Dr. Whitham

CHATS FALLS SEISMOGRAPH OPERATION

Station Commissioning

prepared for

Geotechnical Engineering Dept.

Ontario Hydro

by

S. Mercure

SEISMOLOGICAL SERVICE OF CANADA

INTERNAL REPORT 77-12

Division of Seismology and Geothermal Studies

Earth Physics Branch

Department of Energy, Mines and Resources

OTTAWA

November 1977

INTRODUCTION

This is the first report on the operation of the Chats Falls seismograph station which commenced recording on October 6, 1977. It encompasses brief descriptions of the station instrumentation, location, operation and sensitivity.

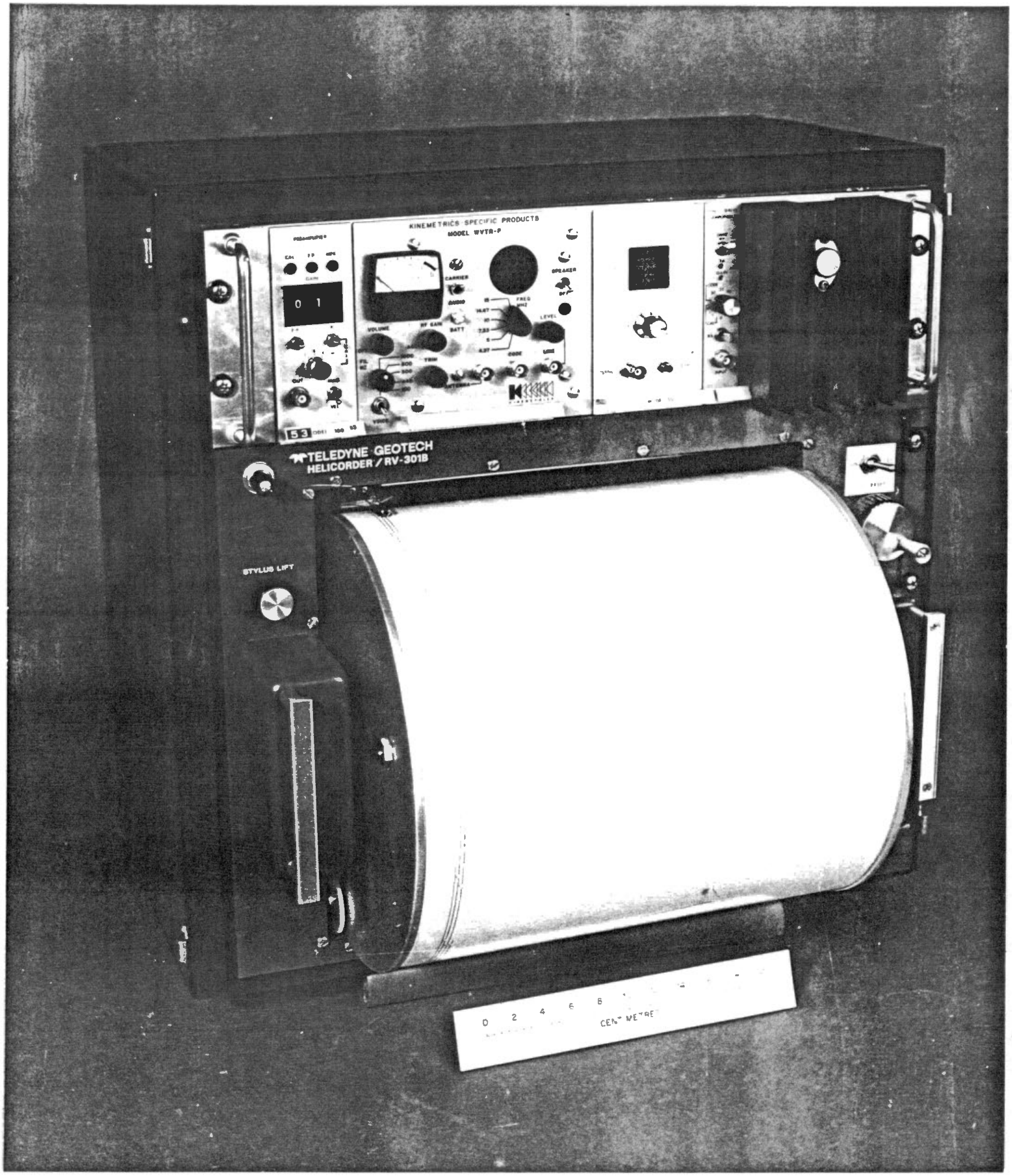
Subsequent reports will be prepared on a quarterly basis and will be devoted primarily to an analysis of detected seismic activity.

