GEOLOGICAL SURVEY OF CANADA COMMISSION GÉOLOGIQUE DU CANADA

DEPARTMENT OF ENERGY, MINES AND RESOURCES
MINISTÈRE DE L'ÉNERGIE DES MINES ET DES RESSOURCES

# Airborne Geophysical Survey
# Levé géophysique Aéroporté
# Port Hawkesbury
## Nova Scotia

NTS/SNRC 11 F/11 and 11 F/10 (part of)

Contents include gamma ray spectrometric and magnetic colour maps, flight path map, VLF profilemaps and accompanying stacked profiles

Contient des cartes en couleur de rayons gamma spectrométrique et magnétique, une carte de lignes de vol, VLF sous forme des cartes de profils et profils multi-paramétriques

COOPERATION

COOPERATION AGREEMENT ON MINERAL DEVELOPMENT

ENTENTE DE COOPÉRATION SUR L'EXPLOITATION MINÉRALE

Contribution to Canada-Nova Scotia Cooperation Agreement on Mineral Development (1990 - 1992) a subsidiary agreement under the Economic and Regional Development Agreement.

Contribution à l'Entente de coopération Canada - Nouvelle-Écosse sur l'exploitation minérale (1990 - 1992), entente auxiliaire négociée en vertu de l'Entente Canada/Nouvelle-Écosse de développement économique et régional.

Canada

Nova Scotia Province of Nova Scotia

Energy, Mines and Resources Canada Energie, Mines et Ressources Canada

Canada



Colour – Geophysical Series
Couleur – Séries géophysiques

35611(11)G

GEOLOGICAL SURVEY OF CANADA
COMMISSION GEOLOGIQUE DU CANADA
OTTAWA

## Airborne Geophysical Survey

In 1990, a multi-parameter airborne geophysical survey of southeastern Cape Breton Island, Nova Scotia was flown by the Geological Survey of Canada (GSC). This survey was flown as a contribution to the Canada-Nova Scotia Cooperation Agreement on Mineral Development (1990-1992), a subsidiary agreement under the Canada-Nova Scotia Economic and Regional Development Agreement. The area was surveyed using the GSC Skyvan aircraft. Gamma-ray spectrometric, VLF electromagnetic and total field magnetic data were recorded digitally and sampled at one second intervals. The aircraft was flown at a mean terrain clearance of 125 meters and at an average ground speed of 190 km/h. The flight lines were flown in an east-west direction with a line spacing of 1000 meters.

For this survey the data are released as eight (8) G-Series booklets. This booklet for the **Port Hawkesbury area, G-Series 35611(11)G** includes a set of colour maps with the flight path of the aircraft superimposed, two black and white profile maps and stacked profiles for each flight line, all at 1:150,000 scale. The following maps are enclosed:

1) An **exposure rate** map,
2) 3 maps of the ground concentration of **Potassium** (K), **Uranium** (eU) and **Thorium** (eTh),
3) 3 ratio maps - **eU/eTh**, **eU/K** and **eTh/K**,
4) A three component or **Ternary Radioelement** map combining the potassium, uranium and thorium data,
5) A **Magnetic Total Field** map,
6) Two VLF profile maps, one with **Total Field** VLF profile data and the other with **Quadrature** VLF profile data,
7) A matte positive of the corresponding 1:50,000 NTS map sheet reduced to 1:150,000 scale.

The stacked profiles in the booklet have a five point weighted average filter applied to each parameter. Each profile shows the aircraft radar altimeter, the three radioelement ratios, the ground concentrations of potassium, uranium and thorium, the exposure rate, the magnetic total field and the VLF total field and quadrature components. The picked fiducials along the horizontal axis of each profile relates the data to the flight lines shown on the colour maps.

### Gamma-ray Spectrometric Data

The airborne gamma-ray measurements were made using a 256 channel gamma-ray spectrometer with fourteen 102 x 102 x 406 mm NaI(Tl) crystals. The main detector array consisted of twelve crystals (total volume 50 litres). Two crystals, shielded by the main array, were used to detect variations in background radiation. The system constantly monitored the natural potassium peak and adjusted the gain for the system.

Potassium is measured directly from the 1460 keV gamma-ray photons emitted by $^{40}K$, whereas uranium and thorium are measured indirectly from gamma-ray photons emitted by daughter products ($^{214}Bi$ for uranium and $^{208}Tl$ for thorium). Although these daughters are far down their respective decay chains they are assumed to be in equilibrium with their parents; thus gamma-ray spectrometric measurements of uranium and thorium are referred to as equivalent uranium and equivalent thorium i.e. eU and eTh. The energy windows used to measure potassium, uranium and thorium are:

| | |
|---|---|
| Potassium ($^{40}K$) | 1360 - 1560 keV |
| Uranium ($^{214}Bi$) | 1660 - 1860 keV |
| Thorium ($^{208}Tl$) | 2410 - 2810 keV |

During processing, the spectra were energy calibrated, and counts were accumulated into the windows described above. The window counts were corrected for deadtime and for background activity due to cosmic radiation, the radioactivity of the aircraft and atmospheric radon decay products. The window data were then corrected for spectral scattering in the ground, air and detectors. Corrections for deviations, of altitude from the planned terrain clearance, and of temperature and pressure were made prior to conversion to ground concentrations of potassium, uranium and thorium, using factors determined from flights over a calibration range near Ottawa. In areas of extreme topographic variations accurate terrain corrections are difficult. Thus, estimates of radioelement concentrations may be inaccurate in these areas. The stacked profiles should be inspected in areas of extreme topographic relief.

| | |
|---|---|
| Potassium | 91.0 cps/% |
| Uranium | 9.1 cps/ppm |
| Thorium | 7.0 cps/ppm |

Corrected data were interpolated to yield 100 m grids using an inverse distance weighted average technique. The results of an airborne gamma-ray spectrometer survey represent average surface concentrations which are influenced by varying amounts of outcrop, overburden, vegetation cover, soil moisture and surface water. As a result the measured concentrations are usually lower than the actual bedrock concentration.

The exposure rate in micro Roentgens per hour was computed from the measured ground concentration of potassium, uranium and thorium. To compare this exposure rate with older total count maps contoured in Ur (units of radioelement concentration) the conversion factor is 1µR/h = 1.67 Ur.

### VLF Data

The VLF electromagnetic data were recorded using a Hertz Totem 1A system. The system was tuned to a primary electromagnetic field generated by one of several VLF communication stations. For this survey, the receiving coils were tuned to station NSS in Annapolis, Maryland which transmits at a frequency of 21.4 kHz.

Anomalies reflect distortions in the primary field cause by a secondary electromagnetic field generated by eddy currents flowing in geological and man-made conductors. Anomalies produce positive peaks on the total field trace and are of the cross-over type (negative to positive) on the quadrature trace. Both parameters are plotted with positive deflections toward north. The profiles presented are the total field value (vector sum of the horizontal and vertical components) and the quadrature value (out-of-phase component). For the stacked profiles, the mean value or line average of the total field and quadrature component were removed along each flight line. The quadrature, which depends on the flight line direction, was inverted for lines flown from east to west. All the VLF data are plotted with a two second lag.

### Magnetic Data

The aeromagnetic data were acquired using a Geometrics model G-803 proton precession magnetometer with a sensitivity of one nanotesla (1 nT). The magnetic data were corrected to remove spikes, heading effects and diurnal variations.

**Information regarding these G-Series Maps may be obtained from: Geological Survey of Canada, 601 Booth Street, Ottawa, Ontario, K1A 0E8; Telephone (613) 995-4342 or 992-4279.**

**Base map material supplied by Surveys and Mapping Branch.**

**Airborne gamma-ray spectrometer, VLF and magnetic survey carried out by the Mineral Resources Division of the Geological Survey of Canada as a contribution to the Canada-Nova Scotia Cooperation Agreement of Mineral Development (1990-1992), a subsidiary agreement under the Canada-Nova Scotia Economic and Regional Development Agreement.**


PORT HAWKESBURY
NOVA SCOTIA

**Airborne Geophysical Map Series - Colour**
Cartes de Séries Géophysique Aérien — Couleur

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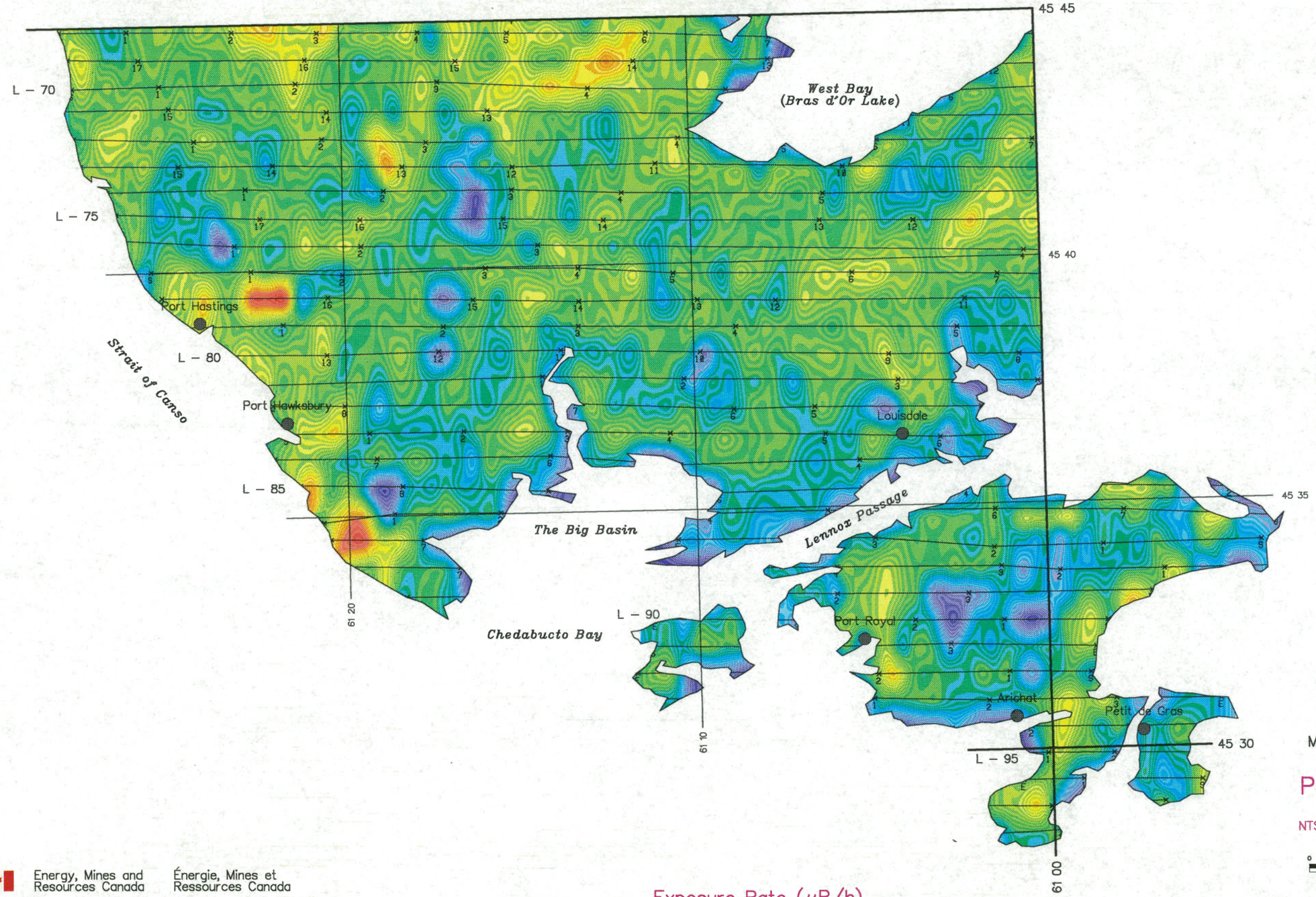
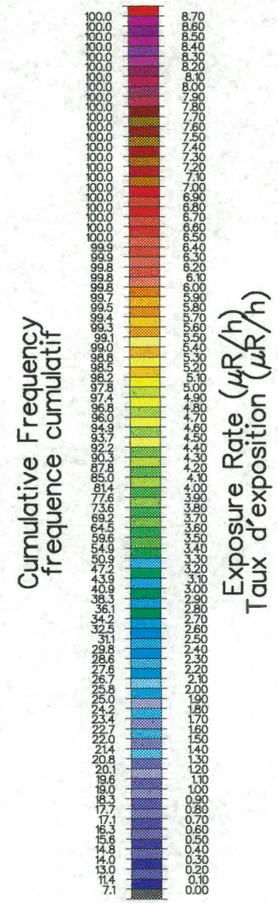
Levé Géophysique Aérien
1992




MAP 35611(11) G CARTE

## Port Hawksbury
Nova Scotia
NTS 11F/11 and 11F/10 (part of)

0 3 6
kilometers

Scale/Échelle = 1:150 000
Line spacing/Espacement des lignes = 1000 metres

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Exposure Rate (μR/h)
Taux d'exposition (μR/h)

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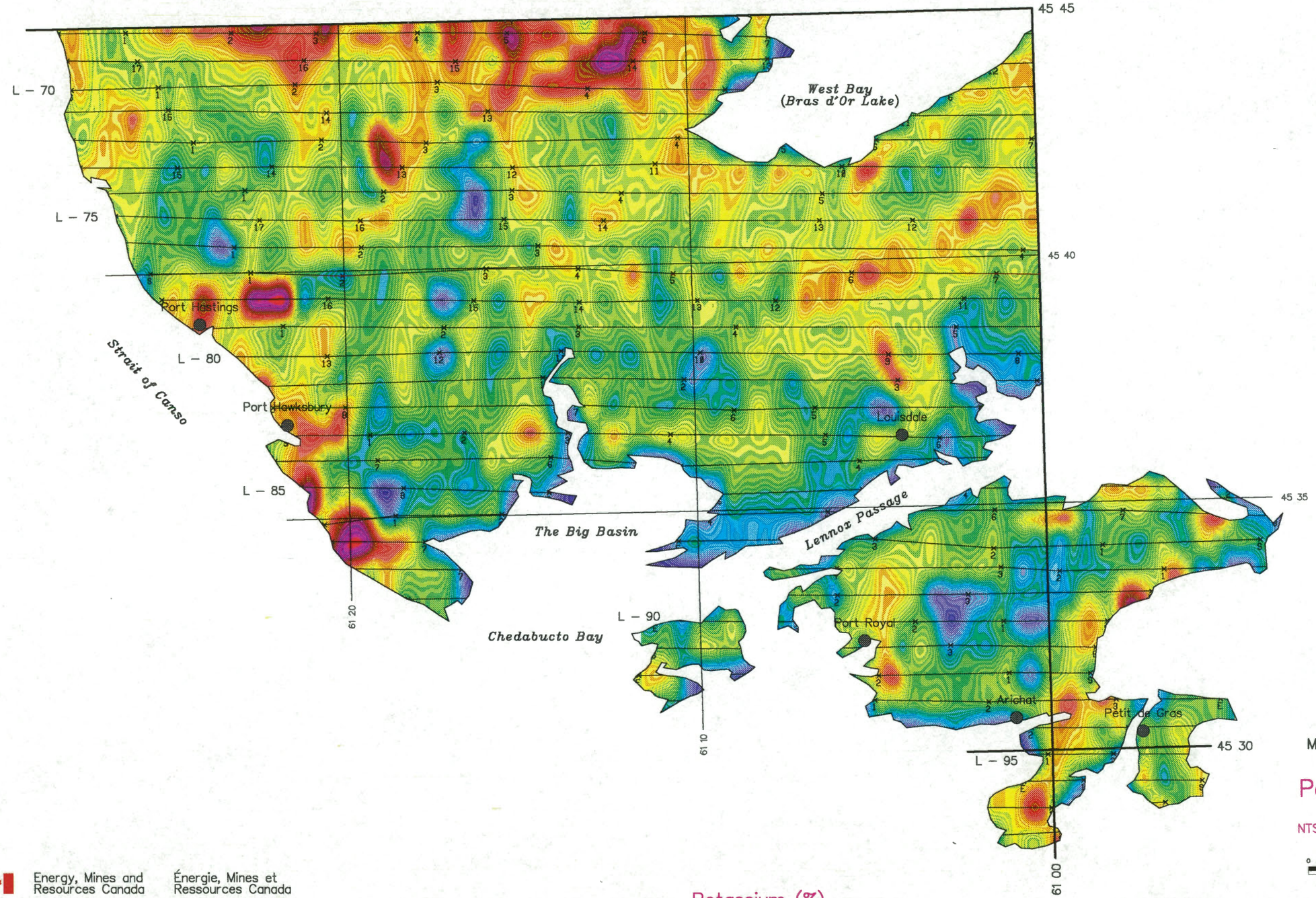


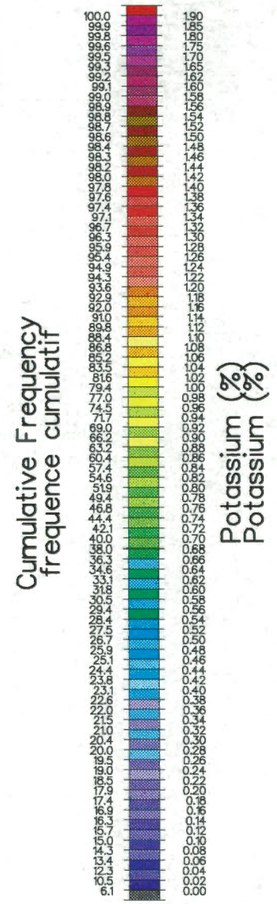


MAP 35611(11) G CARTE

# Port Hawksbury
## Nova Scotia
NTS 11F/11 and 11F/10 (part of)

0 3 6
kilometers

Scale/Échelle = 1:150 000
Line spacing/Espacement des lignes = 1000 metres

Potassium (%)
Potassium (%)

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Canada

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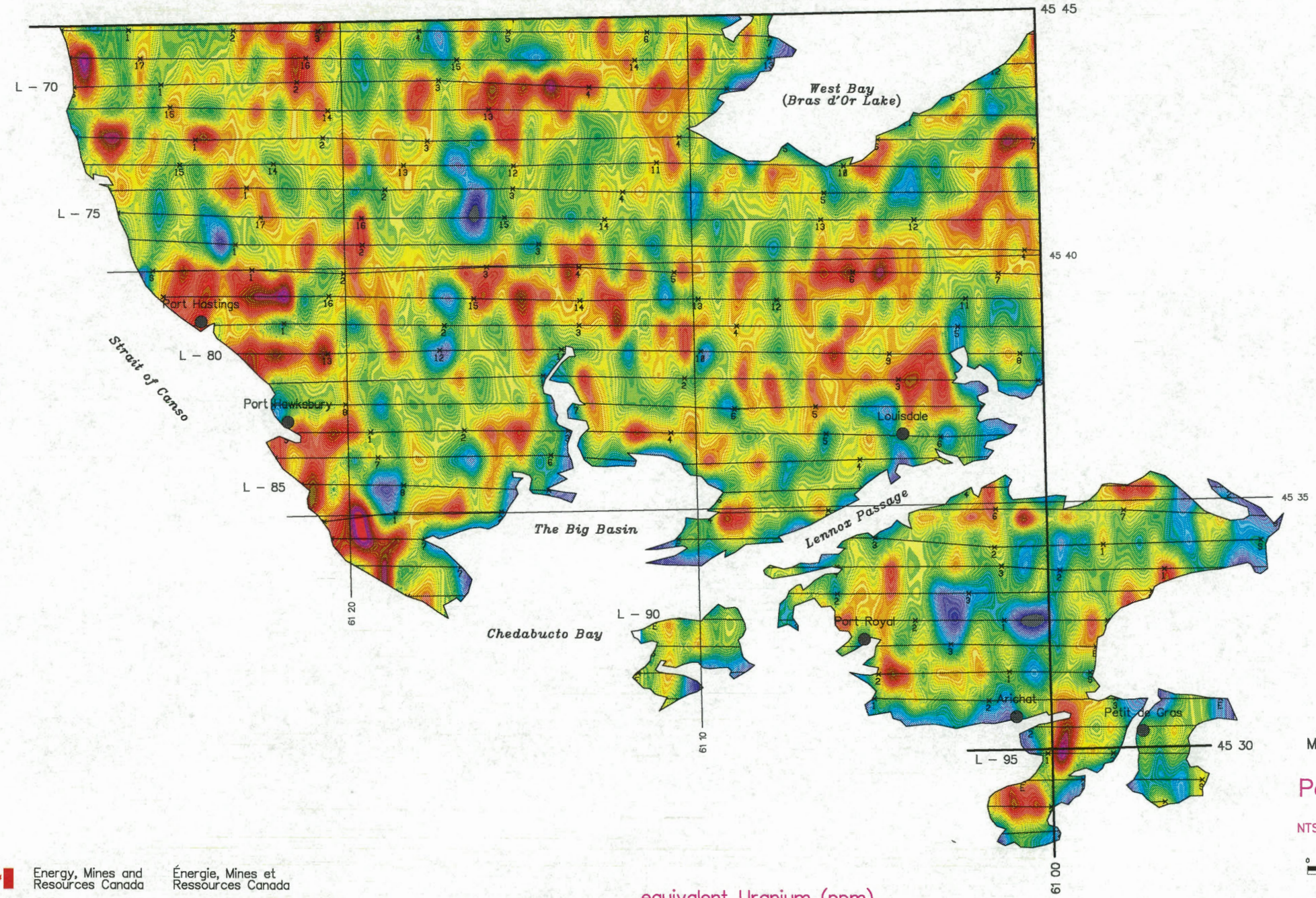


