.C.	**DATE**	4-4-79		
TYPE OF SURVEY	1.S.S.	**LATITUDE**	49 34 46.486		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 51 23.424		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 493 876.27		
FIELD BOOK NO.		**UTM EASTINGS**	654 952.58		
AIR PHOTO NO.	NWS 55678 LINE 4N 63	**ZONE**	11		
INSTRUMENT	I.S.S.Ferranti MARK 1	**ELEVATIONS**	2093.84		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: IRON POST LOCATED ON THE TOP OF SMALL PEAK 3.5Km NORTH WEST OF MARTEN AND LEACH CREEK CONVERGENCY AND 2.5Km (Leach) EAST OF MARTEN RIDGE. ACCESS BY THE HELICOPTER.

LOCATION:



SURVEYOR A.B. MIKES **DATE** 4-4-78

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH SEE OTHER SIDE

MONUMENT RECORD

SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

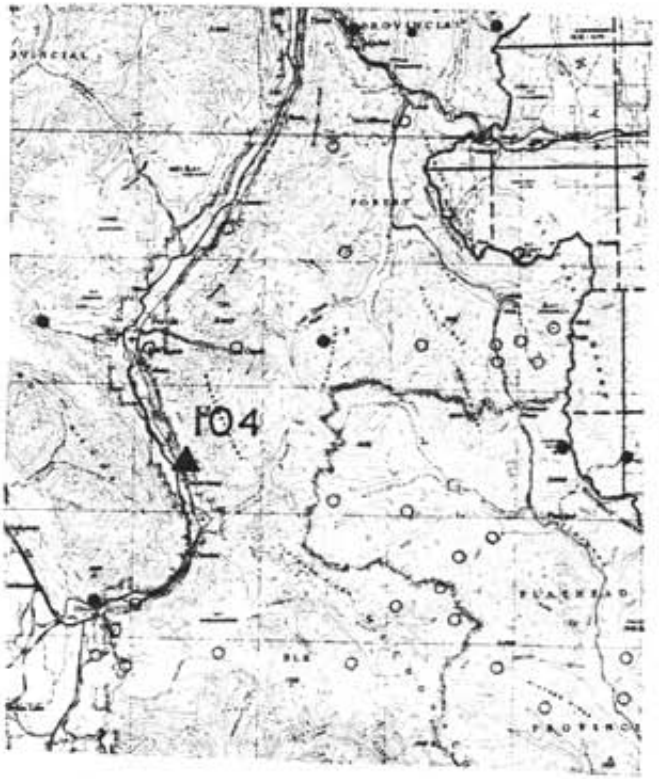
PROJECT: C.N.R.L.

NAME: C.N.R.L.
NO.: 78-104

STATION NAME	78-103				
MAP SHEET	82-G-6				
PROVINCE	B.C. .	**DATE**	4-4-78		
TYPE OF SURVEY	I.S.S.	**LATITUDE**	49 24 20.0469		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	115 01 42.9755		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5474192.18		
FIELD BOOK NO.		**UTM EASTINGS**	643 018.80		
AIR PHOTO NO.	NWS 55678 LINE 2N-7	**ZONE**	11		
INSTRUMENT	I.S.S.FERRANTI MARK 1	**ELEVATIONS**	954.21		
		LEVELING METHOD	I.S.S.		

DESCRIPTION: IRON POST ON THE WEST SIDE OF THE ELK RIVER 1.5Km NORTH MORRISSEY AND 50m EAST OF THE ELKO-SPARWOOD HIGHWAY No. 3.

LOCATION:



SURVEYOR A.B. MIKES **DATE** 4-4-79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH SEE OTHER SIDE

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

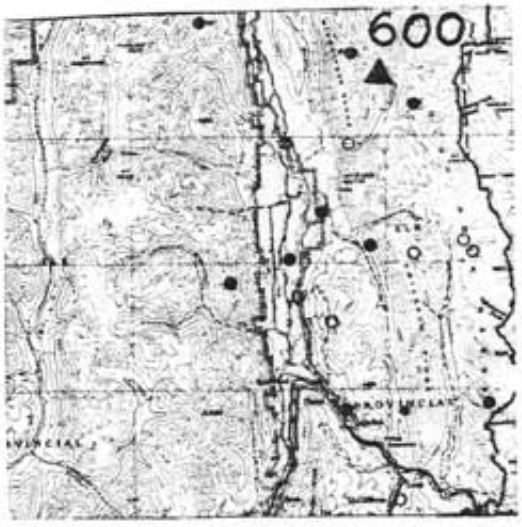
NAME: C.N.R.L.