STATION INSTRUMENTATION

In this section, each of the components of the Chats Falls seismograph system will be briefly described. Figure 1 shows a photograph of the regional seismograph system (seismometer not shown).

Seismometer S-13: A Teledyne Geotech model S13 seismometer is used in the system. It may be operated in either the horizontal or vertical position and the period is adjustable from 1.33 to .91 seconds. It is equipped with a calibration coil and provisions for weight lift calibrations. The inertial mass is 5 kg and the total weight 10.9 kg. The cover and electrical connections are watertight so that the instrument may be submerged in up to 100 feet of water without leakage. All operational adjustments are external to the instrument. Included are adjustments for the period, mass position, and instrument levelling, a mass lock, a mass position indicator, and a bubble level.

Preamp/Calibrator: The model 100 preamplifier is a short-period seismic amplifier providing both a fixed low-gain output ('digital' output) with antialias filtering for use in digital recording systems and a variable gain band-pass filtered output (analog output) for use in analog recording systems. A 'constant velocity' or 'constant magnification' seismic response can be selected independently for each of the outputs. Facilities for calibration via front panel control and for both


KINEMETRICS SPECIFIC PRODUCTS
VOLUME
RF GAIN
LEVEL
TELEDYNE GEOTECH
HELICORDER / RV-301B
STYLUS LIFT
0 2 4 6 8

calibration and 'digital' output multiplexing via digital input commands are incorporated.

Pen Drive Amplifier: The pen drive amplifier model 110/111 is designed as a power amplifier for Geotech helicorders. The unit is contained in a 1" module and fabricated on a one-sided printed circuit card using discreet components. The amplifier is a basic inverting operational amplifier with adjustable gain and limiter function. The gain is selectable from 1 v/cm to 50 v/cm by means of a front panel control. In addition to seismic signals, the amplifier also responds to external clock time signals (voltage or contact) as well as external radio signals (tone or code), with radio signals being manually or automatically inserted. Internal amplifier calibration is provided in addition to pen motor damping. The frequency response including the pen motor is ±1 dB from DC to 30 hertz and the peak-to-peak pen deflection is approximately 10 cm.

Helicorder: The Helicorder/RV-301 is a drum recorder for producing traces of analog data on a sheet of heatsensitive paper. The trace is a helix that translates with each turn of the drum. A variety of chart speeds and leads can be chosen permitting as many as 72 hours of continuous data to be recorded on a single sheet of paper. As many as three pen motors can be installed in the unit. The Helicorder can be either rack mounted or installed in a carrying case for field use.

Inverter-Charger-Power Supply: The EPB model 930 power supply provides all operating voltages for the seismograph. The supply operates from 115 VAC mains and maintains a 12 V automotive battery in a fully charged (13.7 V) condition. In the event of 115 AC mains power failure, the battery supplies input power to the power supply to maintain all operating voltages for a minimum of 10 hours.

Radio WVTR-P: The Kinemetrics model WVTRP standard time receiver is a plug in version of the standard production units, and has been manufactured in the modular form to EPB specifications.

The receiver is a double conversion superheterodyne receiver that provides crystal-controlled reception of the five front panel selected standard CHU and WWV frequencies and one H.F. communication frequency. An audio FILTER selector switch provides normal audio response or a selected 100, 440, 500, 600, or 1000 Hz response. The unit requires a good external antenna for correct operation.