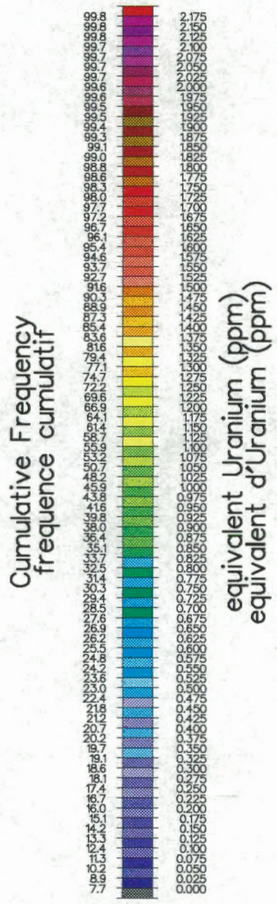


MAP 35611(11) G CARTE

## Port Hawksbury
Nova Scotia
NTS 11F/11 and 11F/10 (part of)

0 3 6
kilometers

Scale/Échelle = 1:150 000
Line spacing/Espacement des lignes = 1000 metres

equivalent Uranium (ppm)
equivalent d'Uranium (ppm)

Energy, Mines and Resources Canada
Énergie, Mines et Ressources Canada
Canada

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Cartes de Séries Géophysique Aérien – Couleur

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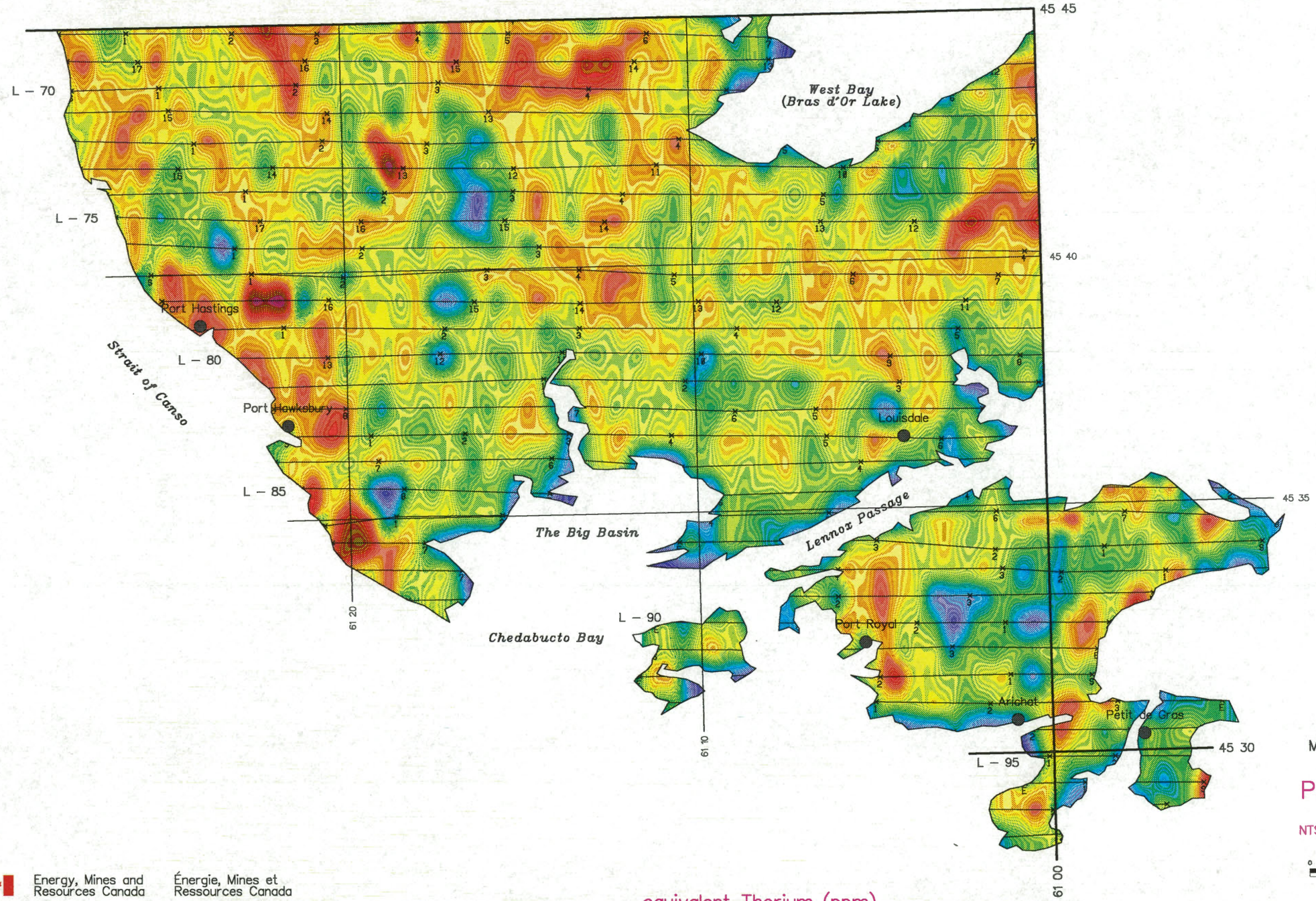


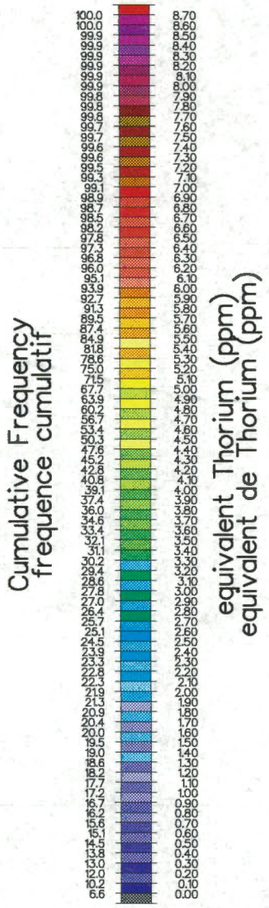


MAP 35611(11) G CARTE

# Port Hawksbury
## Nova Scotia
NTS 11F/11 and 11F/10 (part of)

0 3 6
kilometers

Scale/Échelle = 1:150 000
Line spacing/Espacement des lignes = 1000 metres

equivalent Thorium (ppm)
equivalent de Thorium (ppm)

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Canada

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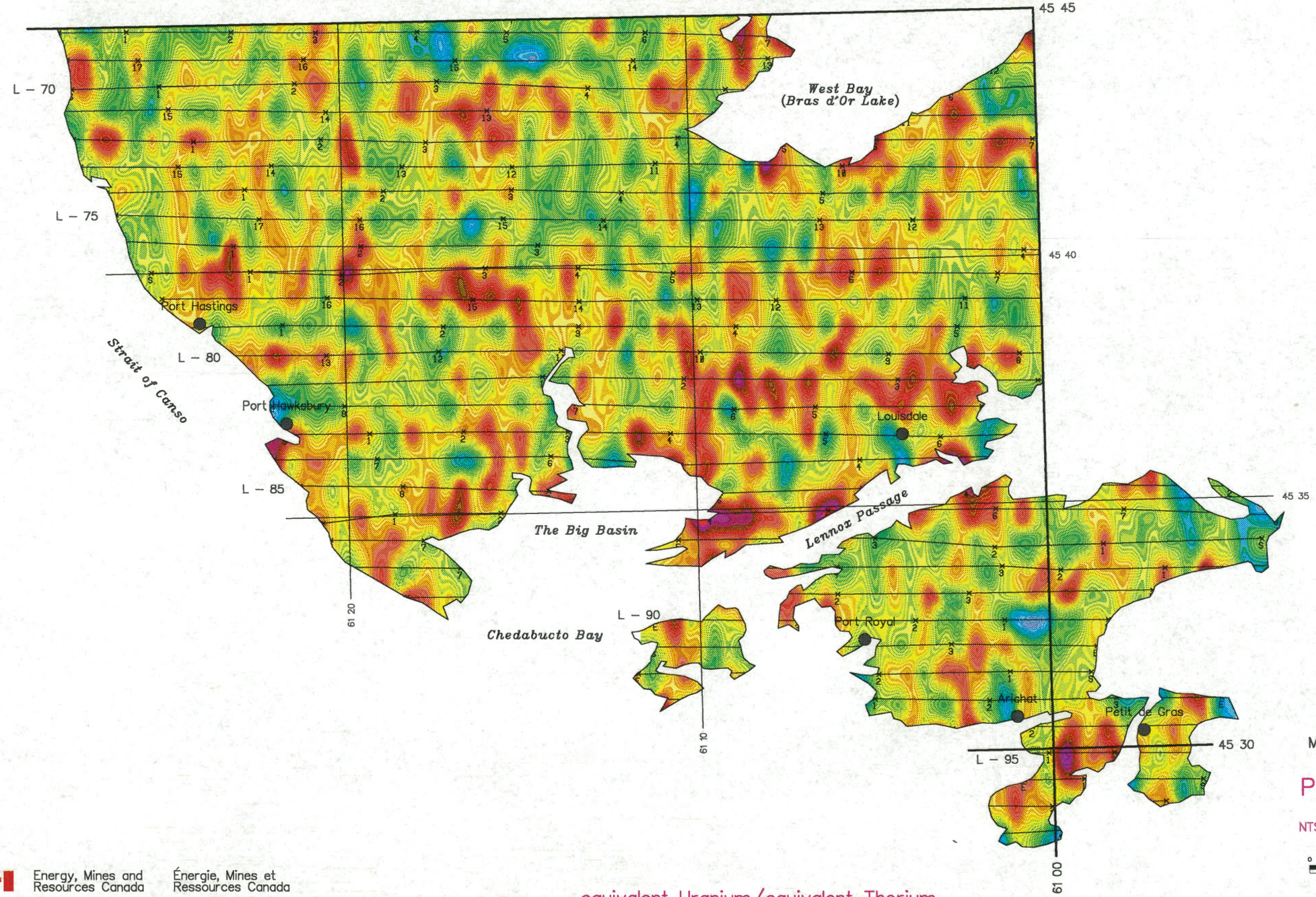


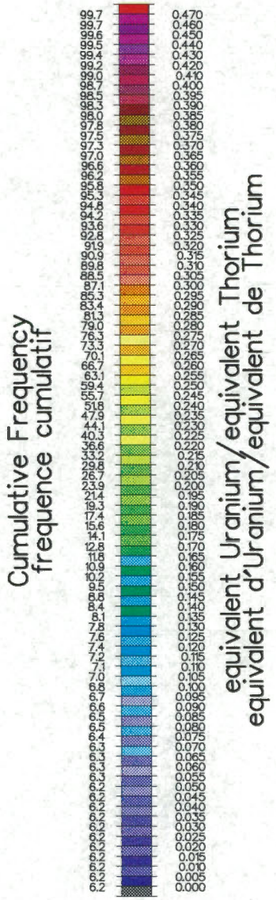


MAP 35611(11) G CARTE

# Port Hawksbury
## Nova Scotia
NTS 11F/11 and 11F/10 (part of)

0 3 6
kilometers

Scale/Échelle = 1:150 000
Line spacing/Espacement des lignes = 1000 metres

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equivalent Uranium/equivalent Thorium
equivalent d'Uranium/equivalent de Thorium

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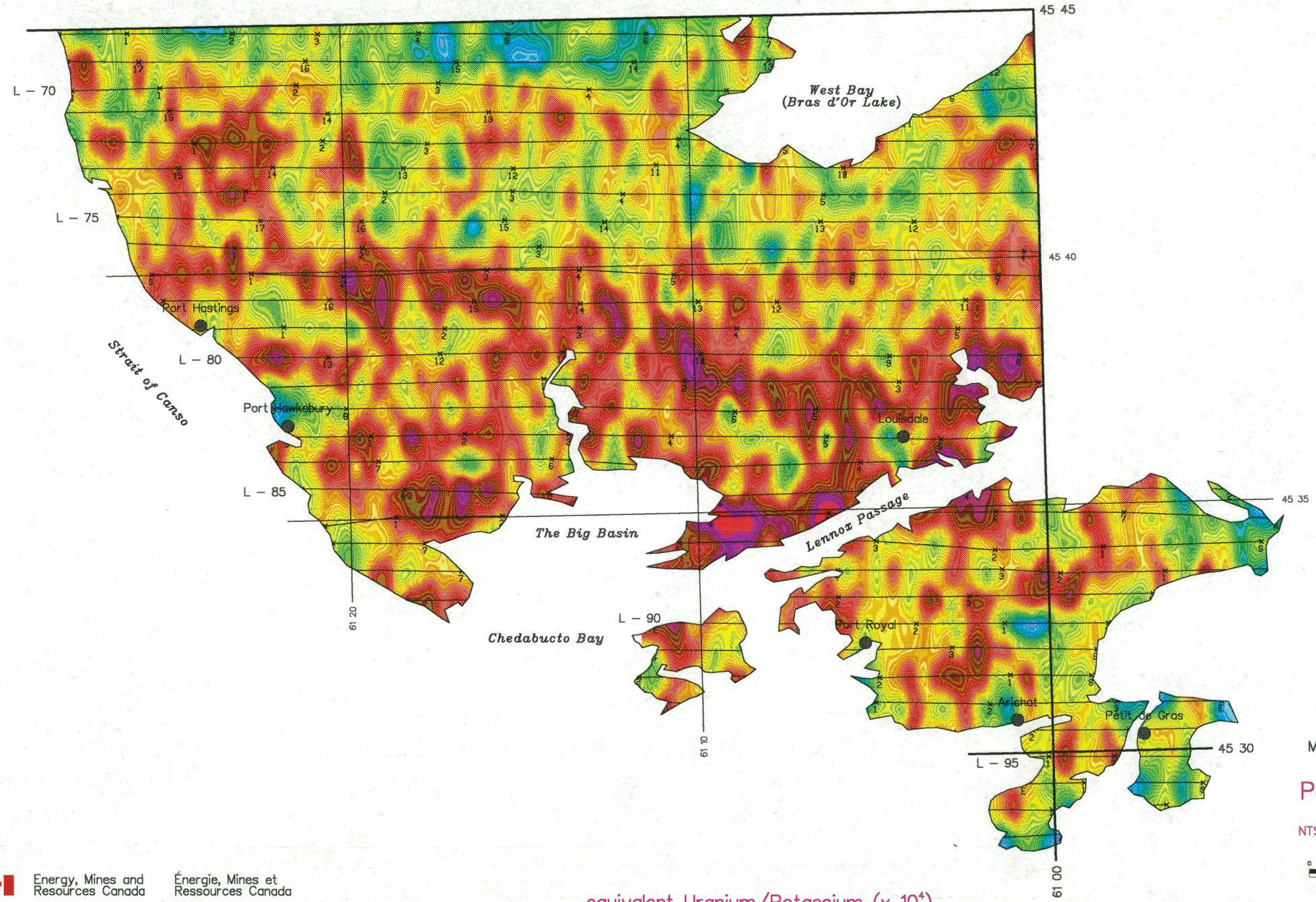


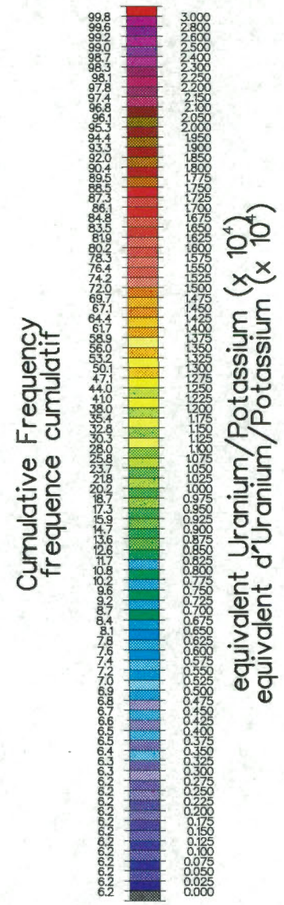


MAP 35611(11) G CARTE

## Port Hawksbury
Nova Scotia
NTS 11F/11 and 11F/10 (part of)

0 3 6
kilometers

Scale/Échelle = 1:150 000
Line spacing/Espacement des lignes = 1000 metres

equivalent Uranium/Potassium (x $10^4$)
equivalent d'Uranium/Potassium (x $10^4$)

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Cartes de Séries Géophysique Aérien – Couleur

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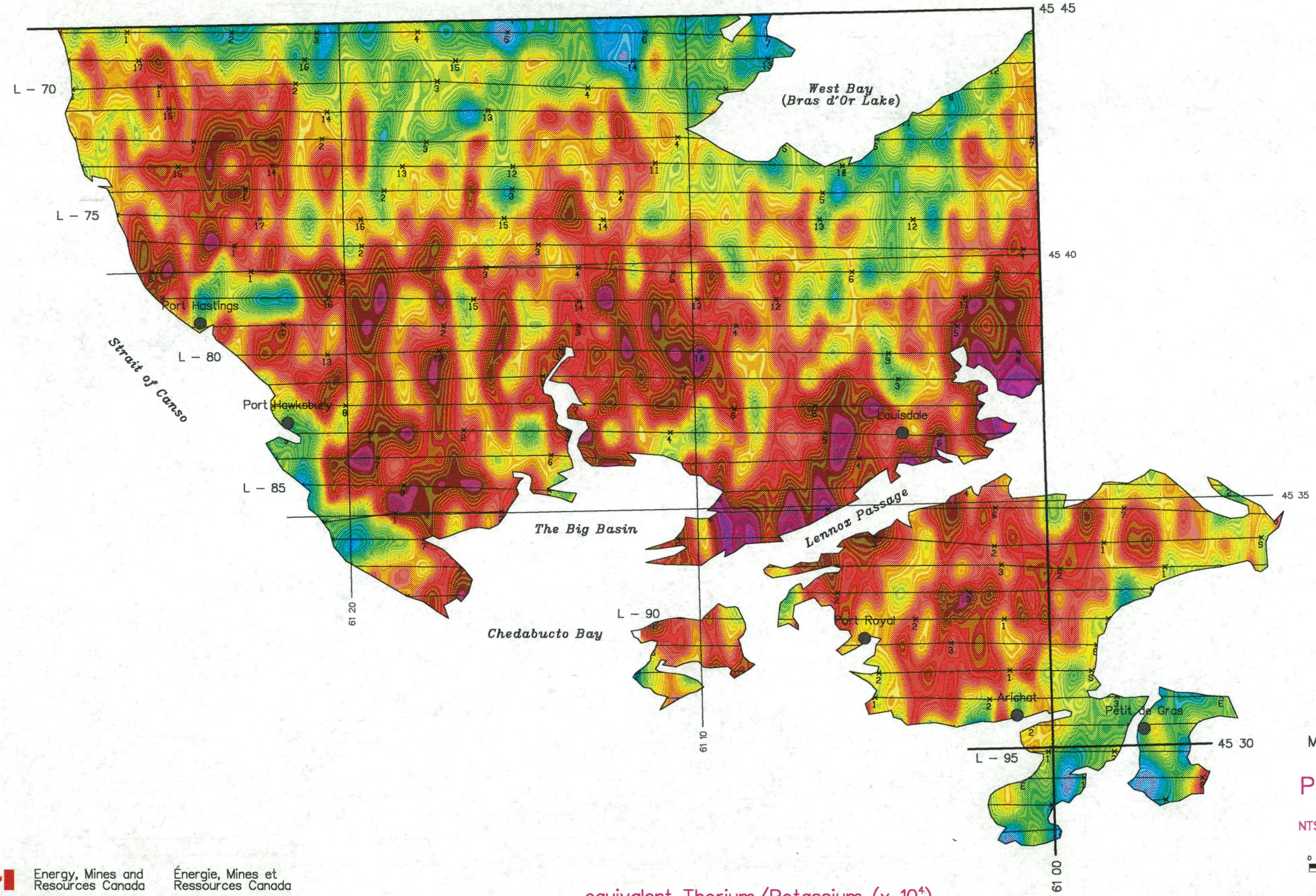