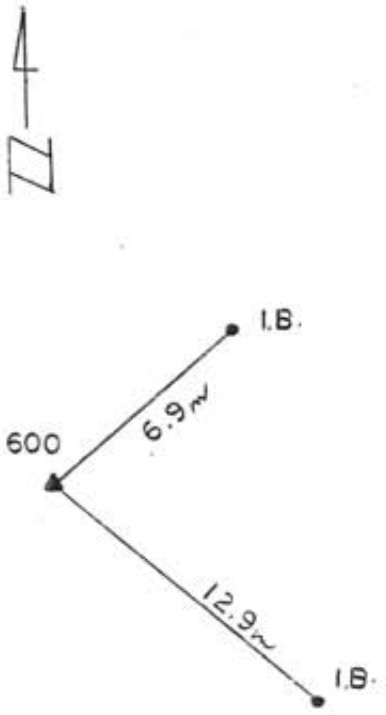
NO.: 78-600

STATION NAME	78-600				
MAP SHEET	82-G-15				
PROVINCE	B.C.	**DATE**	29-3-79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 56 49.247		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 47 01.388		
DATE PLANTED	JUNE 1978	**UTM NORTHINGS**	5 534 875.01		
FIELD BOOK NO.		**UTM EASTINGS**	659 007.33		
AIR PHOTO NO.	N.W.S.	**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	2181.0		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: IRON POST SET IN THE COAL SEAM 2.5km SOUTH EAST FROM MOUNT LYNE IN THE WISU KITSAK RANGE AND 3km WEST FROM THE HORSESHOE RIDGE. THE POINT CAN BE RE-OCCUPIED BY THE MOTOR VEHICLE FROM THE LINE CREEK ROAD AND IS 4km NORTH OF LINE CREEK AND SOUTH LINE CREEK TRIBUTORY.

LOCATION:





SURVEYOR A.B. MIKES **DATE** 29-3-79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH SEE OTHER SIDE

MONUMENT RECORD
SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

PROJECT: C.N.R.L.

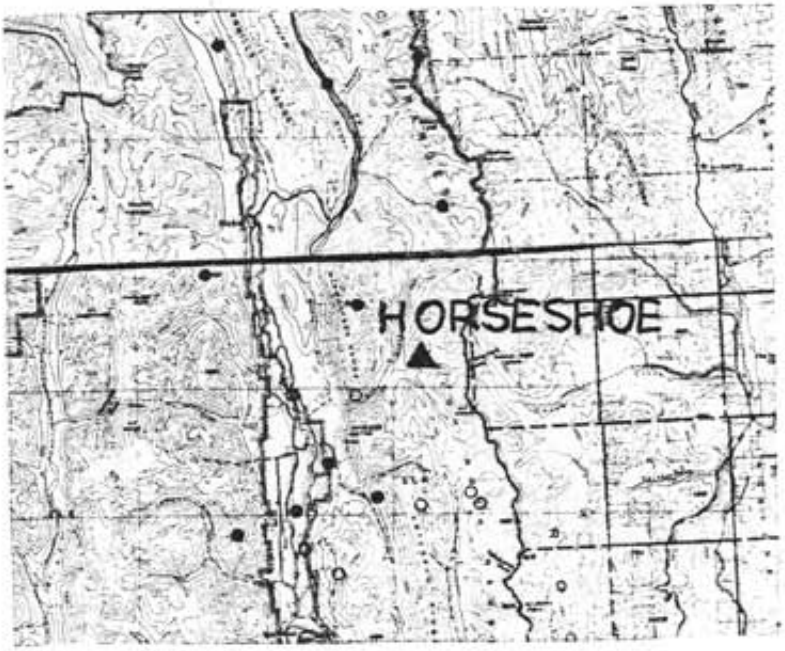
NAME: C.N.R.L.

NO.: HORSESHOE

STATION NAME	Horseshoe				
MAP SHEET	82-G-15				
PROVINCE	B.C.	**DATE**	2/4/79		
TYPE OF SURVEY	DOPPLER	**LATITUDE**	49 55 37.300		
MONUMENT TYPE	IRON POST	**LONGTITUDE**	114 44 34.200		
DATE PLANTED	MAY 1979	**UTM NORTHINGS**	5 532 740.96		
FIELD BOOK NO.		**UTM EASTINGS**	662 007.42		
AIR PHOTO NO.		**ZONE**	11		
INSTRUMENT	JMR-1	**ELEVATIONS**	2020.8		
		LEVELING METHOD	DOPPLER		

DESCRIPTION: Iron post 10 km south of the highest point on the Horseshoe Ridge, 20 km south-east of Sparwood and 3 km north east of the Line Creek and south Lone Creek convergency accessed by the helicopter.

LOCATION:



SURVEYOR A.B. MIKES **DATE** 2/4/79

FOR ADDITIONAL INFORMATION SKETCH AND PHOTOGRAPH SEE OTHER SIDE

"APPENDIX D"

STATION PICTURES

INTER-OFFICE CORRESPONDENCE

Date APRIL 24, 1979

To CROWS NEST RESOURCES LIMITED (C.N.R.L.)