Clock: The digital clock model 500 utilizes a Temperature Controlled Crystal Oscillator (TCXO) with 983.040 KHz frequency. A 14 stage binary counter divides this down to 60Hz. The frequency is further subdivided by a chain of dividers which divide by 60, 60, 24, 365 and 10 respectively, to generate seconds, minutes, hours, days and year.

STATION LOCATION

The Chats Falls station is located in an old telephone exchange building, on Ontario-Hydro property, along the road leading to the power house. (see Figure 2). The electronic and recording equipment is installed on the ground floor with the seismometer in the basement seated on a precambrian outcrop. The coordinates for this new station, tentatively coded CFO, are 45° 28.15'N, 76° 13.75'W, and the elevation is approximately 70 metres.

Keeping in mind station servicing and the purpose of monitoring a potential site for a nuclear power station, it appears the present location is ideal. Nevertheless, it suffers from two minor drawbacks: its proximity to the power house and its generators (1km) and its closeness to a busy Canadian National Railroad line (750m.)

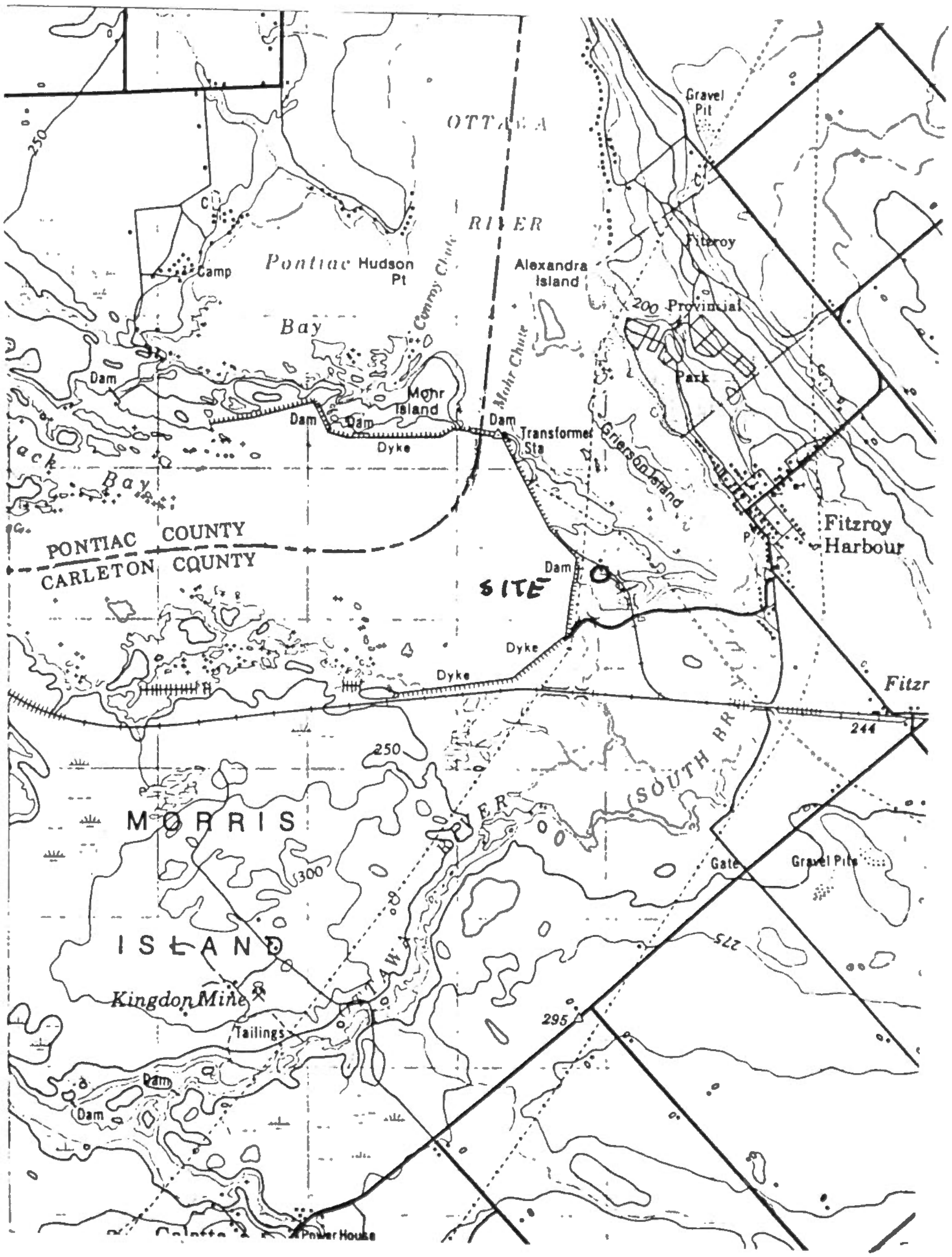

OTTAWA
RIVER
Gravel Pit
Fitzroy
Pontiac Hudson Pt
Bay
Camp
Alexandra Island
200 Provincial
Park
Mohr Island
Mohr Chute
Dam
Dyke
Transformer Sta
Grierson Island
Fitzroy Harbour
PONTIAC COUNTY
CARLETON COUNTY
SITE
Dyke
250
244
SOUTH
MORRIS
ISLAND
Kingdon Mine
Tailings
Gate
Gravel Pits
275
295
300
Power House

Figure 2

However it will be shown in a later section that these noise sources are not serious with respect to the overall performance of the station.

STATION OPERATION