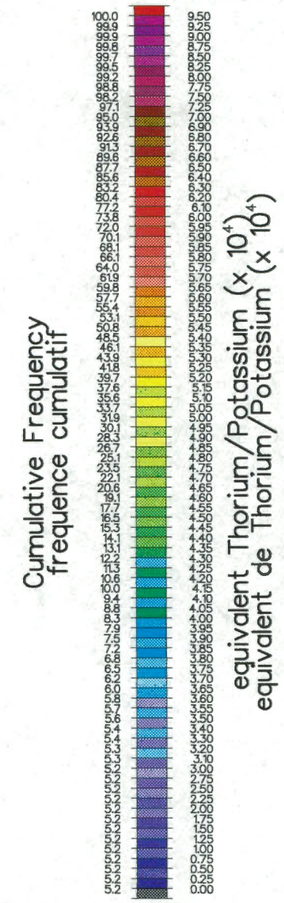


MAP 35611(11) G CARTE

## Port Hawksbury
Nova Scotia
NTS 11F/11 and 11F/10 (part of)

0 3 6
kilometers

Scale/Échelle = 1:150 000
Line spacing/Espacement des lignes = 1000 metres

equivalent Thorium/Potassium (x $10^4$)
equivalent de Thorium/Potassium (x $10^4$)

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Énergie, Mines et Ressources Canada
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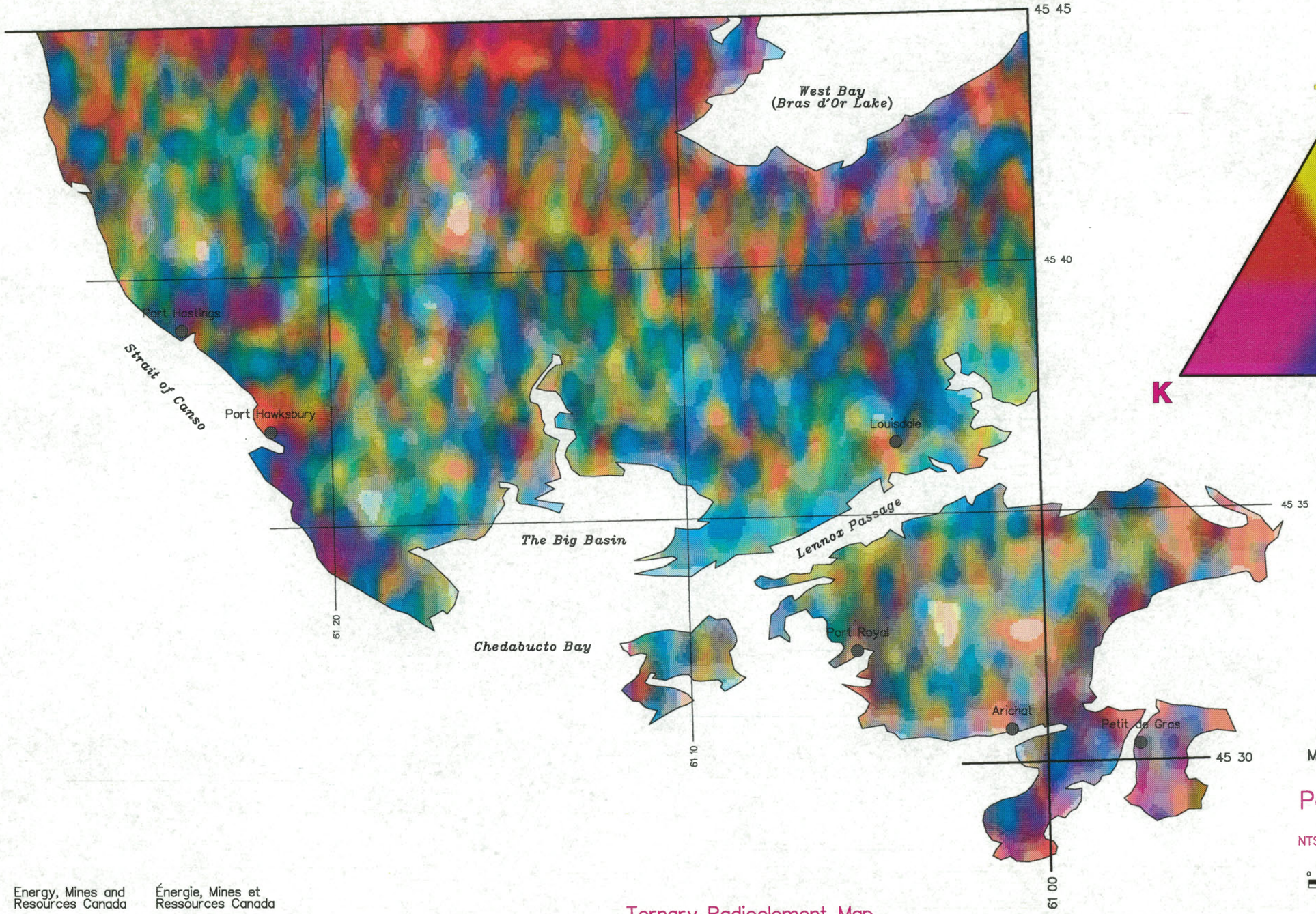


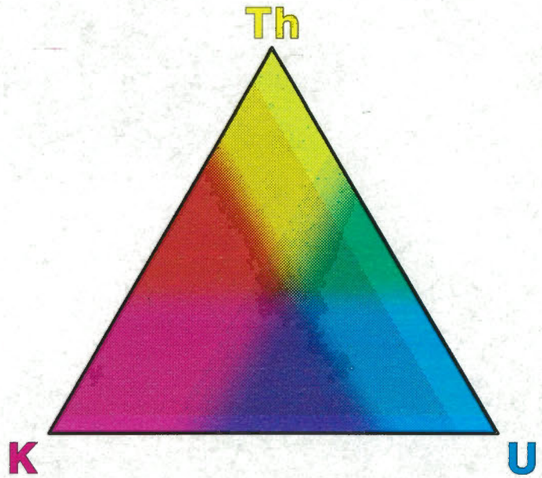


MAP 35611(11) G CARTE

## Port Hawksbury
Nova Scotia
NTS 11F/11 and 11F/10 (part of)

0 3 6
kilometers

Scale/Échelle = 1:150 000
Line spacing/Espacement des lignes = 1000 metres

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Ternary Radioelement Map
Carte Ternary

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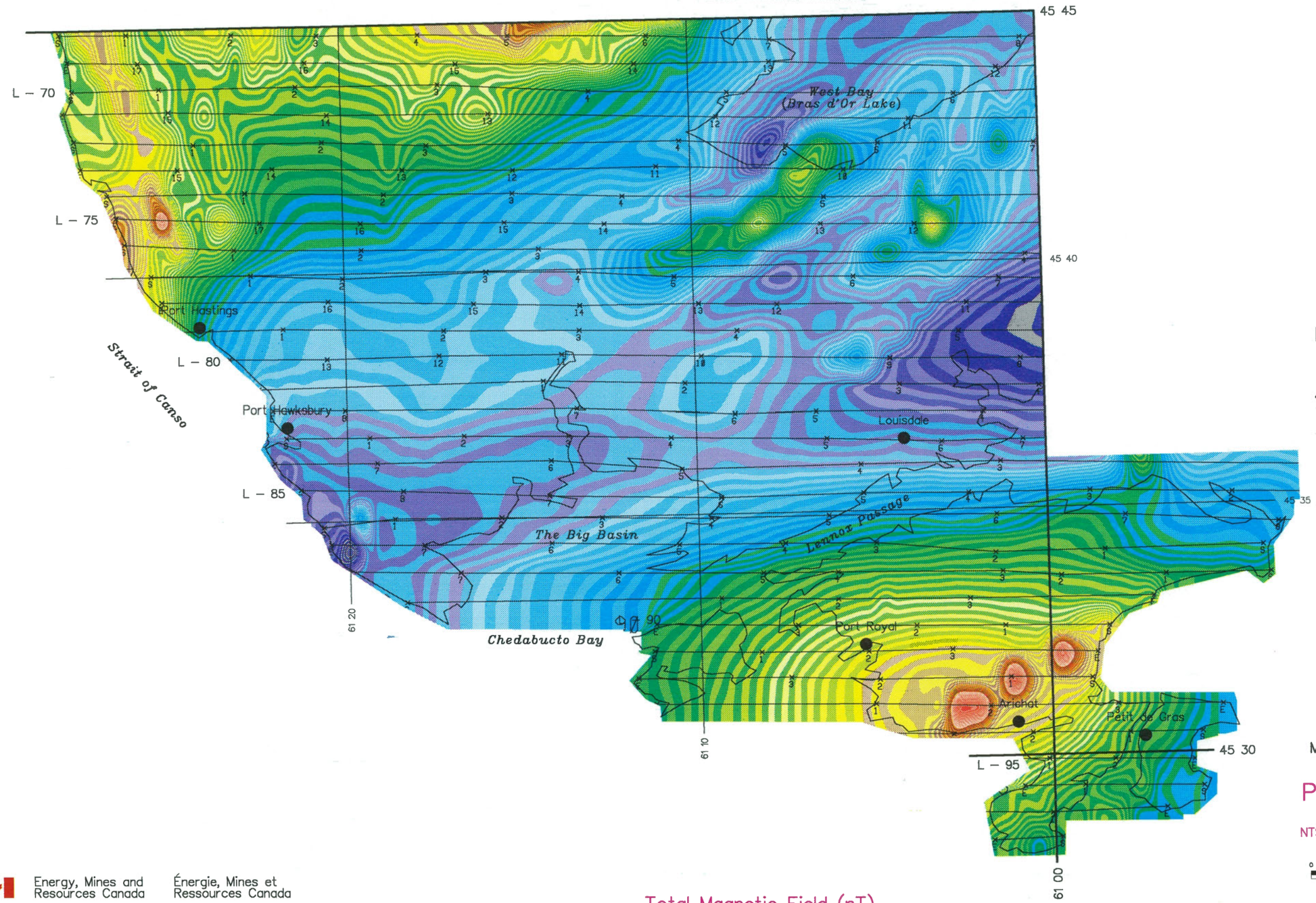


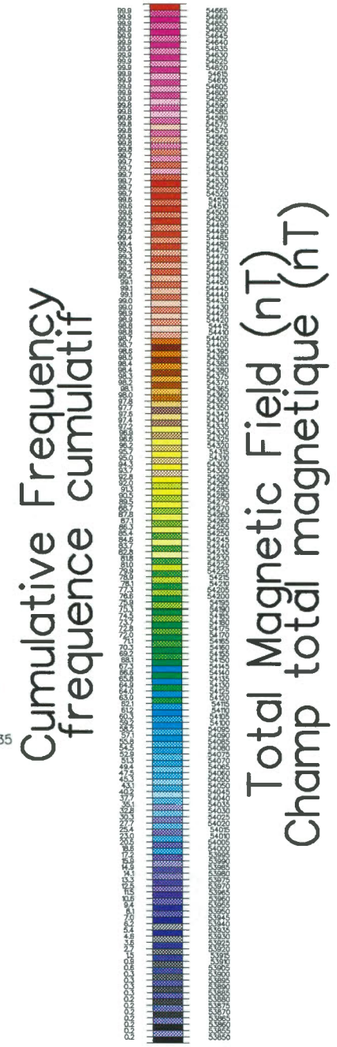


MAP 35611(11) G CARTE

## Port Hawksbury
Nova Scotia
NTS 11F/11 and 11F/10 (part of)

0 3 6
kilometers

Scale/Échelle = 1:150 000
Line spacing/Espacement des lignes = 1000 metres

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Total Magnetic Field (nT)
Champ total magnetique (nT)

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Cartes de Séries Géophysique Aérien — Couleur

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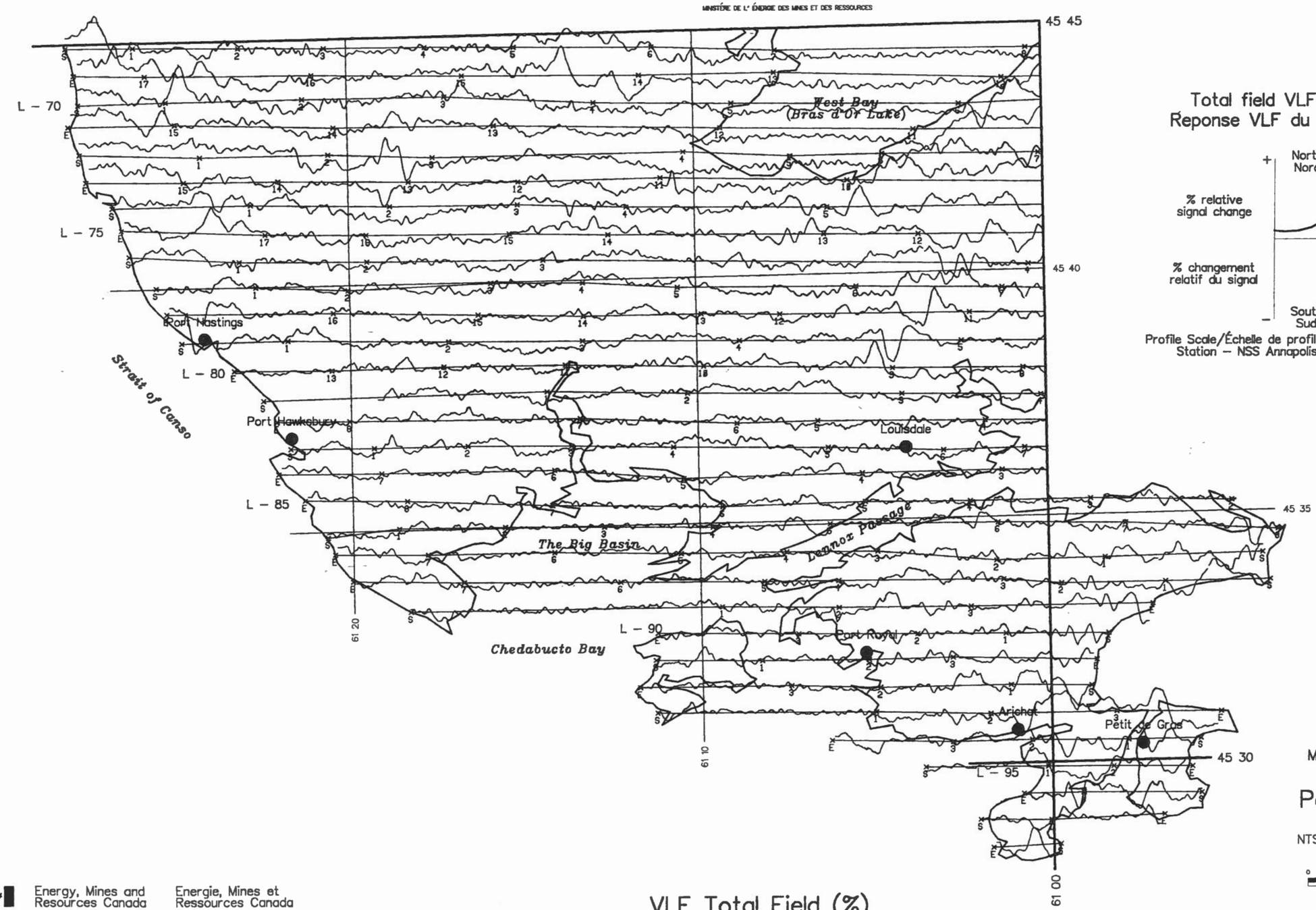
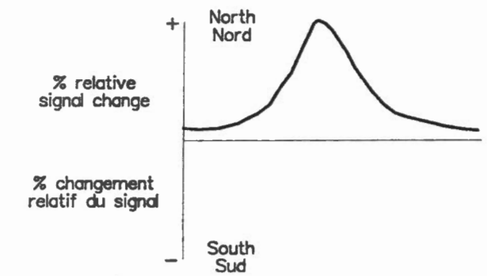



Total field VLF response
Reponse VLF du champ total




Profile Scale/Échelle de profil = 45% / cm
Station — NSS Annapolis Maryland

MAP 35611(11) G CARTE

# Port Hawksbury
## Nova Scotia
NTS 11F/11 and 11F/10 (part of)

0 3 6
kilometers

Scale/Échelle = 1:150 000
Line spacing/Espacement des lignes = 1000 metres

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Canada

VLF Total Field (%)
Champ total TBF (%)

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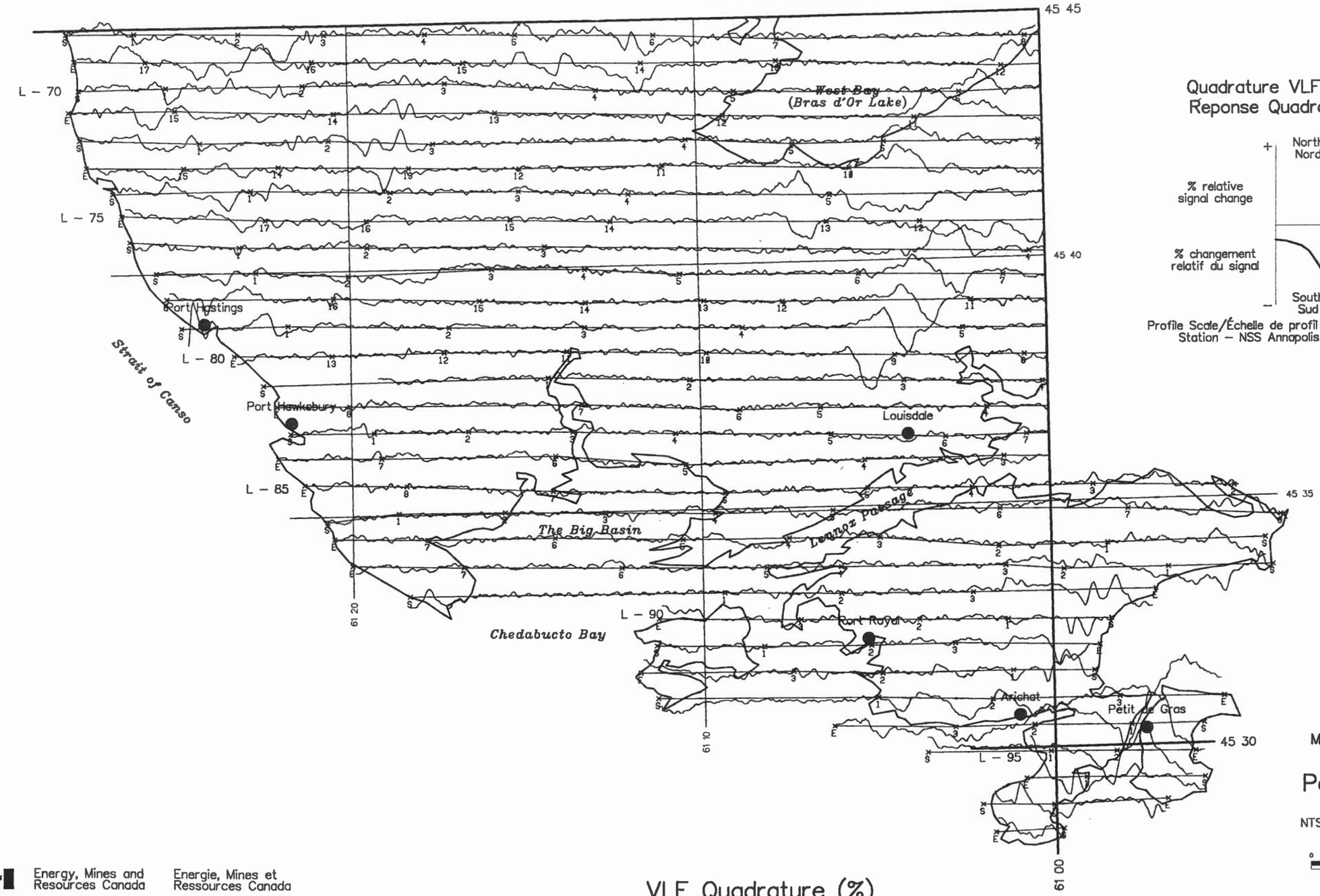
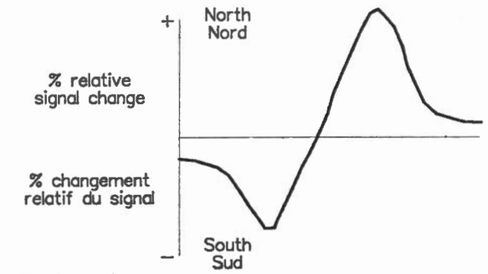