From SHELL CANADA RESOURCES LIMITED
SURVEYING SECTION

Subject PHOTOGRAMETRIC MAPPING PROJECT (1978)
FERNIE - SPARWOOD AREA - S.E. BRITISH COLUMBIA

1. To facilitate evaluation of existing and potential coal reserves in the Fernie-Sparwood area, C.N.R.L. together with Shell Canada Resources Limited decided to map approxmately 165000 acres at a map scale of 1:5000 in an area roughly 50 miles north and 30 miles south of Sparwood, S.E. British Columbia. Approximately 30000 acres within this block was to be mapped at a scale of 1:2000. All mapping was to be produced using photogrametric techniques, as outlined on the flight-line index map; enclosure #1.

2. The contract was awarded to North West Survey Corporation (Yukon) Limited, Edmonton, Alberta, as a result of competition bidding with three other firms, and in accordance with specifications outlined by C.N.R.L. and Shell Canada Resources Limited; a copy of which is enclosed. To produce the photographs approximately 320 line-miles were flown using North West Survey aircraft equiped with a Wild RC-10 Camera. The films and prints were processed on the Kodak Versamat Processor.

   The photogrametric bridging was produced on the Wild A-8 Autograph with Cybernex Digitizer interfaced to a Nova II Computer System. The co-ordinates obtained were adjusted by the space-M adjustment program. Ground control was provided by Shell Canada Resources Limited as described in the Survey Control Report.

   The manuscipt compilation was produced on Wild B-8 and Galieo Stereo II plotting instruments.

3. North West Surveys produced approximately 64 Scribed map sheets at the 1:2000 scale, 68 scribed map sheets at the 1:5000 scale and a semi-controlled mosaic at 1:20,000 was produced of the entire area flown.

   The total cost of the work project was $368,000 including ground control surveys.

D.C. Poulsom

DCPbp

Attachment:

SCHEDULE A

SHELL CANADA RESOURCES LIMITED

on behalf of

CROWS NEST RESOURCES LIMITED

Request for Proposals

FOR

Aerial Photography, Aerotriangulation
and Topographic Mapping
in
The Crowsnest Pass - Fernie Areas
of British Columbia

Shell Canada Resources Limited
400 - 4th Avenue, S.W.,
Calgary, Alberta.

INDEX

Attachments:

1. Five 1:50,000 maps outlining the areas of concern.

2. General Specifications for Aerial Photography - 1978.

A. DESCRIPTION OF WORK

The work to be done under this contract consists generally of aerial photography, aerial triangulation, compilation and production of topographic maps in the Crowsnest Pass, Fernie areas of British Columbia.

The work includes the following:

1. Aerial Photograph suitable for the production of 1:5000 topographic maps with a 5 metre contour interval. The area to be covered by this photography is outlined in a solid black line on the attached 1:50,000 maps. (Refer to section 3 of the attached specifications).

2. Aerial Photography suitable for the production of 1:2000 topographic maps with a 2.5 metre contour interval. The areas to be covered by this photograph is outlined in — — — — — — — — — on the attached 1:50,000 maps (Refer to section 3 of the attached specifications).

3. Photogrammetric Mapping to a scale of 1:5000 with a five metre contour interval within the areas outlined by ▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪ on the attached 1:50,000 maps.

4. Photogrammetric Mapping to a scale of 1:2000 with a 2.5 metre contour interval within the areas outlined by — — — — — — — — — on the attached 1:50,000 maps.

5. Production of a semi-controlled photo mosaic at a scale of 1:20,000 from the aerial photographs.

6. Reprints of both scales of aerial photographs at soonest possible date.

NOTES:

1. Areas outlined in —— - —— - —— - —— on the attached 1:50,000 maps will not be mapped and should not be considered in your proposal except for aerial photography and 1:5000 mapping ground control requirements.

2. In areas where 1:2000 and 1:5000 mapping overlap, the 1:2000 mapping shall prevail - it should not be compiled twice. The 1:2000 maps should be photographically reduced, the odd contour interval eliminated and then made continuous with the 1:5000 mapping.

B. PROPOSALS:

Proposals are to include:

1. types of instrumentation.
2. proposed methodology.
3. proposed work schedule.
4. proposed subcontractors.
5. cost breakdown as per each item of the Description of Work.

Proposals must be returned to Shell Canada Resources Limited by ~~12:00 noon on May 15, 1978 addressed to:~~

Mr. D. Henderson,
Shell Centre - Rm. 2002,
400 - 4th Avenue, S.W.,
Calgary, Alberta T2P 0J4

C. OWNERSHIP

All data, materials, etc. resulting from the work, as well as all data and materials supplied to the contractor shall be the property of Shell. The contractor shall see that any data or materials used on his premises shall be properly safeguarded and he shall ship them properly identified and packaged to Shell at the end of the project or when instructed to do so.

Title to, any copyright in respect of air photo negatives, tracings, field notes, maps and other information deemed to be of use to Shell and forming part of the work covered by this agreement shall vest in Shell.

The contractor shall deliver to Shell such material and information in accordance with instructions issued by Shell.

D. FAULT IN WORK

Should Shell during the term of the project, discover work carried out by the contractor to be faulty and such faulty work is clearly the responsibility of the contractor, such work shall forthwith be remedied by the contractor at his own expense.