After the initial installation on October 6, 1977, the Chats Falls station was visited on October 13, by two EPB staff members to resolve any outstanding problems and to instruct Mr. Ken Munro on station procedures, as outlined in the station operator's manual. During this meeting, the convenience of a telephone line installed in the instrument room was discussed. Subsequently, a telephone was installed and now it is possible for Mr. Munro or his assistants to call Ottawa for technical or operational assistance from the station.

Should any problems arise, the following is a list of EPB staff to be contacted (collect) according to the type of trouble the operator is confronted with.

Technical questions: Mr. Frank Lombardo 994-9091

Operational questions: Mr. Bob Halliday 994-9091

Scientific Questions: Mr. Stephan Mercure 994-5428

Under normal conditions, communication between Chats Falls and EPB will consist of a bundle of records and a generator service log sent on a weekly basis to the EPB's Seismicity, Seismic Hazards and Applications section.

STATION SENSITIVITY

A copy of our preliminary calibration curve is attached on Figure 3. It shows that for periods between 0.1 to 0.5 seconds the velocity sensitivity is constant at about 5K. (Seismogram trace velocity equals ground velocity X5000.) This gain level is comparable to that of other regional stations in the Canadian network. In practice, considering event detection at a trace amplitude threshold of 2 mm peak-to-peak and a period of 0.3 seconds, it is inferred that any earthquake of magnitude

STATION: Chats Falls (CFO)

ϕ = 45° 28.15° N λ = 76° 13.75' W   Altitude 70 m

Foundation:

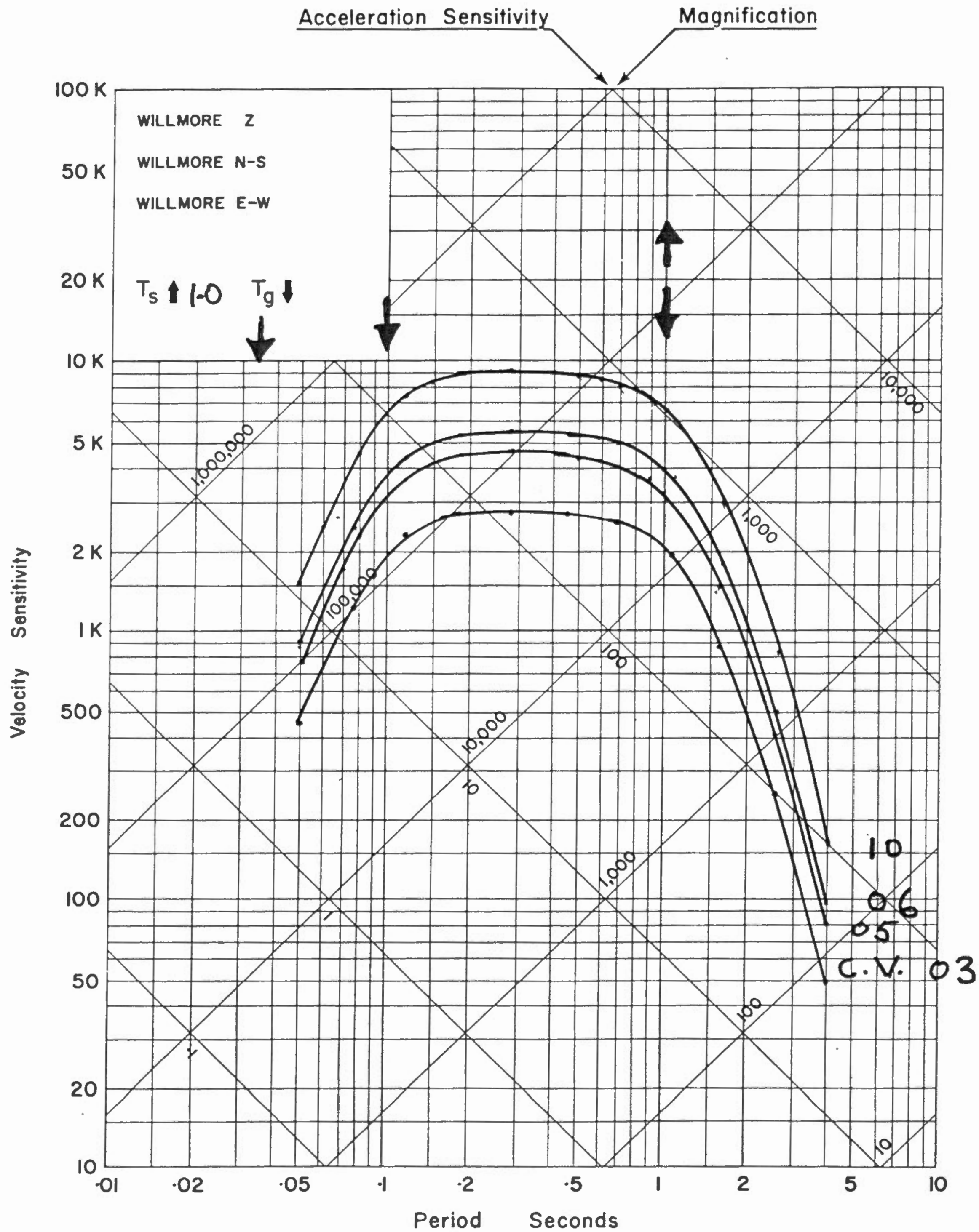


Figure 3

Dates of Calibration:

WILLMORE Z

WILLMORE N-S

WILLMORE E-W

larger than 0.5 would be detected, should it take place within a 30 km radius of the Chats Falls station.

Unfortunately the records are plagued at times with relatively high amplitude noise originating from sluice-gates and generators coming up or shutting down and trains passing by. Although these disturbances make it more difficult to detect small local events, it is important to note that these noise sources are of limited duration.

Under normal circumstances the average background noise level is about 1 mm peak-to-peak, whereas train noise boosts the trace width up to about 2.5 mm and sluice-gate operation and generator start-up and shut-down entail outbursts of noise as large as 4 mm in amplitude. However, the trains cause disruption for barely 2% of total recording time, the sluice-gate and generator operation for roughly 1%.

In addition to the noise sources already mentioned, it appears there is another one, unidentified yet, which perturbs records for periods up to an hour, with amplitude between 3 and 5 mm.

In conclusion, it is hoped that most of the noise sources can be identified and minor adjustments made within the next month so as to concentrate most of our efforts on local event detection.