Quadrature VLF response
Reponse Quadrature VLF




Profile Scale/Échelle de profil = 45% / cm
Station — NSS Annapolis Maryland

MAP 35611(11) G CARTE

# Port Hawksbury
Nova Scotia
NTS 11F/11 and 11F/10 (part of)

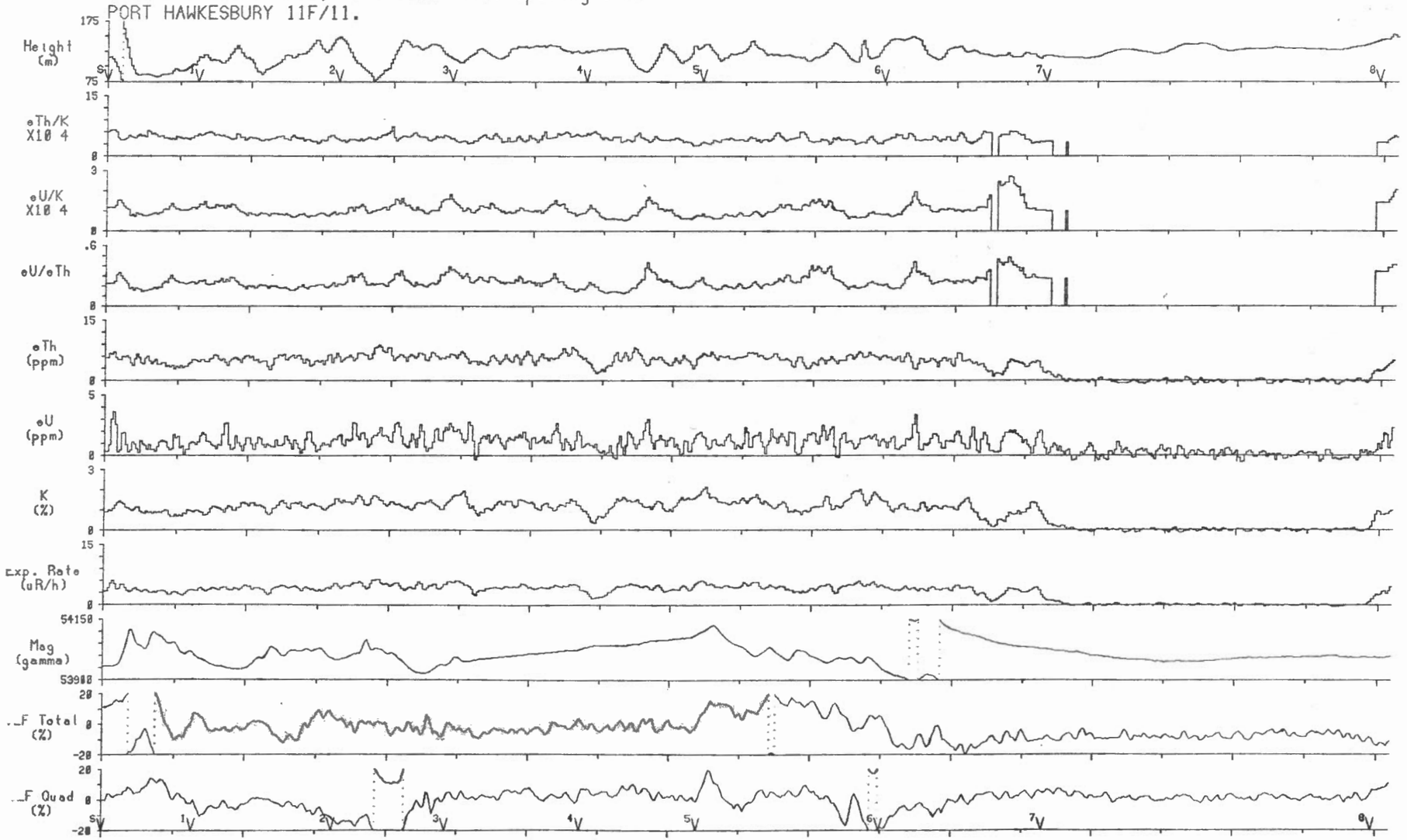
0 3 6
kilometers

Scale/Échelle = 1:150 000
Line spacing/Espacement des lignes = 1000 metres

VLF Quadrature (%)
Quadrature TBF (%)

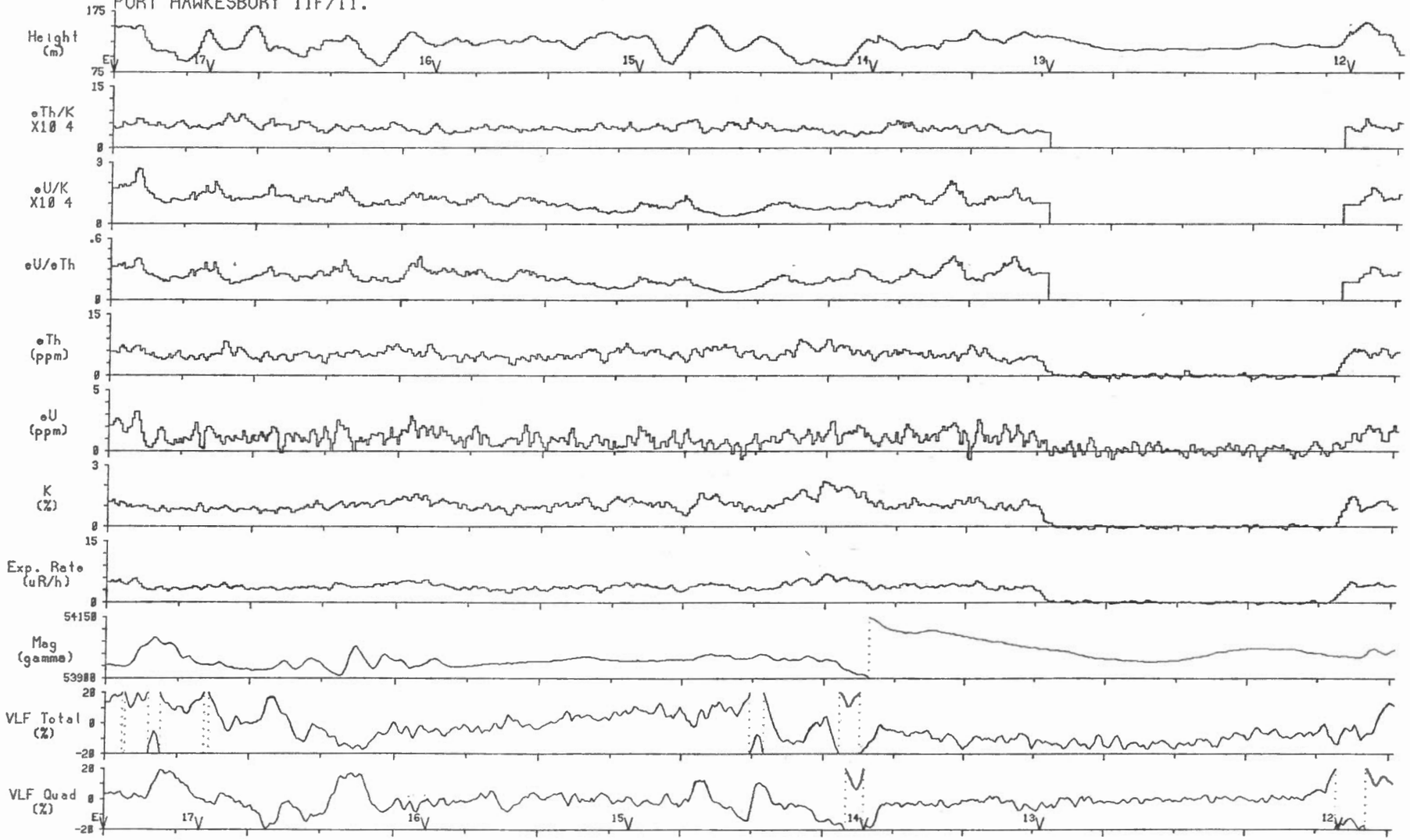
Energy, Mines and Resources Canada — Energie, Mines et Ressources Canada
Canada