E. TECHNICAL SPECIFICATIONS

1. General

Each bidder shall submit proposals detailing methods and equipment to be used and work schedules to be followed for each project. The mapping cost for each project shall be broken down for each phase of the work, and a completion date for each project given.

The Inspector of all work done shall be the Manager of Surveying, Shell Canada Resources Limited, or his duly authorized representative. The Inspector shall, at any time during the process of the work, have access to the Contractor's premises and may examine any part of the work, materials or equipment. The Inspector may order re-execution of any work which is not, in his opinion, in accordance with these specifications or his instructions.

2. Ground Control

The establishment of additional control and the targeting of existing and additional control, shall be the responsibility of Shell Canada Resources Limited. The submitted proposal shall take into consideration and specify the control requirements only to satisfy the mapping requirements. The configuration of existing control and locations of additional control locations will be decided in mutual agreement with successful contractor and Shell.

3. Aerial Photography

The aerial photography shall be suitable for the production of topographic maps at scales of 1:5000 with 5 metre contours in the designated areas or 1:2000 scale with 2.5 metre contours in designated areas. (Note any area shall not be mapped at both scales if areas overlap the 1:2000 shall govern in these areas).

The aerial photography shall be carried out in conformance with the "General Specifications for Aerial Photography - 1978" as issued by Alberta Energy and Natural Resources, a copy of which is attached.

The photography for each project shall be flown in May or early June to achieve high contrast imagery.

Your submission for each project shall specify the proposed flying dates and scale(s) of photography to be used, and shall include a copy of the enclosed index with the proposed locations of flight lines for aerial photography covering the mapping areas added.

Aerial photography shall be obtained using a Category A standard wide angle survey camera with a normal focal length of 152 mm, on pancromatic film, Kodak 2405 or equivalent, exposed behind a minus blue filter excluding wavelengths shorter than 450 mm. Negatives shall be exposed and processed for a minimum density range of 1.1, with an average gradient of 1.2 ± .1.

Film diapositives, on .007 inch thickness estar base, and contact prints of each exposure shall be produced. A clear and legible index map, showing the locations of flight lines and the photo centre of every fifth photo of each line, shall also be produced.

Aerial photo negatives, film reports, indexes, diapositives and contact prints shall be delivered to the Inspector for written approval of conformity with these specifications.

4. Aerial Triangulation and Numerical Adjustment

Instruments and procedures capable of producing precise data for either analytical or semi-analytical aerial triangulation shall be used. A three-dimensional photogrammetric block adjustment shall be carried out on an electronic computer using the program SPACE-M or equivalent. The root mean square error on the position of all horizontal and vertical control points used shall not be greater than 30 μ at plate scale. The root mean square error on the photogrammetric ties shall not be greater than 20 μ at plate scale.

The final output from the block adjustment program, along with a manuscript showing the locations of all ground control, pass and tie points, shall be submitted to the Inspector. This submission shall clearly indicate both actual numbers and coding numbers of all survey control monuments used. Approval to proceed with the work will be furnished in writing when the adjustment is accpetable.

5. Map Details

The topographic maps produced at a scale of 1:5000 should generally depict the following detail:

a) Contour lines at an interval of 5 metres labelled uphill.

b) A Universal Transverse Mercator Grid labelled on all edges at a suitable interval.

c) Major streams, rivers, lakes, etc.

d) Photo Control Points.

e) Major vegetation species outlines.

The topographic maps produced at a scale of 1:2000 should depict all of the above, plus all discernable features, man-made or natural.

6. Photo Details

The aerial photograph copies should be produced with photo identifiable point marked with a cross hair on the photo at a minimum of a 500 metre interval. These points should be clearly identifiable on the photograph, normally road intersections, rock outcrops, etc. where possible. Coordinates in UTM northing, easting and elevation should be listed and indexed to each photo.

LEGEND

FLYING FOR MAP SCALE 1:5 000

FLYING FOR MAP SCALE 1:5 000
WITH GROUND CONTROL FOR 1:5 000

FLYING FOR MAP SCALE 1:5 000
& GROUND CONTROL 1:5 000
& PHOTOGRAMMETRIC MAPPING
IN SCALE 1:5 000 WITH 5 METRE
CONTOUR INTERVALS

FLYING FOR MAP SCALE AND
GROUND CONTROL 1:2 000
WITH 2.5 METRE PHOTOGRAMMETRIC
MAPPING IN 1:2 000 SCALE WITH 2.5
CONTOUR INTERVAL (ON STEEP SLOPES
AND HEAVILY TREED AREA'S BE DROPPED
ACCORDING TO PRIORITY SET BY SHELL).

WHERE 1:2 000 SCALE PHOTOGRAMMETRIC
MAPPING IS DONE 1:5 000, SCALE PHOTO-
GRAMMETRIC MAPPING SHOULD BE DONE
1:2 000 SCALE MAPS SHOULD BE REDUCED.
1:5 000 AND ALTERNATE CONTOUR SHOULD
BE DROPPED.

NOTE:

PLEASE NOTE FILE CHANGES MADE
MAPS NOW FILED IN:

VS24 – LOWER FLATHEAD
VS24A - UPPER FLATHEAD
VS24B - CROWSNEST
VS24C - FORDING RIVER
VS24D - TORONADO

SCHEDULE B

GENERAL SPECIFICATIONS FOR AERIAL PHOTOGRAPHY - 1978

All aerial photography flown by and for the Resource Evaluation and Planning Division of Alberta Energy and Natural Resources, hereafter called the Department, shall meet the following specifications. It is understood that these specifications are to be considered the minimum allowable and that any improvement on them may be made, so long as the end photographic product meets specific project requirements. For the purpose of these specifications, the word "shall" indicates a mandatory requirement and "should" indicates a desirable requirement.

1. Flight Standards

1.1 Calibration

The camera, magazine, filter and camera port glass shall be tested and calibrated by the National Research Council and shall meet standards for a Category A camera for aerial survey photography, the operation of the camera shall be in accordance to Part I, Equipment and Calibration, ICAS specifications. Yearly calibration tests shall be made by NRC on the complete optical unit, as it shall be used subsequently for aerial photography. Copies of the NRC calibration report for all cameras, film plattens and glass ports shall be submitted to the Department, prior to the undertaking of any photographic projects for this Department.

1.2 Camera Data Panel

The camera data panel shall be photographically recorded at the time of each exposure. Lighting of the panel shall be adjusted to suit the film speed.

The clock shall record Greenwich Mean Time during the flight. The altimeter reading recorded shall be set to agree with the calibrated altimeter. The exposure counter should agree with the counter seen by the camera operator.

1.3 Vacuum Supply

The vacuum supply to the camera shall be checked to ensure it meets camera operating requirements (see Section 1.2.2.5 of ICAS specifications).

1.4 Mounting

The camera shall be mounted vertically in the aircraft and oriented so that the film transport over the focal plane is in the direction of flight.

The camera shall be isolated from the vibration of the aircraft by a suitable mount. Angular vibration of the camera shall be reduced to a level which does not significantly affect resolving power at the shutter speeds used. (See Section 1.2.4 of ICAS specifications).

Provision shall be made for levelling the camera in flight and compensating for the crab of the aircraft.

1.5 Camera Port Glass

The camera shall be mounted behind a camera port glass. The camera port glass shall meet the deviation requirements of Section 1.2.3.7 of ICAS specifications. The port glass in the aircraft shall be kept clean and free of scratches.

1.6 Temperature

The camera compartment shall be maintained at a temperature of $15^{o}C \pm 10^{o}C$. Temperature variations shall not exceed 4^{o} throughout all portions of the camera where temperature variations might affect either the sharpness or metric properties of the image.

2. Films/Filters

2.1 Films

The film shall have a dimensionally stable polyester base and shall be stored and handled in accordance with the manufacturer's recommendations. Film emulsion type shall be specified by project. Film manufacturer shall be approved by the Department.

2.2 Filters

The filter shall be calibrated with the camera with which it will be used and shall meet Category A specifications. Filter type shall be specified by project.

3. Exposure

3.1 Film Speed vs Development

The exposure shall produce an image which results in most of the densities on that image falling on the straight line portion of the characteristic curve of the film product.

3.2 Resolution

Exposure shall be made at the aperture setting and shutter speed setting for maximum resolution and least amount of image motion. Image motion on the film shall be held to less than 20 uM.

3.3 Humidity Control

Humidity should be controlled in the camera compartment to 58% ± 2% relative humidity. The film should be kept at the above humidity from the time it is removed from the sealed container, until it is all exposed and returned to the sealed container.

If no humidity control is used, at least 5 exposures preceeding the first line of photography and 5 exposures proceeding the last line of photography of each roll or flight shall be made.

3.4 Establishment of True Altitude

The altitude for photography when specified or the resultant altitude determined from the scale and datum is the true altitude above sea level. The indicated altitude to fly shall be determined from the required true altitude by subtracting the correction for air temperature and adding the instrument error as described in the following sectors.

3.4.1 Setting the Calibrated Altimeter

The calibrated altimeter's subscale shall be set to the local value of sea level pressure before take off, or failing the availability of this information, it shall be set to indicate the height of the air field plus instrument error.

During flight, before commencing photography of an area, it shall be reset to the value of local sea level pressure which best applies to the area.

3.4.2 Calculation of Indicated Height to Fly

The correction for air temperature is obtained as follows: Outside temperature at every integral 1000 feet of indicated altitude during climb is to be recorded on form ICAS 2B. Outside temperature readings should ideally be taken in the area to be photographed. The use of temperature readings which might differ seriously from those in the photographed area, by reason of distance, time or weather, should be avoided.

(a) Calculate the arithmetic mean actual air temperature from the outside temperature readings taken during climb and corrected for air speed.