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



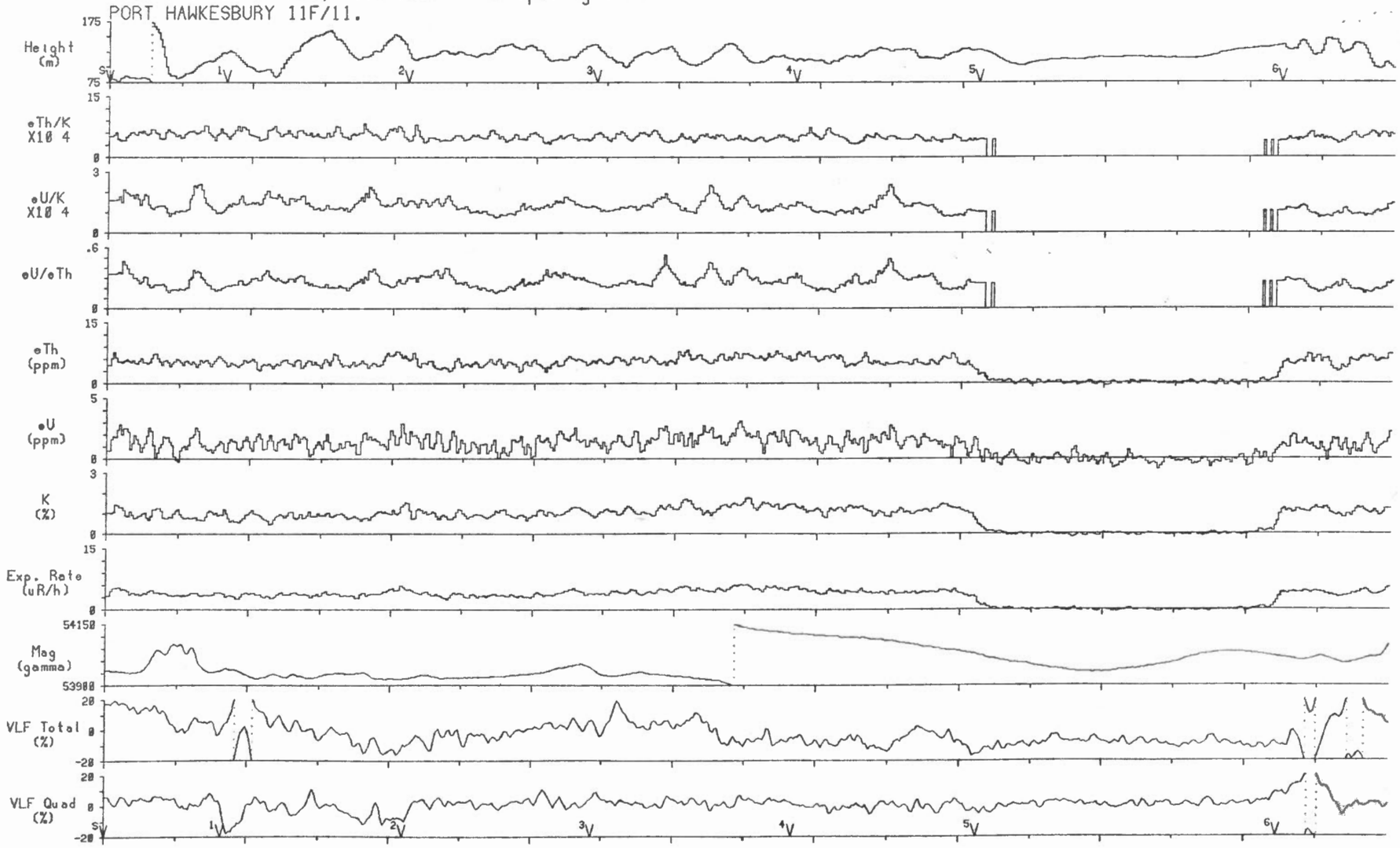

Line 68 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



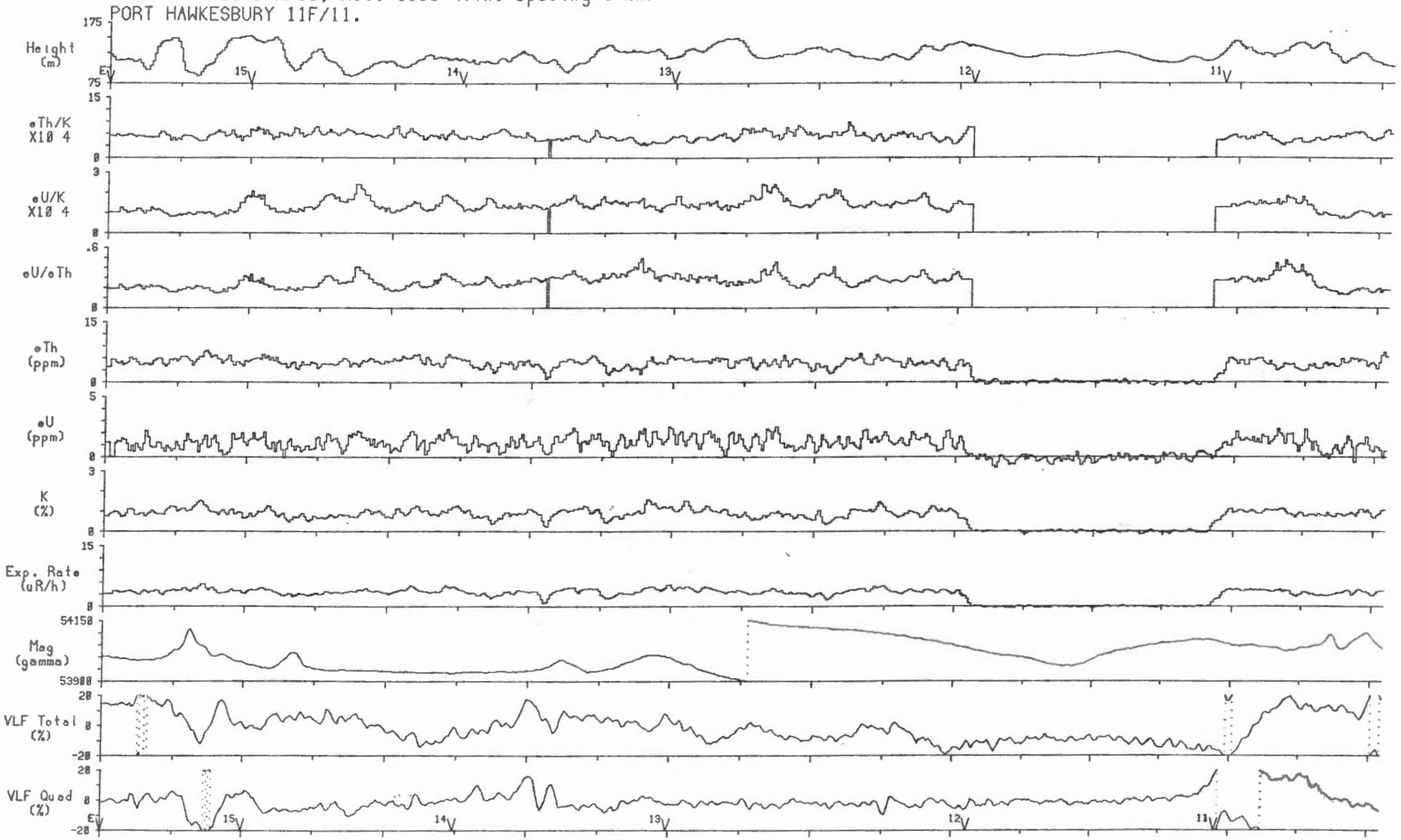

Line 69 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



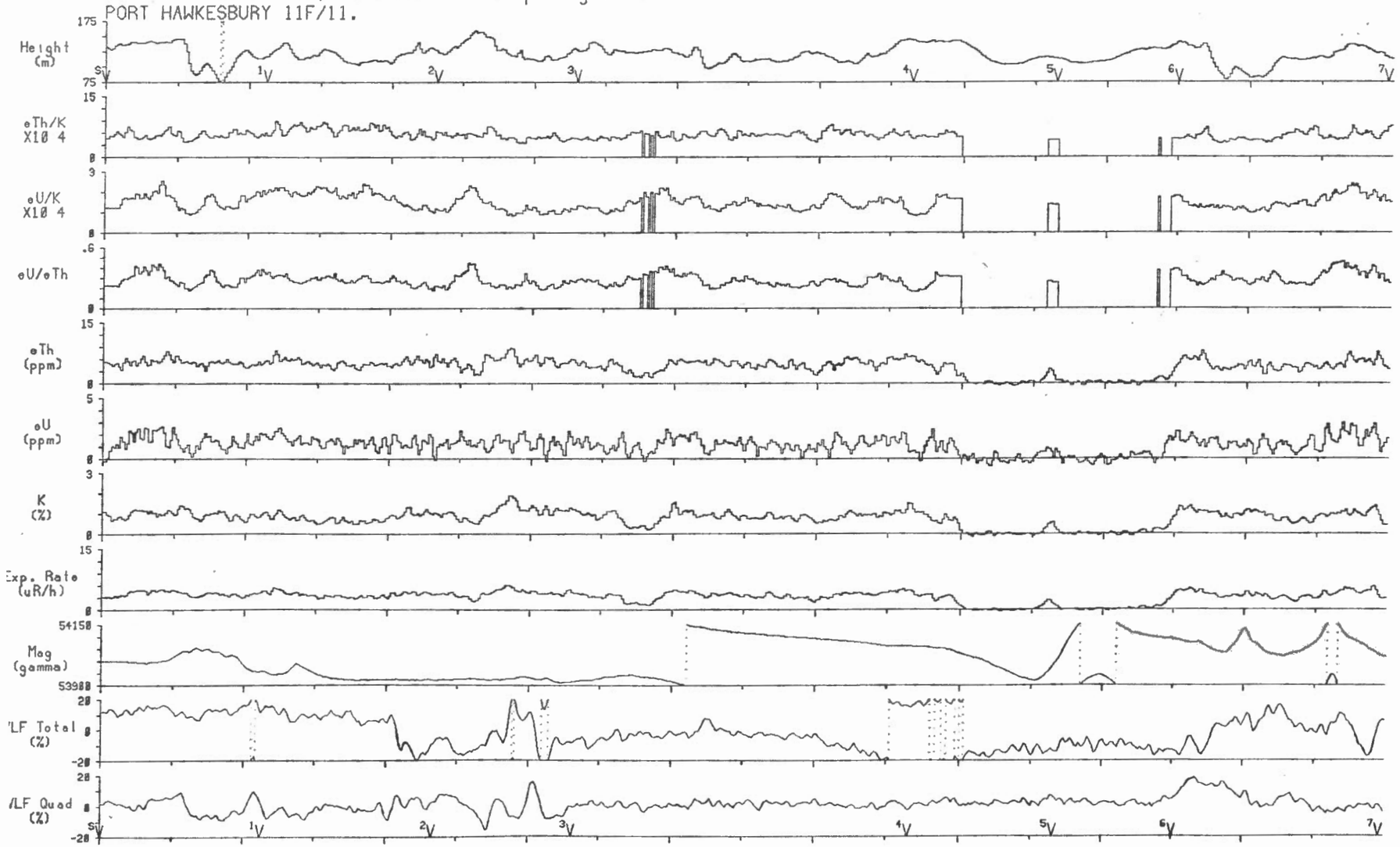

Line 70 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



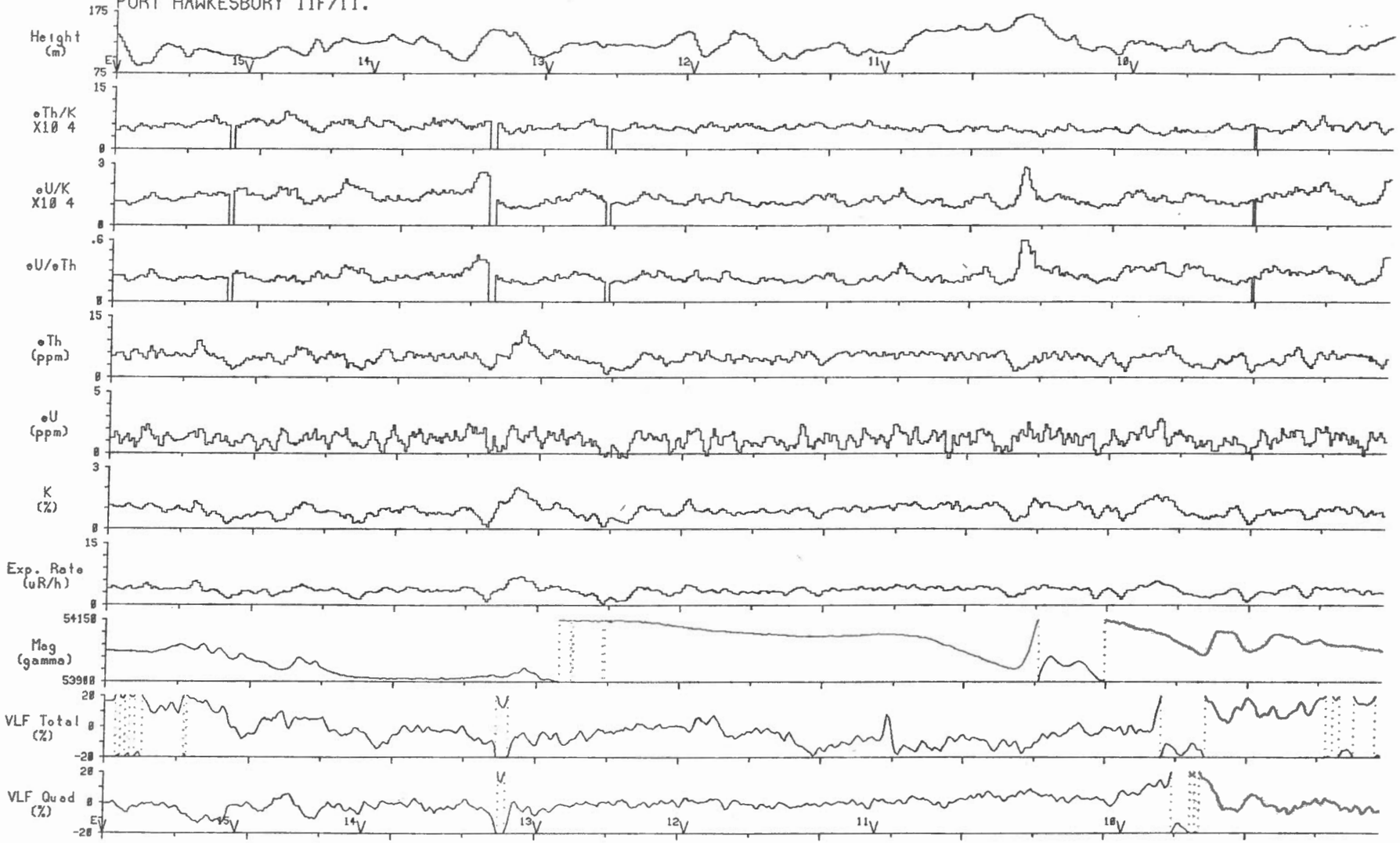

Line 71 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



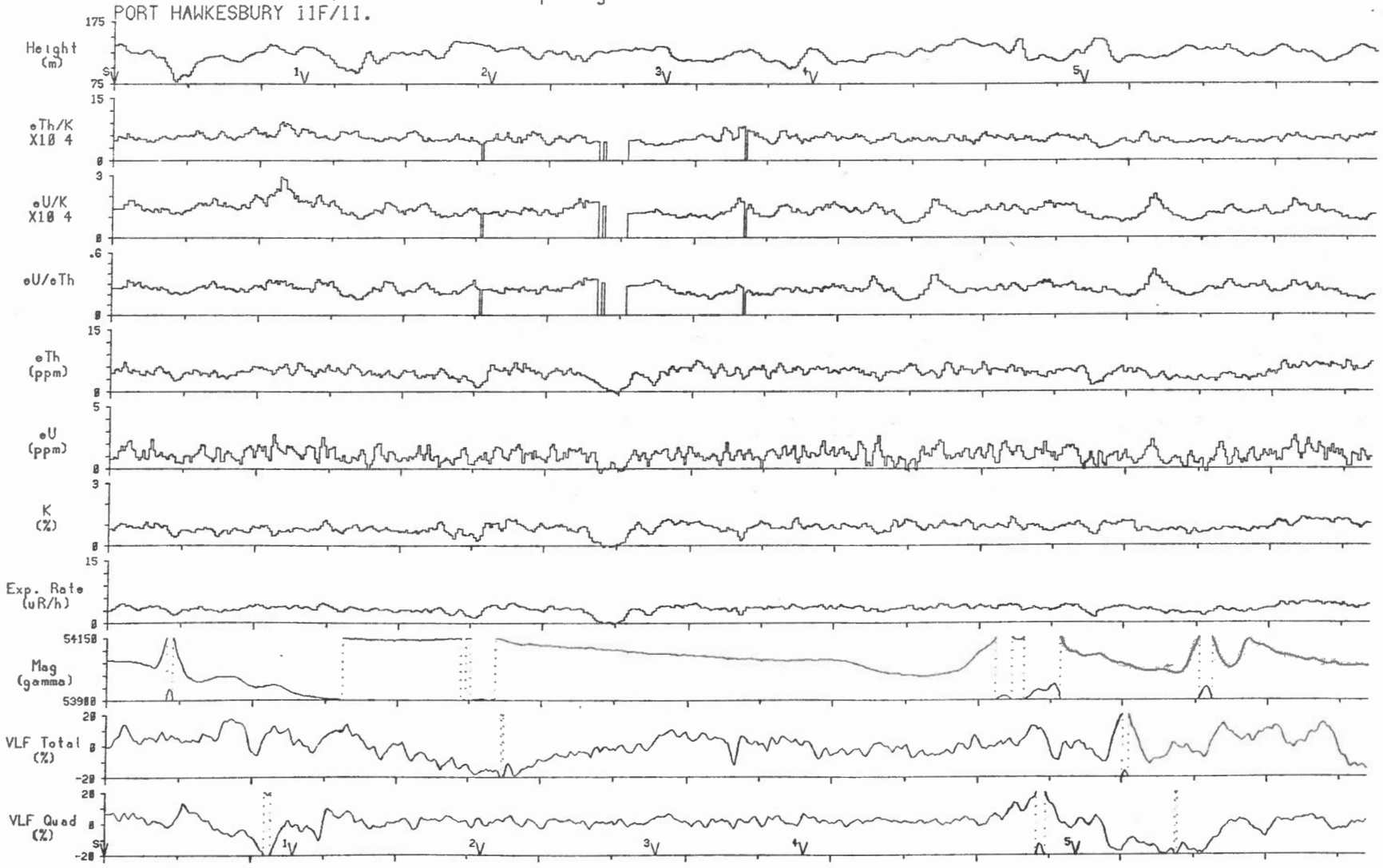

Line 72 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



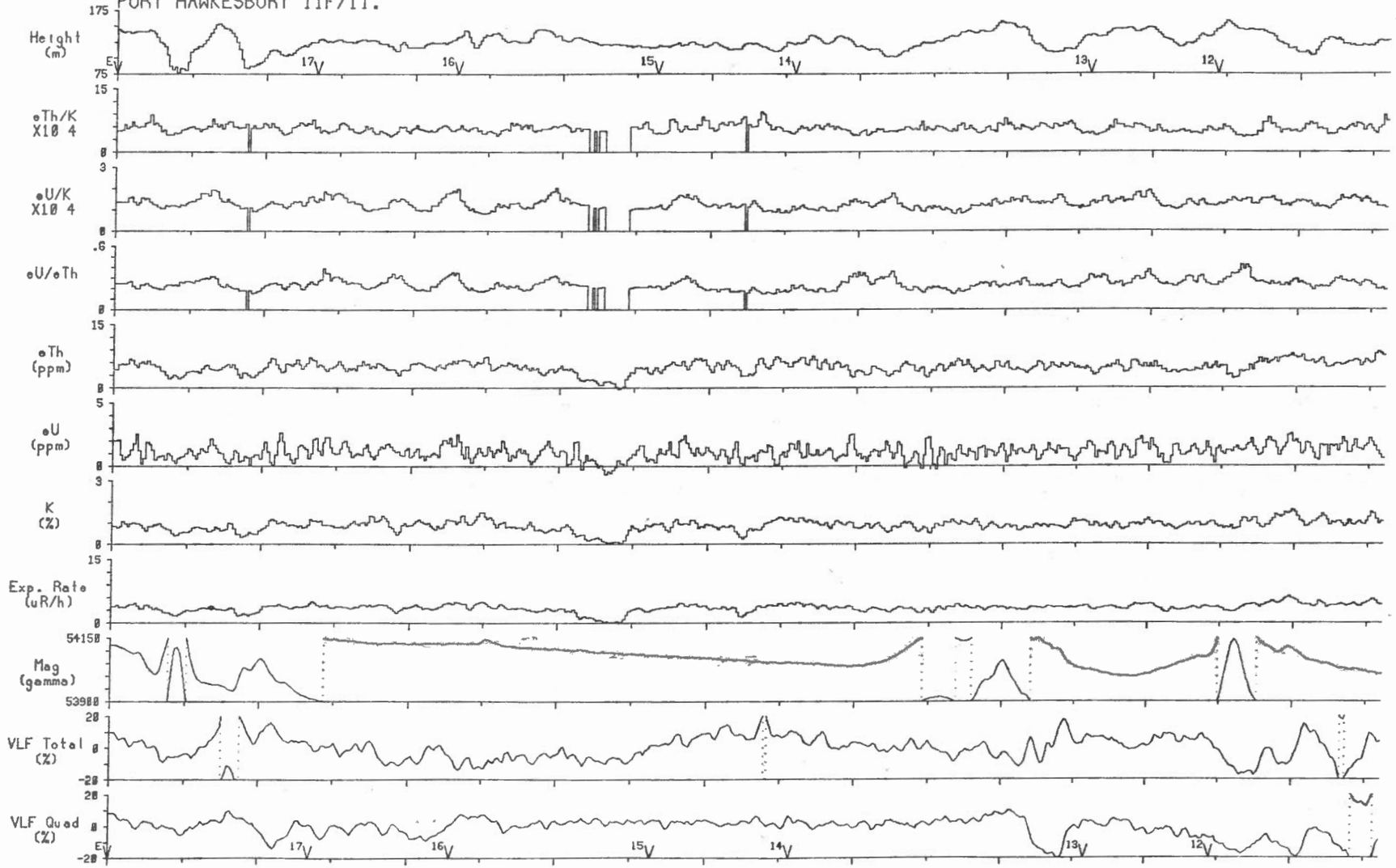

Line 73 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



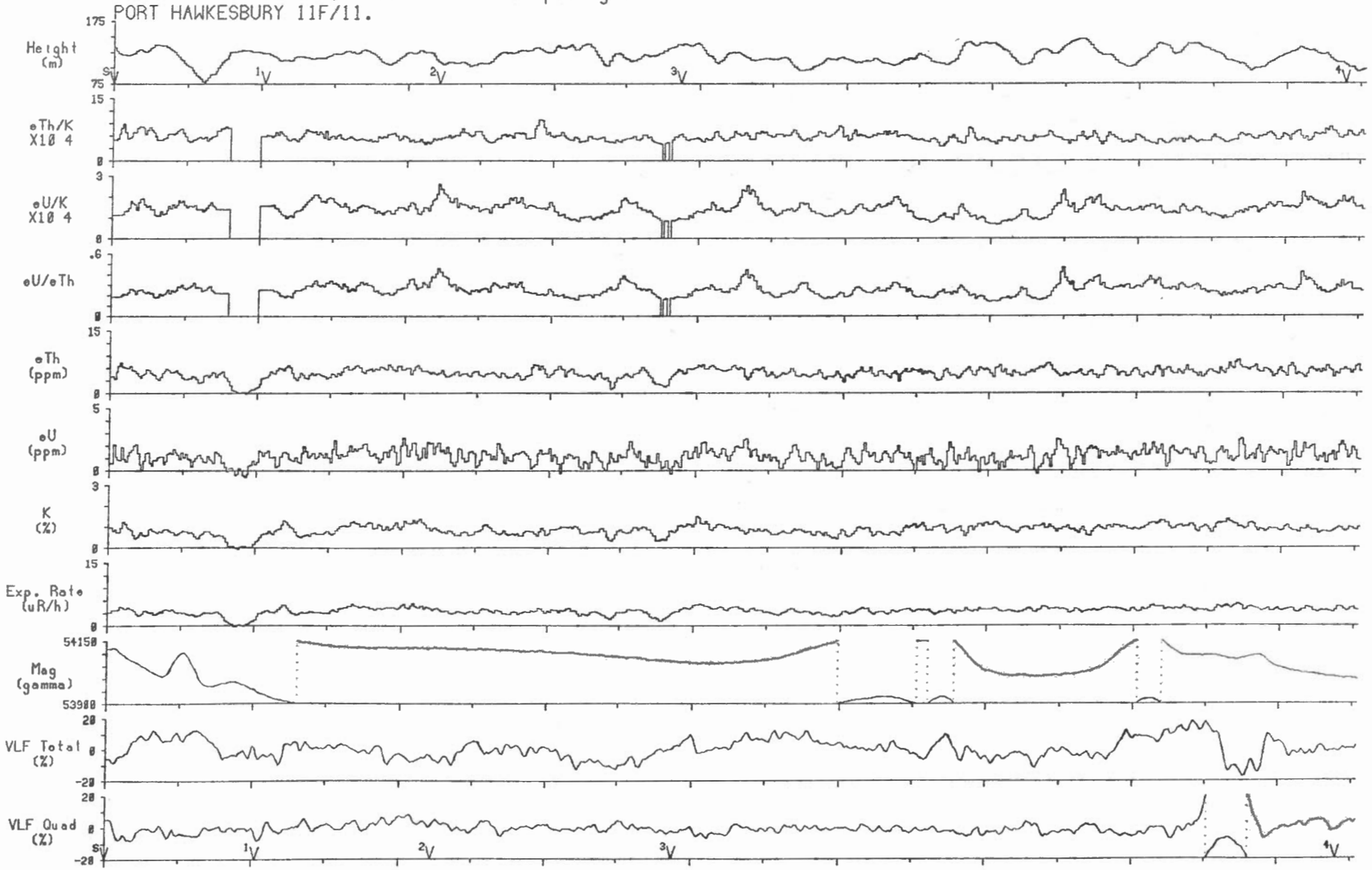