(b) Calculate the arithmetic mean standard air temperature from the I.C.A.O. - N.A.C.A. standard air temperatures for the corresponding altitudes.

(c) Where take off is from an airport that is not at sea level, temperature soundings will be recorded for that depth of the atmosphere through which the survey aircraft climbs to reach operating altitude. The resulting actual average air temperature must be compared with the average temperature of the standard atmosphere over the same range of altitudes and the correction computed on the basis of the height climbed.

4. Photographic Flight Tolerances

4.1 Flight Line Pattern

The flight lines shall normally be spaced for 30% lateral overlap at mean ground level unless otherwise noted in project specifications. In case of extreme relief, the lateral overlap shall be adjusted to provide a minimum of 15% overlap. The layout of the flight lines shall be such that the outside line shall not fall more than one half the normal line spacing from the lateral boundary. Where possible, flight lines shall be flown in an east-west direction.

4.2 Forward Overlap

Forward overlap shall be of an average of 60% (±4%). Isolated deviations from specified forward overlap up to three consecutive exposures will be acceptable except where it exceeds 68% or is less than 54%.

4.3 Flying Height/Photo Scale

The photo scale shall not deviate by more than ±5% from that requested, except where:

$$\frac{\text{Maximum ground elevation} - \text{Minimum ground elevation}}{\text{Flying height above datum}} > .1$$

In areas where this ratio is greater than .1, the flight lines shall be broken or fitted to keep scale changes to a minimum. For the purpose of these specifications, allowable deviations shall be accepted as follows:

Flat terrain	±5%
Hilly	±7%
Mountainous	±10%

4.4 Course Correction

Shall not exceed 3° between successive exposures.

4.5 Crab

Crab shall not exceed 3° between successive exposures.

4.6 Verticality

The lens axis shall not be allowed to depart from the vertical during any exposure by an angle greater than 2.5°.

4.7 Combined Crab/Verticality

The apparent crab caused by the combined effects of course correction, crab and lack of verticality shall not exceed 5° in successive exposures.

4.8 Atmospheric Conditions

The photography shall be taken in clear sky with a minimum of atmospheric haze conditions. Cloud cover and cloud shadow shall be less than 5% on each photograph.

4.9 Area Coverage

The photographic flight shall extend far enough beyond the borders of the specified area to ensure full stereoscopic coverage of the entire area included within the borders.

4.10 Altitude

When an altitude is given instead of a scale, the indicated altitude shall be held within ±100 feet of the "indicated height to fly". The actual true altitude shall be within ±(3% + 200 feet) of the required true altitude. A closer altitude tolerance for photography taken below 10,000 feet may be specified.

4.11 Documentation of Flight Information

The complete details of the flight shall be accurately recorded on the Air Photography Report (form ICAS 2 or equivalent). The remarks section of the report shall show complete information detailing any factors that may affect exposure, processing or film recording and handling.

The Aerial Photography Report shall contain the following information:

1. Roll number.
2. Average scale - determined from flying height and mean ground elevation.
3. Camera type.
4. Lens number, type and focal length as calibrated by NRC.
5. Film type and number.
6. Magazine type and serial number.
7. Filter type and number.
8. Camera port category and number as given on the NRC test report.
9. Autopilot - if used.

10. Name of agency executing the project with names of pilot, navigator and camera operator.
11. Calibrated altimeter number.
12. Log of flights on which the roll was exposed, with the following data for each flight:

    a. Date of photography - day, month and year.
    b. Annotated negative numbers.
    c. Line number and direction.
    d. Exposure number corresponding to the camera data panel.
    e. Greenwich Mean Time at the start and end of each line, with corresponding exposure numbers.
    f. True altitude above sea level.
    g. Camera exposure, relative aperture and effective shutter speed.
    h. Remarks:
       - solar altitude (required).
       - area name or project name.
       - completeness of line - location of gaps by co-ordinates or other means.
       - deviations from average scale.
       - blanks, run-ups, over runs, rejections and reasons for rejections.
       - atmospheric conditions - haze, smoke, cloud cover estimate, turbulence.
       - splices, removal of roll sections, location of stepwedges.
       - any other information to assist the processor or user of the film including estimate of f stop over or under exposed.

4.12 Solar Angle

The solar angle shall be a minimum of 30^{o}.

4.13 Ground Cover

Snow cover shall not obscure more than 5% of the ground on any photograph.

5. Photographic Processing

5.1 Density Requirements

Processing shall yield a film product where the resulting densities on the image fall on the approximately straight line portion of the characteristic curve for the particular emulsion used. The minimum density on the image plane, in the area out to 10cm from the fiducial center, shall be between 0.2 and 0.6 above base and fog. The minimum density any where on the image shall not be less than 0.1 above base and fog. Except for the images of extremely bright spots, such as specular reflections of the sun, the maximum density on the image shall not exceed 2.0 above base and fog. Base + fog shall not exceed .25.

5.2 Average Gradient

Unless otherwise specified the average gradient for black and white emulsions shall be 1.2 ± .1 and shall be determined from densitometric readings of sensitometric stepwedges printed on the roll.

The average gradient for color emulsions shall fall in the range as specified by the manufacturer. For true color emulsions, the gradient of the three dye layers shall be coincident or so nearly so as to retain balance over the exposure range. For color I.R. emulsions, the I.R. sensitive layer shall be .35 Log E ± .05, less sensitive than the average of the two remaining dye layers.

5.3 Processing

All aerial film flown by and for the Department, shall be processed in a continuous processing machine. Permanency of the photographic image shall be the best which can be obtained by standard processing procedures and shall be of archival quality. If for some special reason it seems desirable to use a processing technique other than a continuous processing machine, the suitability of the processing technique shall be established to the satisfaction of the Department, prior to bidding.

A processing report shall be completed for every roll of film processed, giving the following information:

1. Equipment - manufacturer and model used.
2. Developer - type used.
3. Fixer - type used.
4. Temperature - in degrees Fahrenheit
5. Processing speed - in feet per minute.
6. Processing path length.

The processing report shall be delivered in conjunction with the processed roll(s), and may refer to more than one roll as long as processing equipment and conditions are the same for every roll.

5.4 Sensitometric Exposure

At least one sensitometric stepwedge shall be exposed on each roll of aerial film prior to processing. The stepwedge shall be exposed in an area of the film that is unexposed, free of fog and which will not be subject to anamalous development effects. A current calibration report on the sensitometer shall be on hand for all film on which the sensitometer was used for stepwedge exposure. An aerial film sensitometric plotting sheet and complete processing report shall accompany every roll of aerial film and shall indicate the gradient of the respective roll.

The sensitometric plotting sheet shall not be a photo copy of an original printed form nor shall the plot submitted by a photo copy of an original plot.

6. Film Handing and Documentation

6.1 Spooling of Negative

Unless amended hereafter, the processed aerial film shall be cut and butt spliced with 3M #850 polyester film tape so that on east-west lines, line 1 will be the southern most line and the exposures will be in series from left to right, continuing through the roll and project. Each roll shall have approximately six feet of leader and trailer, and will clearly be identified with the AS roll number on each end, as well as the words "start" and "end" respectively at the beginning and end of each roll. The rolls shall be submitted on a spool of the same kind as that on which it was supplied by the manufacturer. The film container shall be a Kodak Code 3000 plastic case or its equivalent.

6.2 Verification of Flight Tolerances and Exposure/Processing

The photography shall be checked by the taking agency to ensure that general or project specific specifications have been met. A summary of this inspection shall be made on Resource Evaluation and Planning Division's form T48 or on 1CAS 2 (side 2). Particular note shall be made of the following factors:

6.2.1 Forward and Lateral Overlap

In the case of photography taken for photogrammetric or reconnaissance mapping, departures of the requirements of Section 4, which result in isolated overlaps of less than 52% and lateral overlaps of less than 10% may be sufficient ground for rejecting the photographs of the affected areas.

6.2.2 Crab, Course Correction and Verticality

The combined effect of photographic displacements due to crab, course changes and lack of verticality shall not exceed an apparent crab measurement of 5^{o} of the successive photographs, that is, the angle between the lines joining the flight path as defined by the position of the photo centres shall not be greater than 5^{o}.

6.2.3 Photogrammetric Check

Acceptance of aerial photography will depend on verification of the geometric properties of the imagery in a photogrammetric plotting instrument. The stereoscopic models formed in the photogrammetric check shall be found to be free (or nearly so) of Y parallax in at least five well separated points. Failure of any test model in this respect will result in rejection of the entire roll from which the model was selected.

6.3 Annotation

Each frame of an air survey film roll should be correctly and neatly annotated with an automatic annotation machine, in accordance with the following specifications: (exposures not constituting part of the contract shall not be annotated, nor should they appear on the completed AS roll).

6.3.1 Roll Number

When a roll is ready for annotation, an AS roll number shall be requested from the Department.