Line 74 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



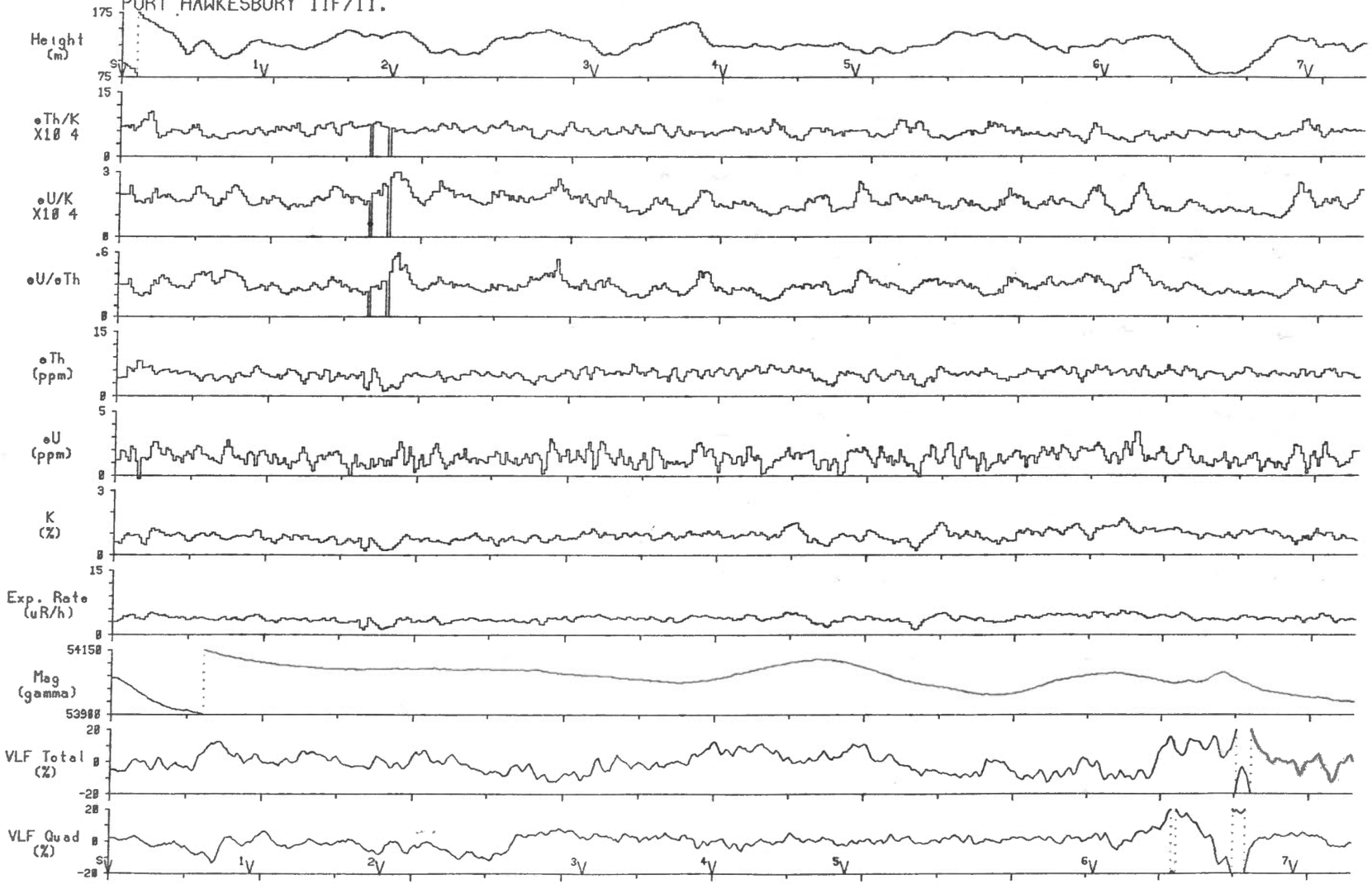

Line 75 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



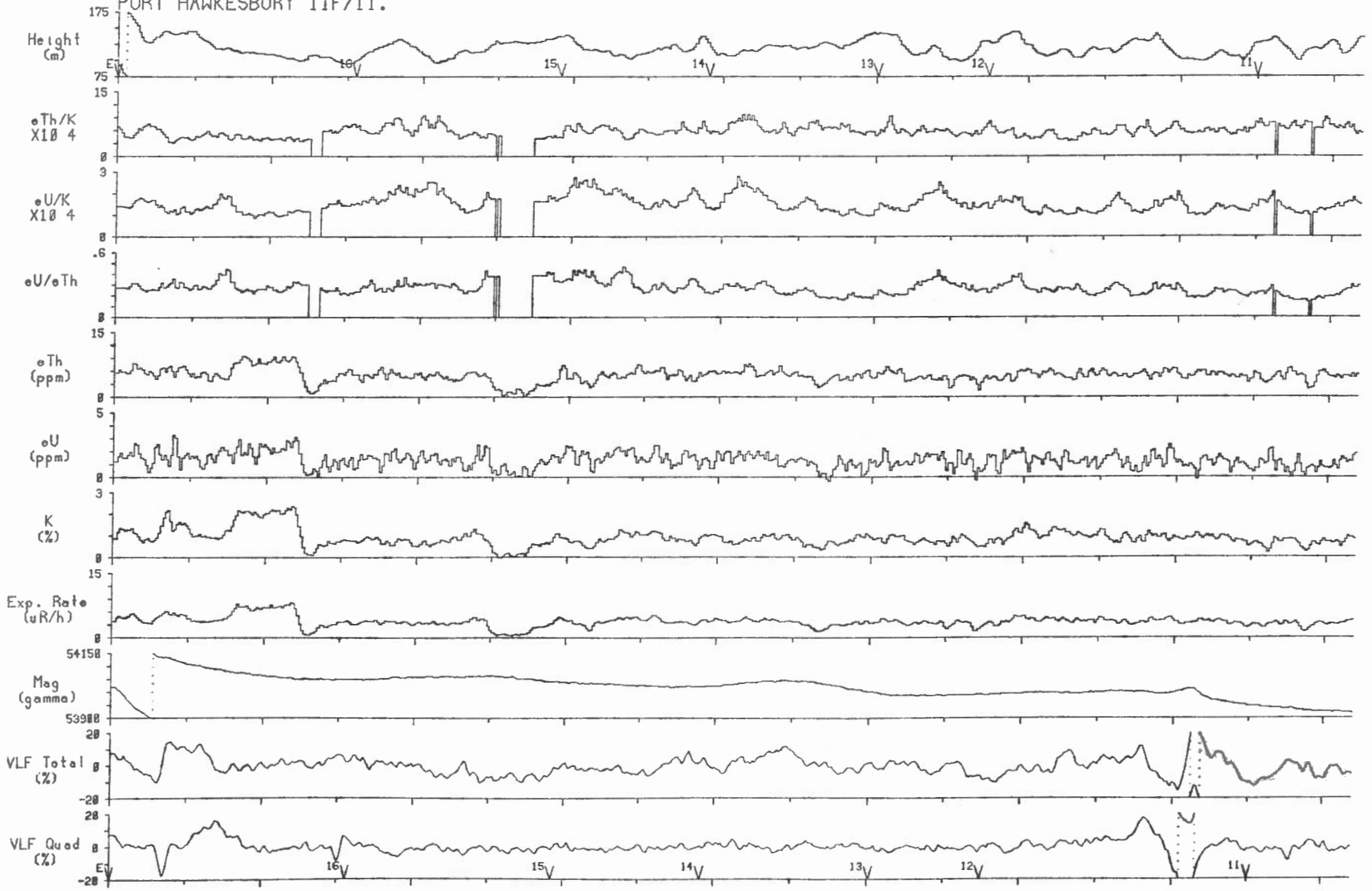

Line 76 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



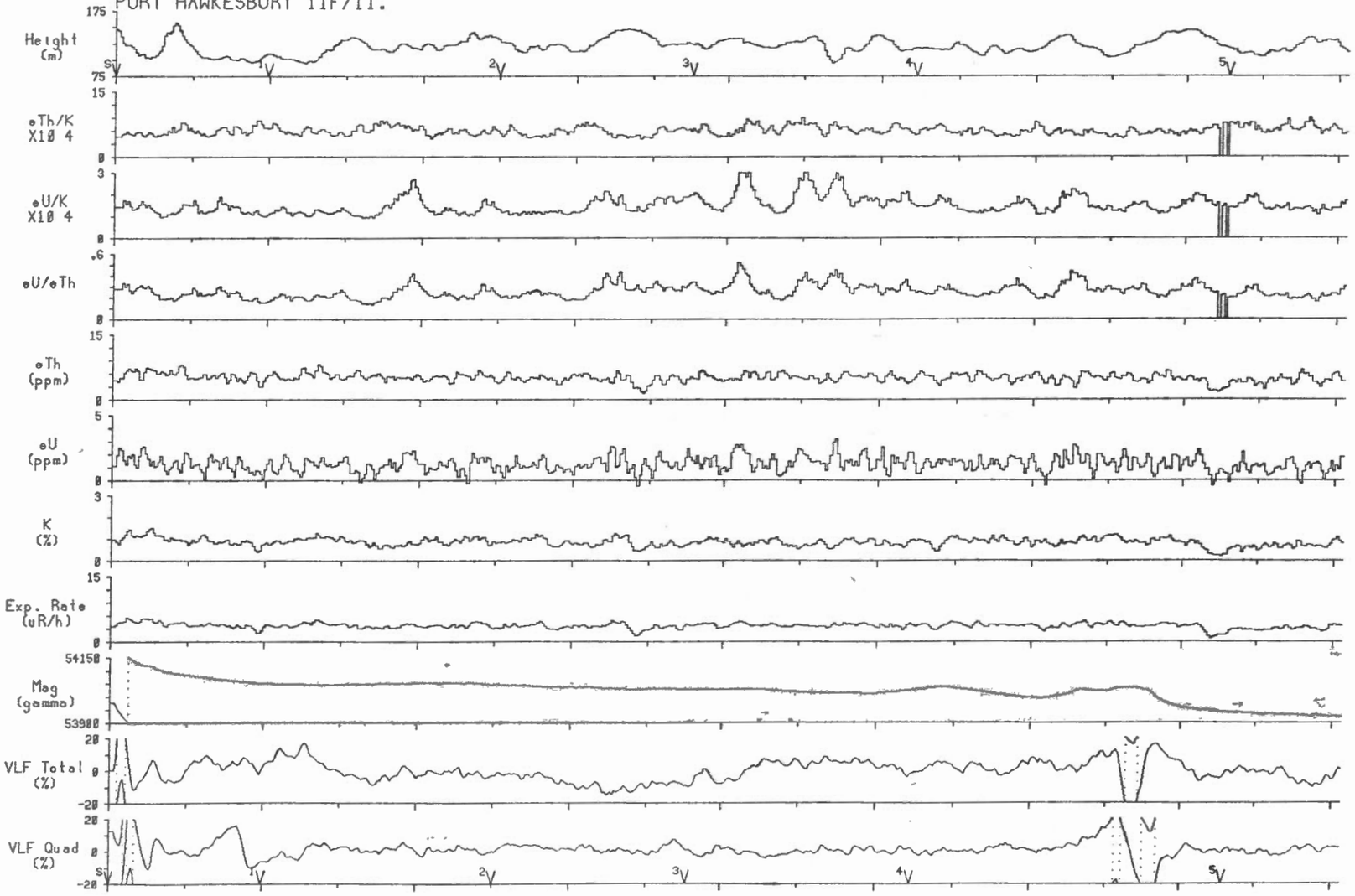

Line 77 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



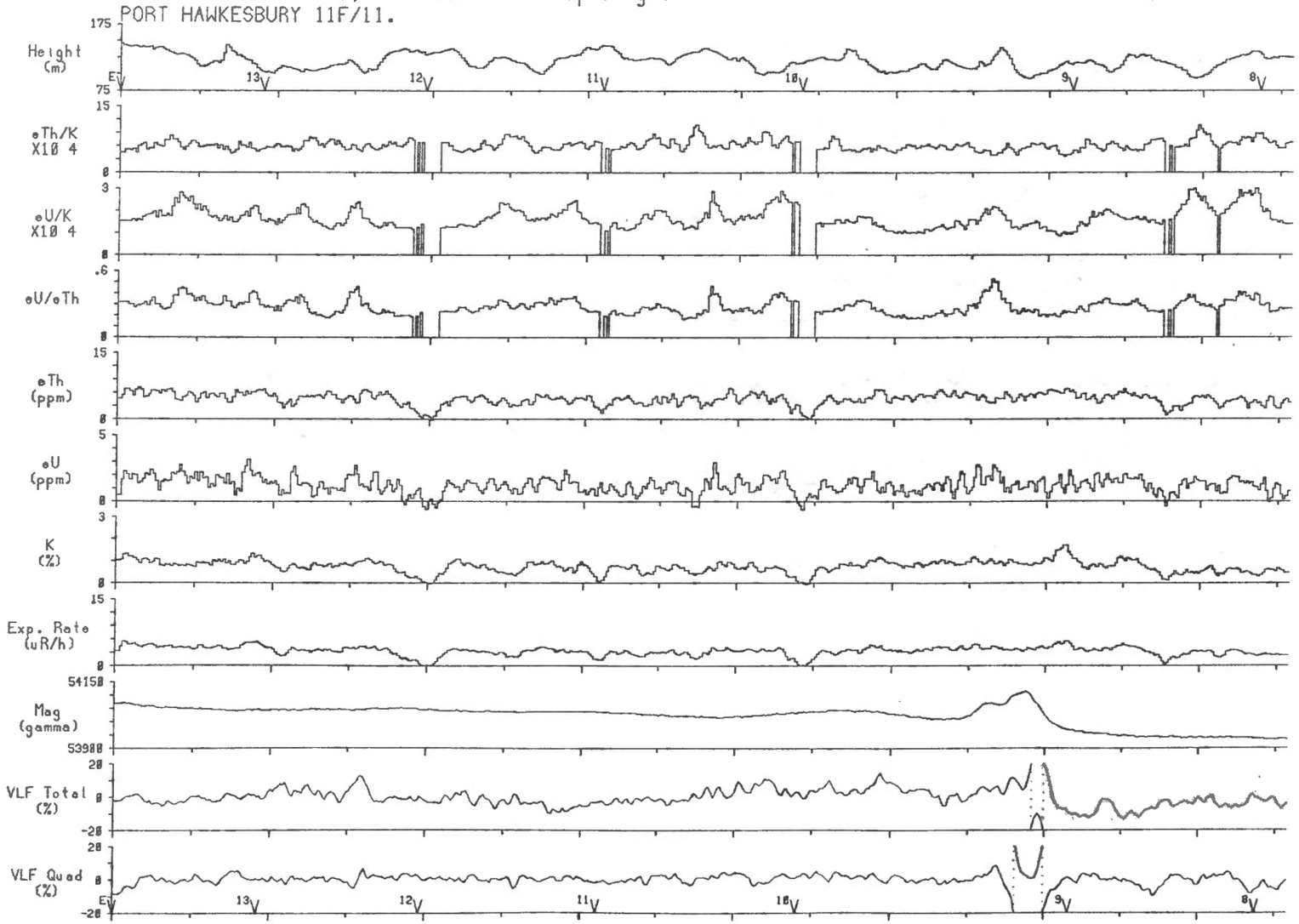

Line 78 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



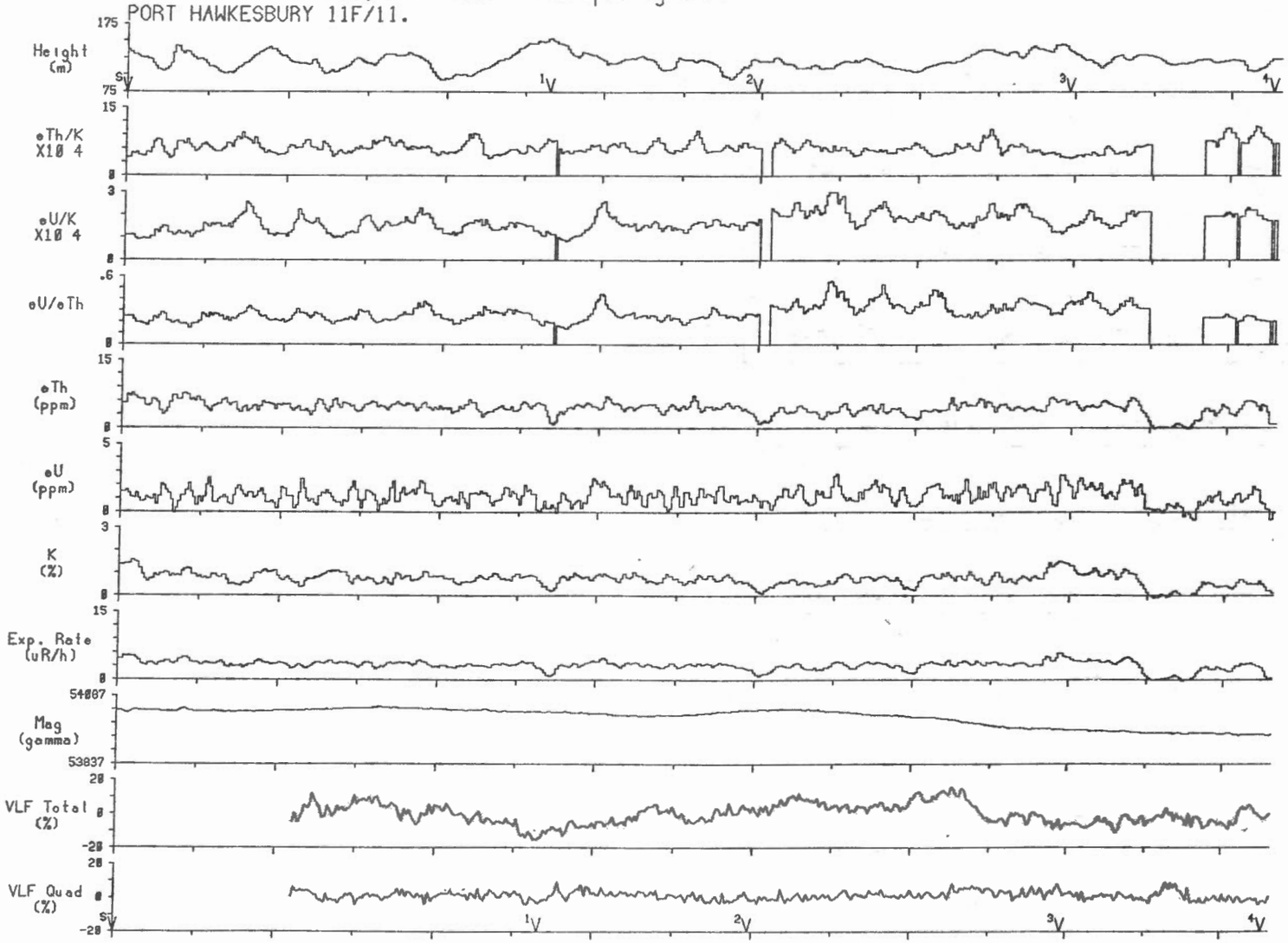

Line 79 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



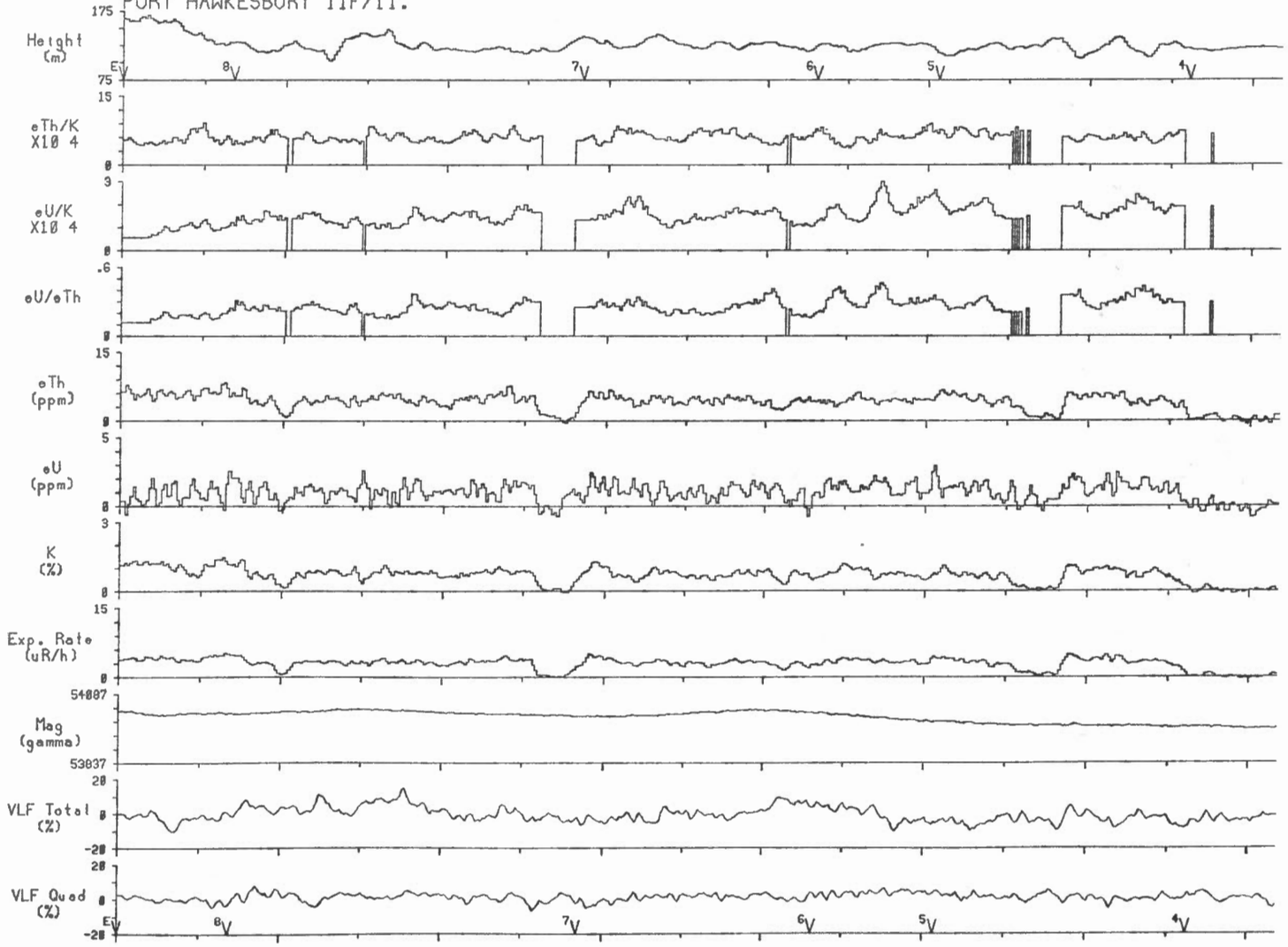

Line 80 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



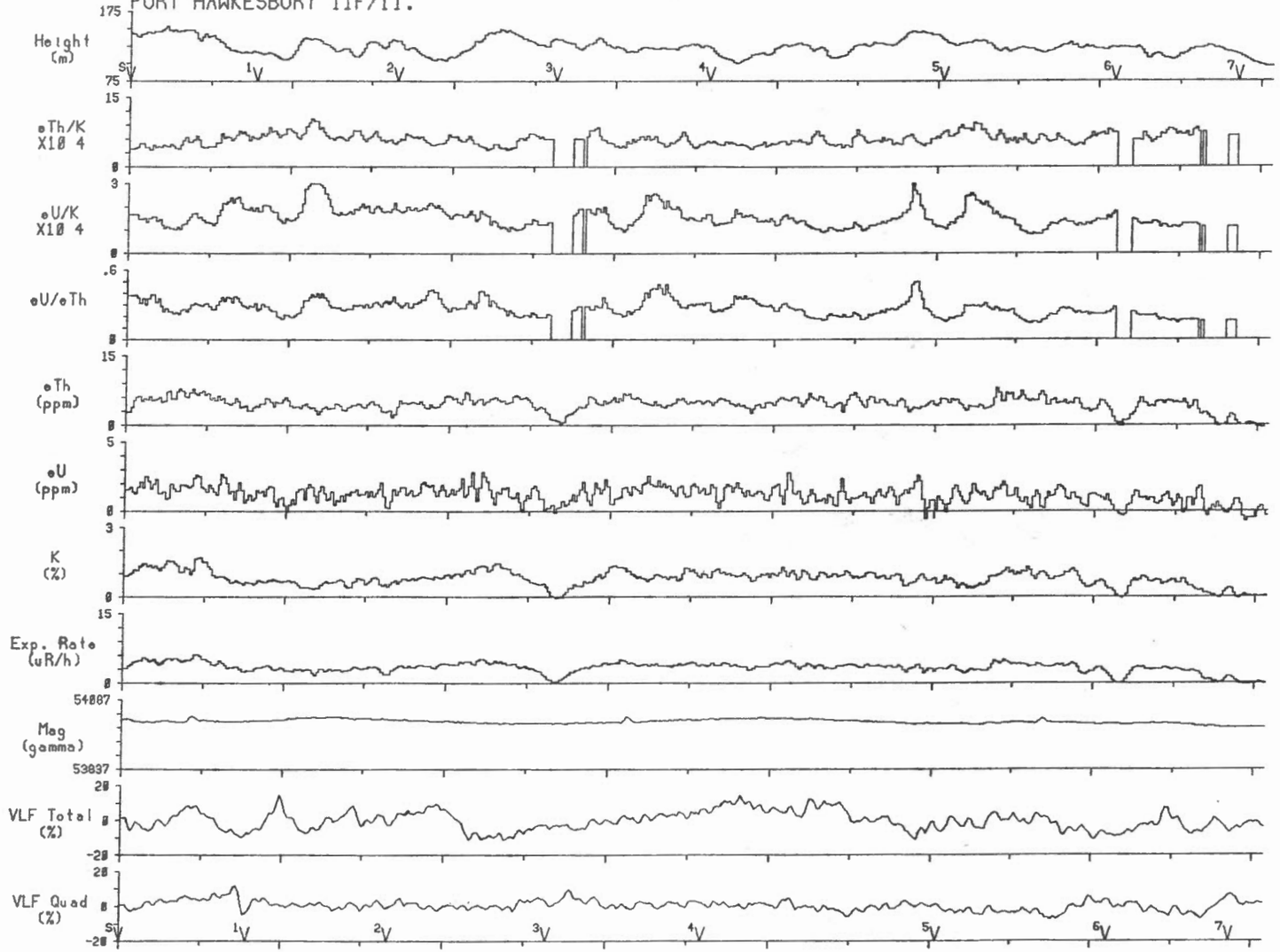