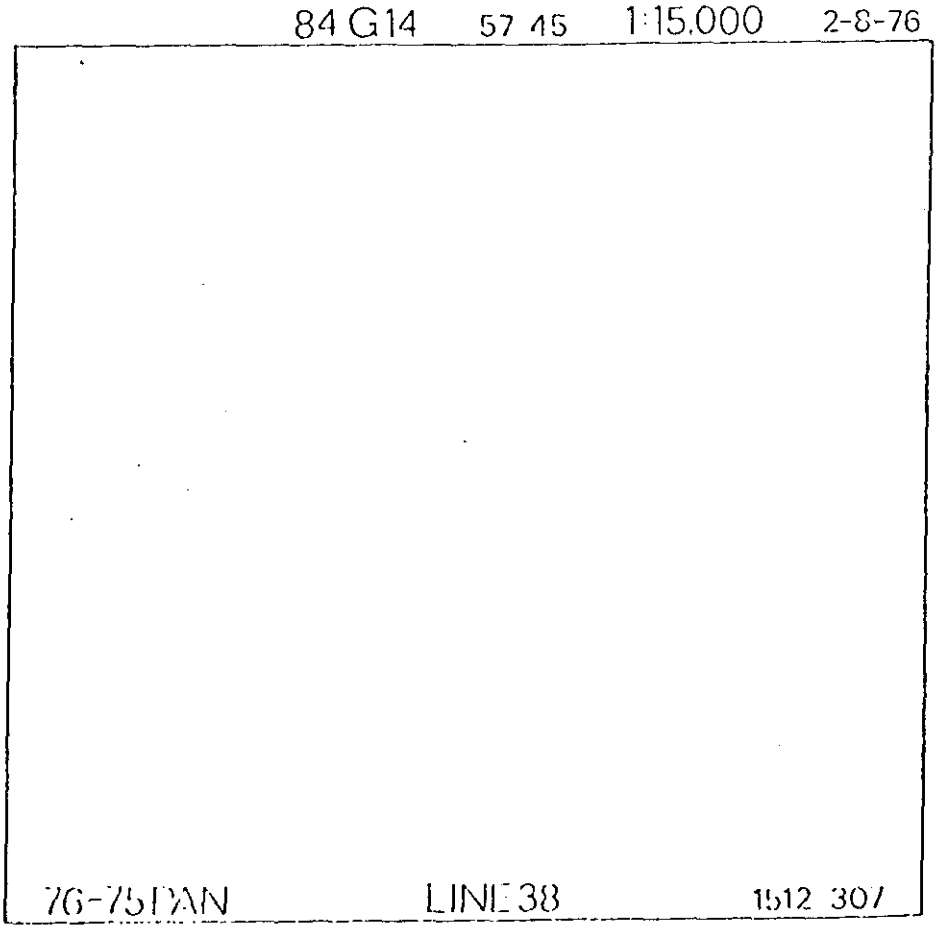
6.3.2 Numbering Sequence

Every exposure constituting part of the contract shall be annotated in numerical sequence, starting with number 1 from the beginning to the end of the roll. On east-west lines, the annotation should read upright when the top of the negative is north.

6.3.3 Annotation

Each exposure shall contain the standard Aerial Survey annotation system. The annotation shall contain the following information as indicated:

(a) Project number
(b) Type of film
(c) Roll number
(d) Line number
(e) Exposure number
(f) N.T.S. 1:50,000 map sheet location
(g) Latitude of line
(h) Scale of project
(i) Date of photography



6.3.4 Index Maps

One film copy of a 1"=4 mile index map shall be supplied. The index map shall be drawn in accordance with the attached sample.

CROWS NEST RESOURCES LIMITED - EXPLORATION
SHELL CANADA RESOURCES LIMITED - SURVEYING

GROUND CONTROL SURVEY AND PHOTOGRAMMETRIC MAPPING
SOUTHEASTERN BRITISH COLUMBIA

DISTRIBUTION OF AFE Z4670: UNDIVIDED COSTS
TO PROJECTS AND GROUPS OF LICENCES
ON THE BASIS OF HOLDING ACREAGES

*HOLDINGS/PROJECTS	AFE	ACREAGE	%	$ COSTS
NORTH BLOCK=GROUP "NA"	4853A	7,840	8.0	29,440
CENTRAL BLOCK NORTH	4851J	10,264	10.5	38,640
HORESESHOE RIDGE	4851E	6,532	6.7	24,656
LINE CREEK J.V.	4851D	1,854	1.9	6,992
(Central Block Total)		(18,650)	(19.4)	(71,392)
(Group "CA")		(6,088)	(6.2)	(22,816)
(Group "CB")		(8,082)	(8.6)	(31,648)
(Group "CS")		(4,480)	(4.6)	(16,928)
CROWN MOUNTAIN TOTAL	4851Z	6,317	6.5	23,920
(Group #31)		(3,117)	(3.2)	(11,776)
(Group #32)		(3,200)	(3.3)	(12,144)
CORBIN=GROUP #6	4851Q	1,760	1.8	6,629
(Coal Mountain)		(640)	(0.7)	(2,578)
(Tent Mountain)		(1,120)	(1.1)	(4,051)
MORRISSEY FREEHOLD	4851U	43,200	44.1	162,288
LODGEPOLE=GROUP #104	4851S	3,345	3.4	12,512
LILLYBURT	4851R	6,122	6.3	23,184
HARVEY CREEK TOTAL	4851T	7,307	7.5	27,600
(Group #105 Renewal)		2,992	(3.1)	11,408
(Remainder)		4,315	(4.4)	16,192
CABIN CREEK=Group #106	4851V	3,200	3.3	12,144
TOTAL	Z4670	97,741	100.0	368,000
		= 39,556ha		$3.77/acre
*All B.C. Coal Licences except Morrissey Freehold				$9.30/ha

1979-01-31

F. Martonhegyi
Exploration

D. Poulsom
Surveying

H. Hofer
Finance Analyst

J. J. Crabb
Manager - Exploration