Line 81 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



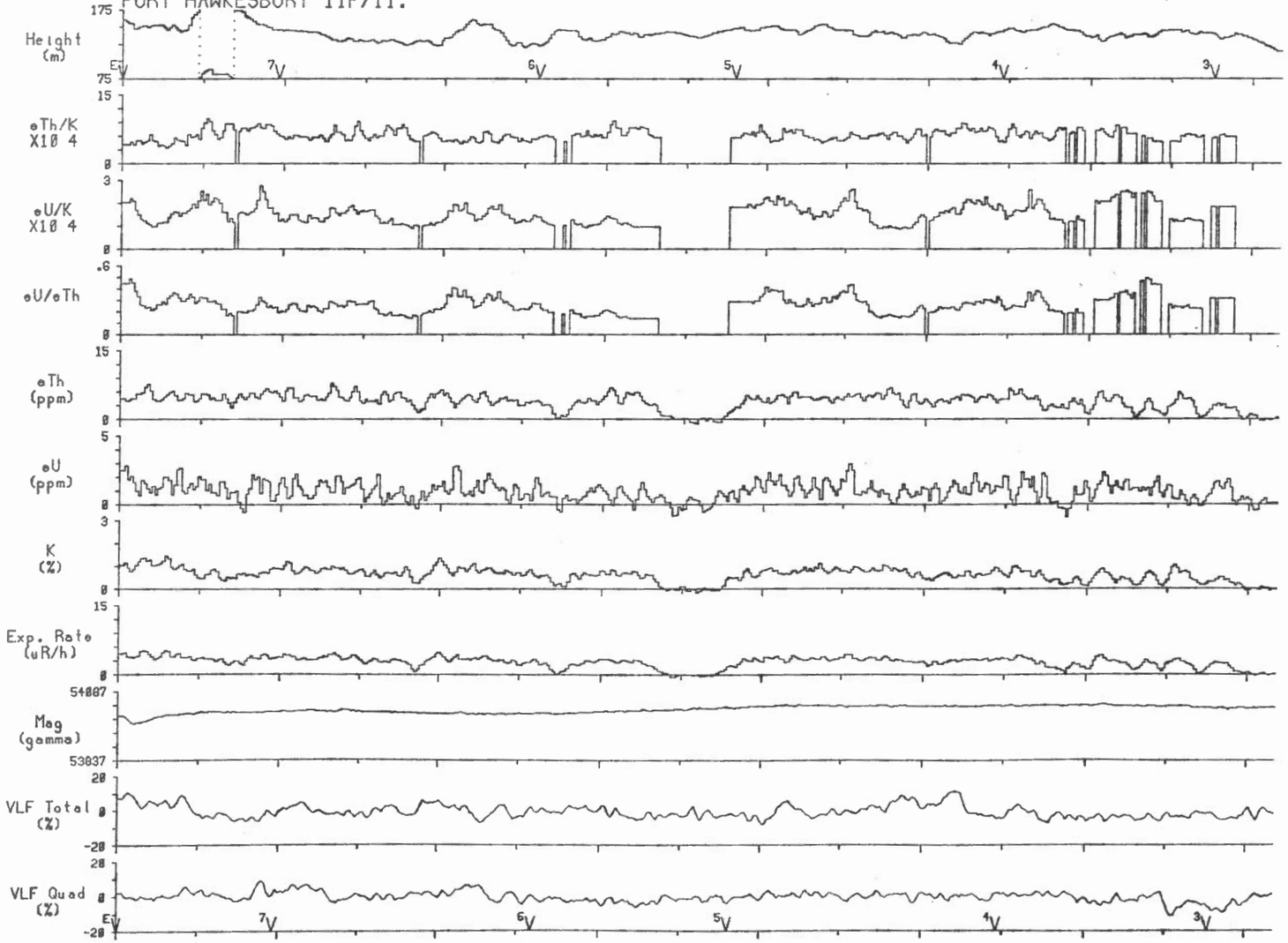

Line 82 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



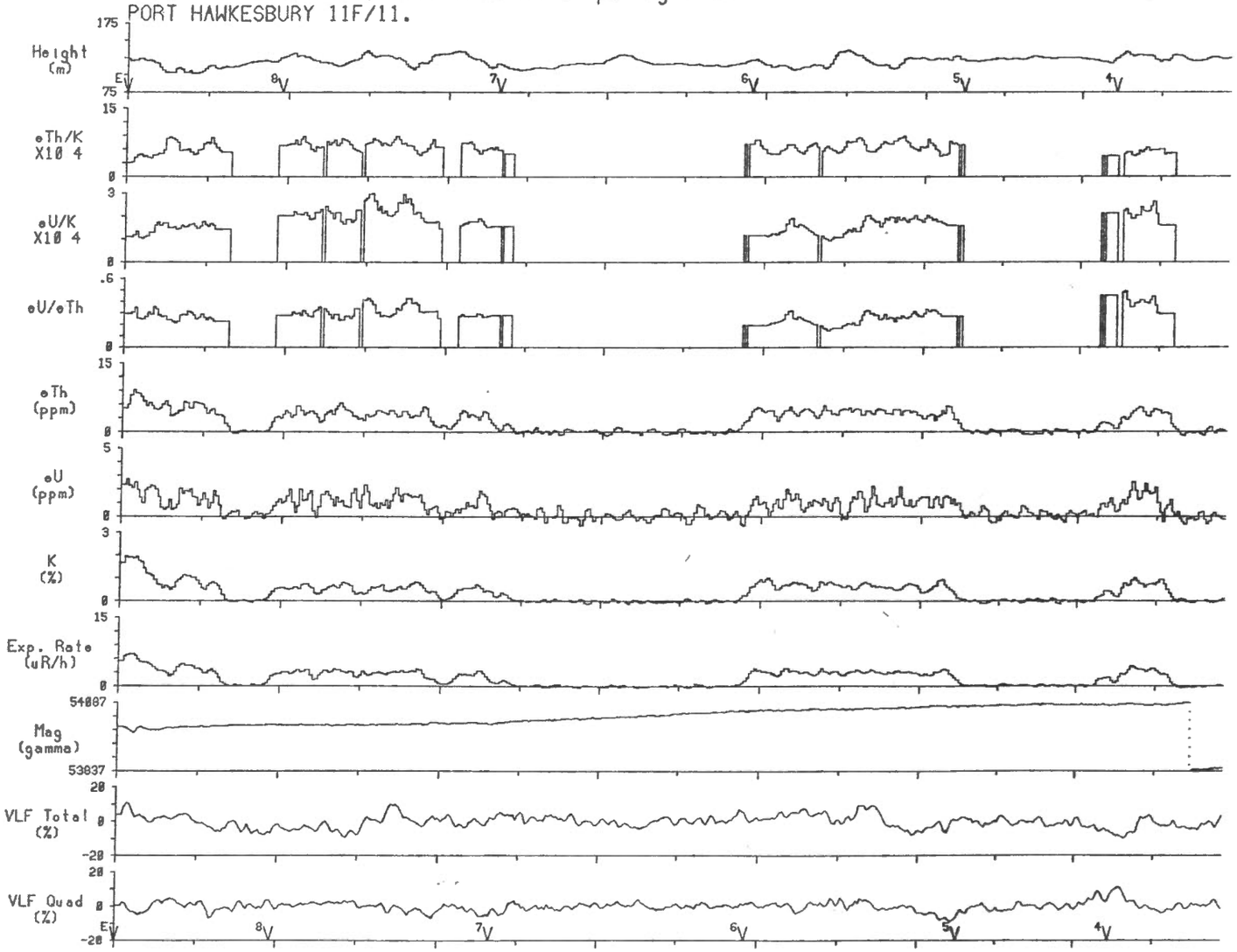

Line 83 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



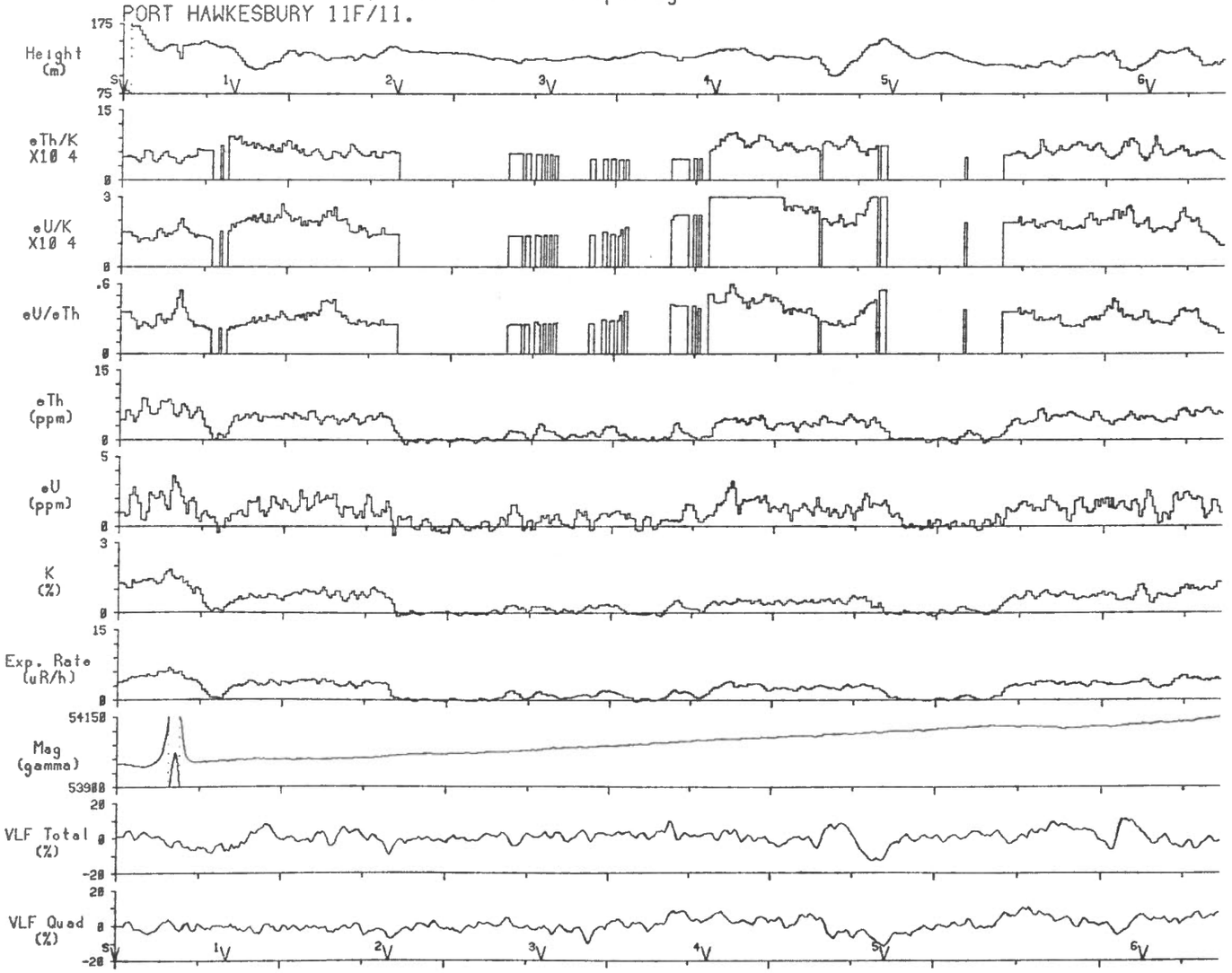

Line 84 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



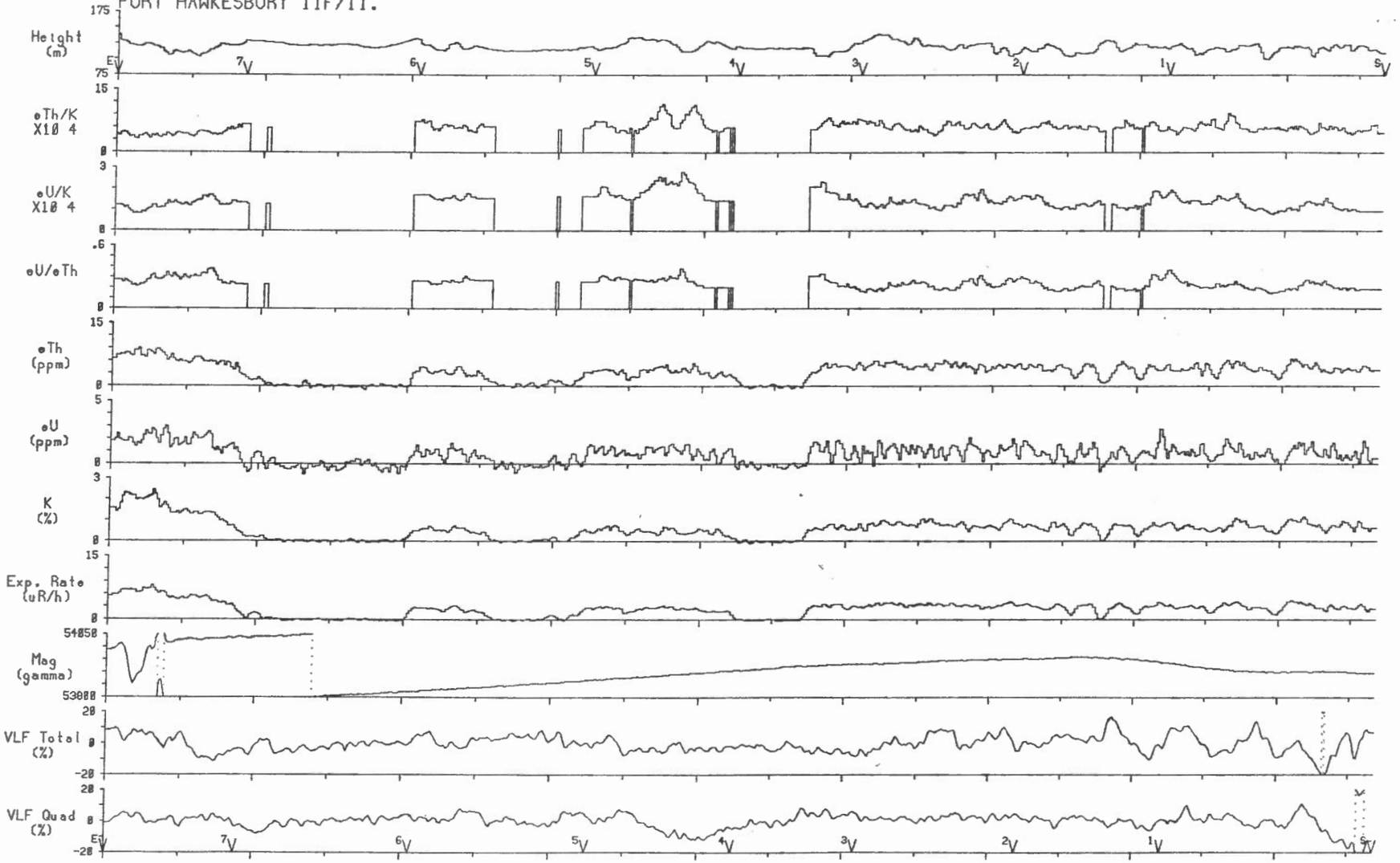

Line 85 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



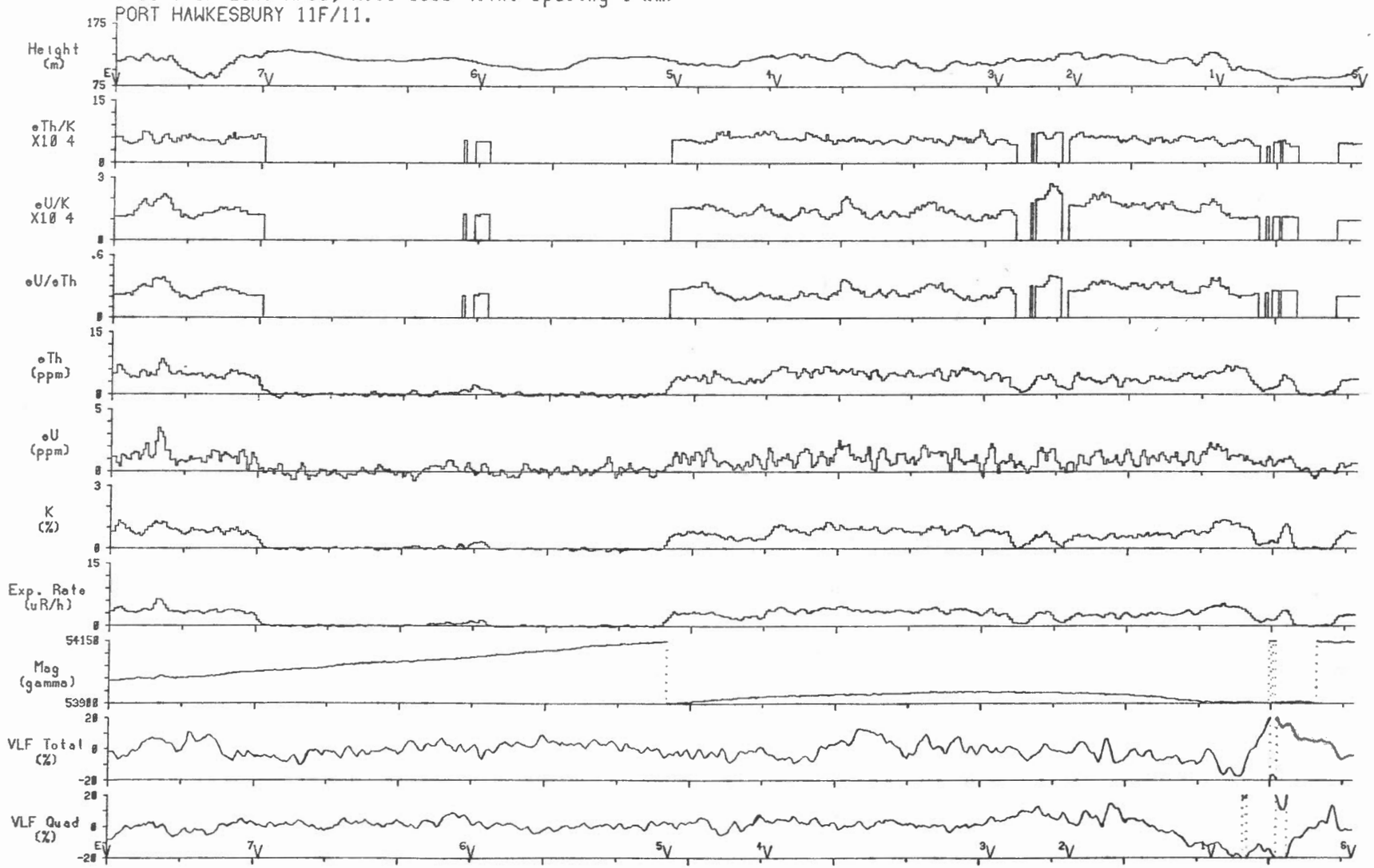

Line 86 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



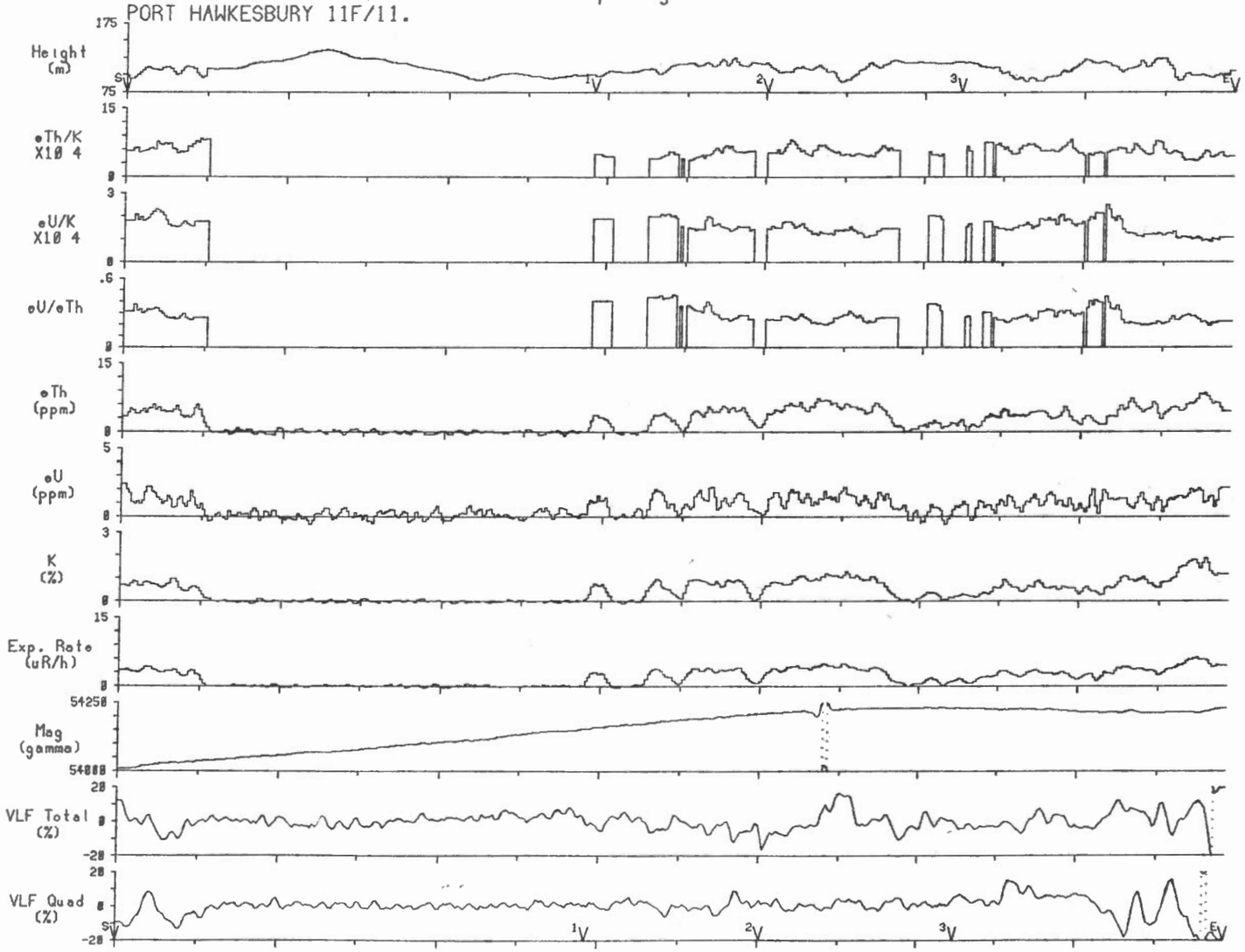

Line 87 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



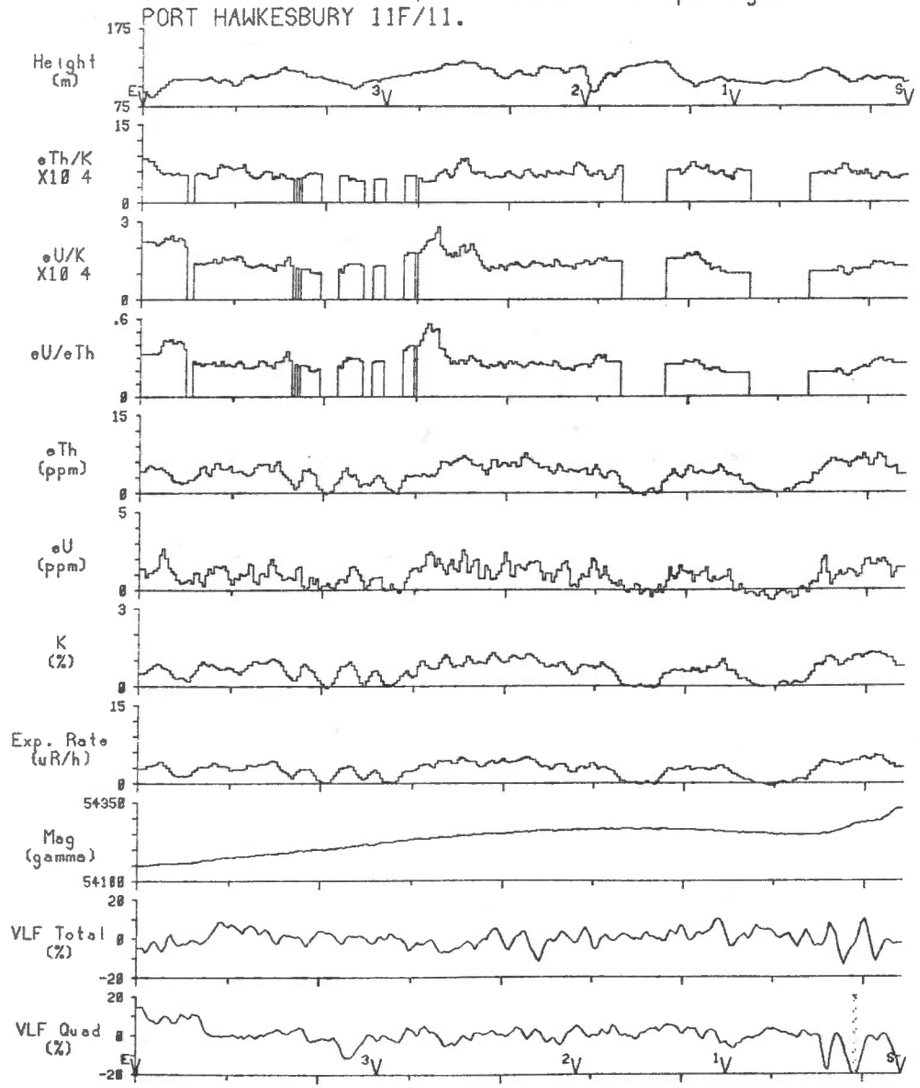

Line 88 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



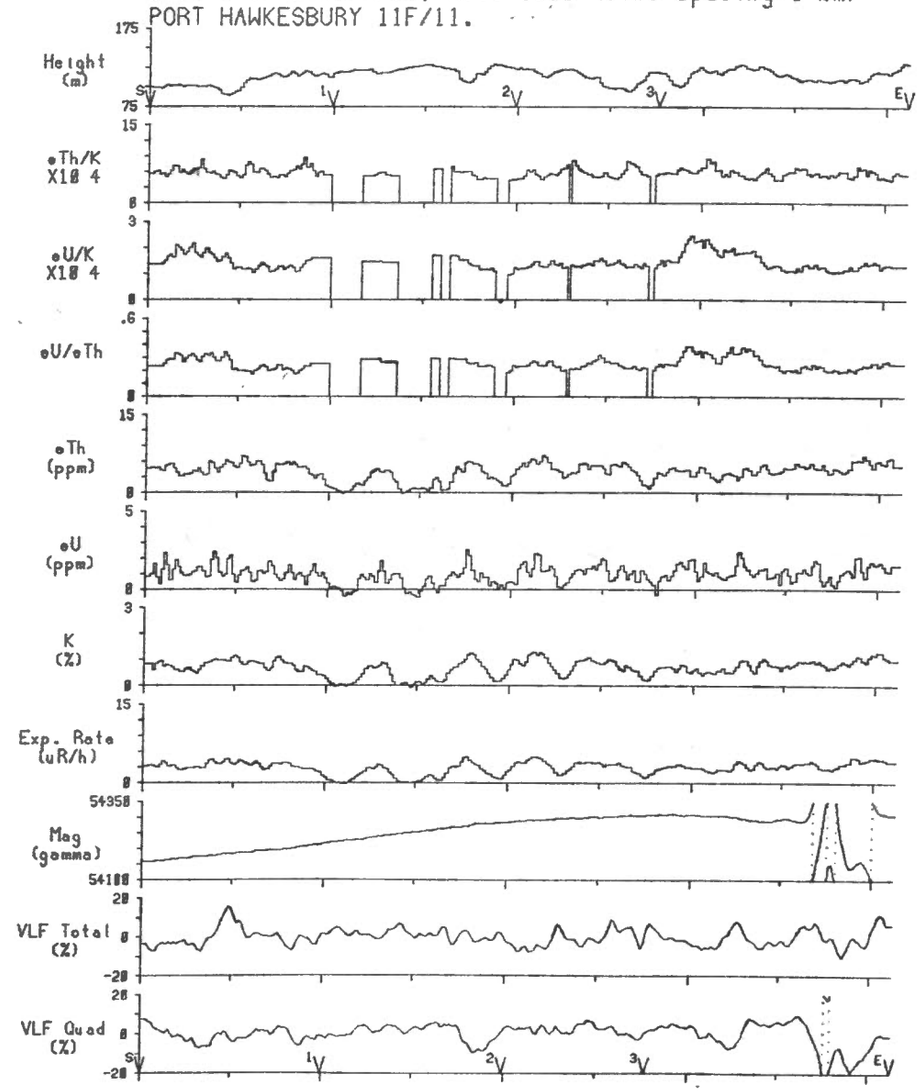

Line 89 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



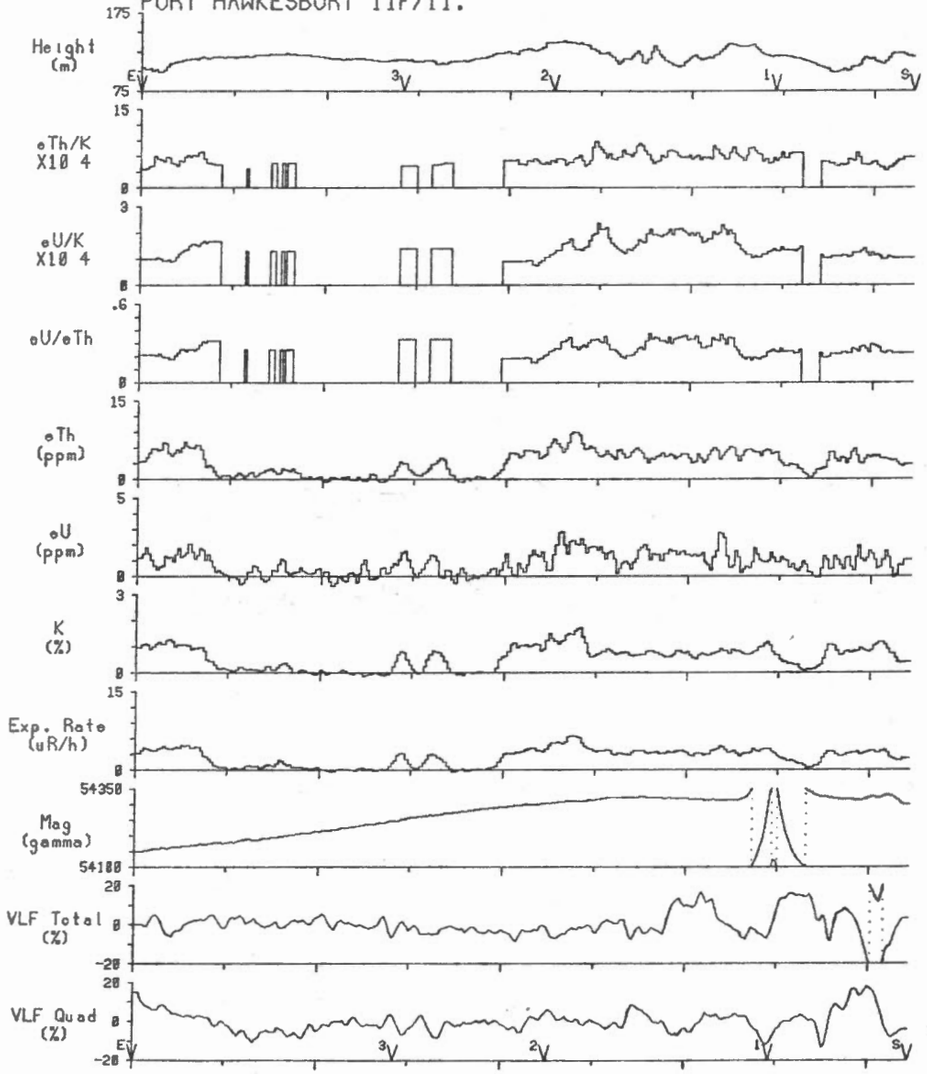

Line 90 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



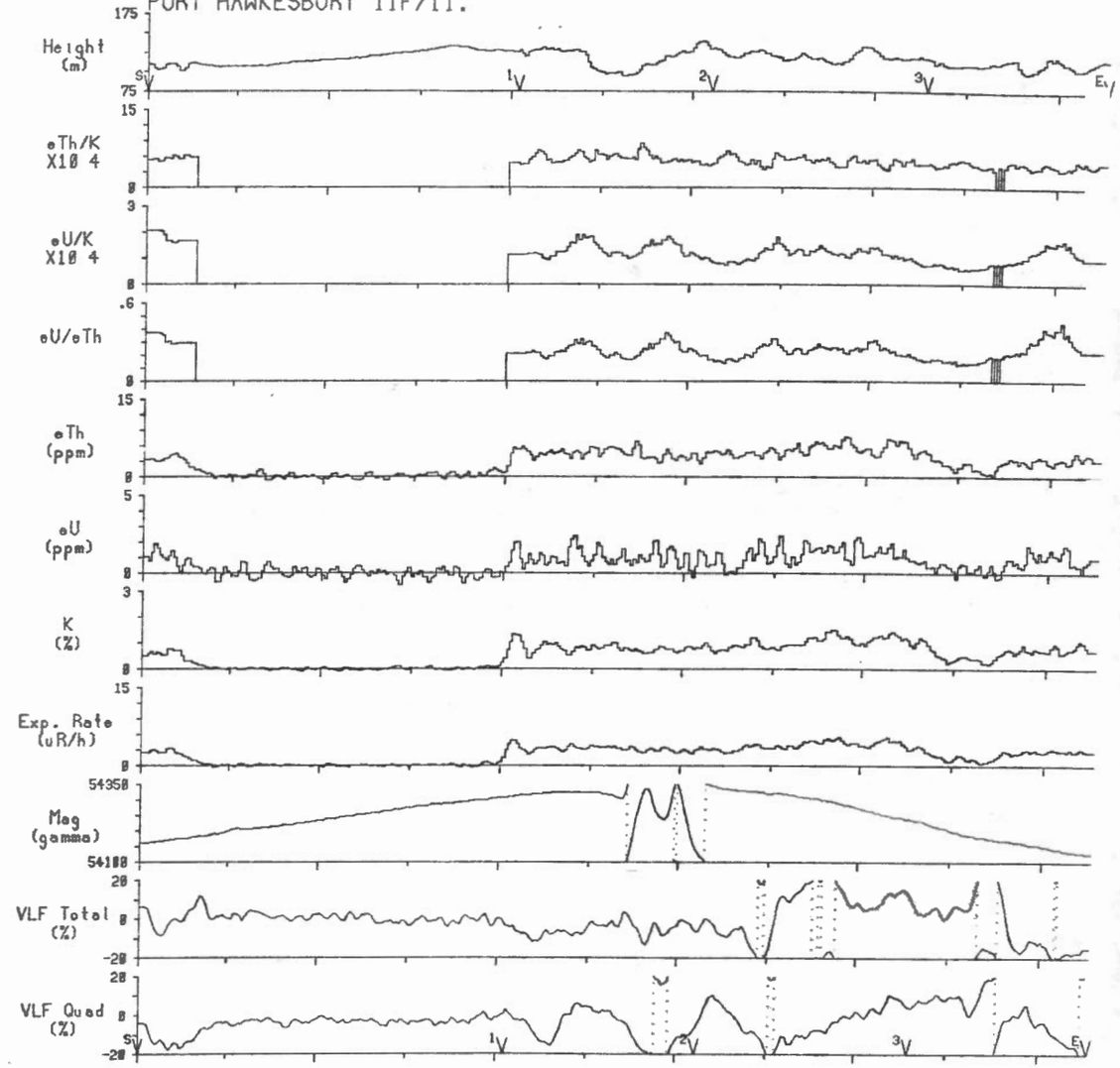

Line 91 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



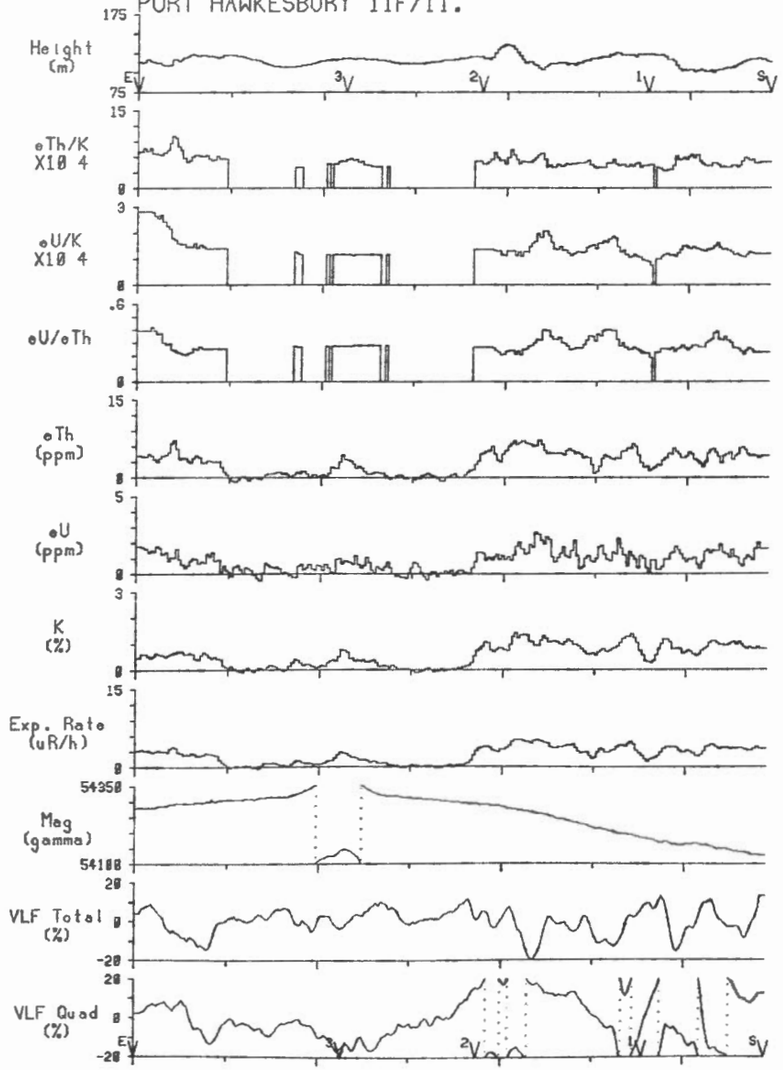

Line 92 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.



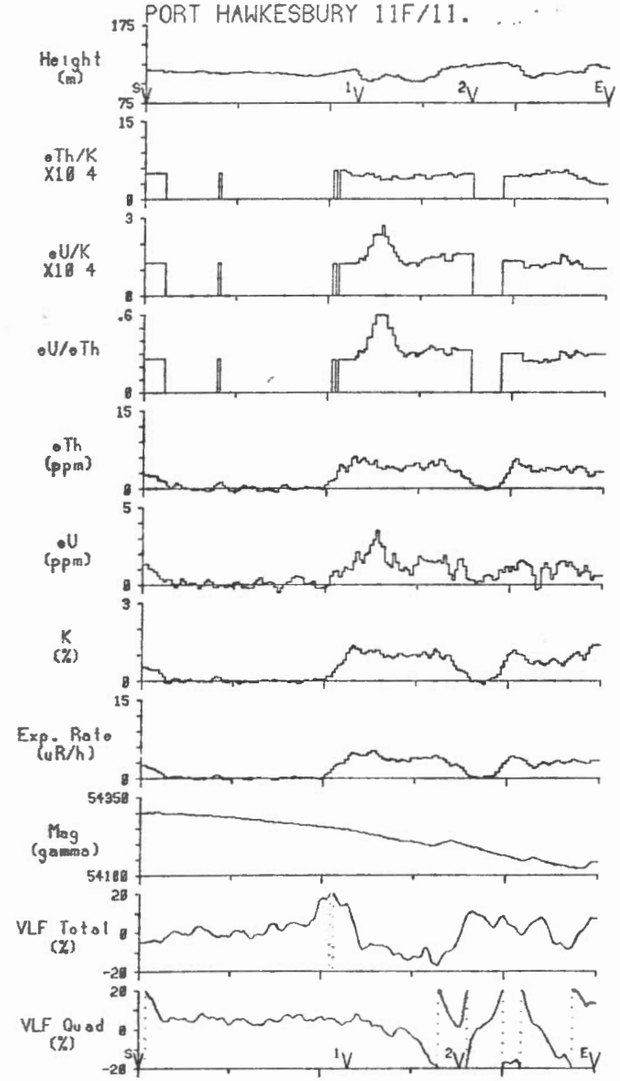

Line 93 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.




Line 94 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.




Line 95 2 km Scale 1:150000

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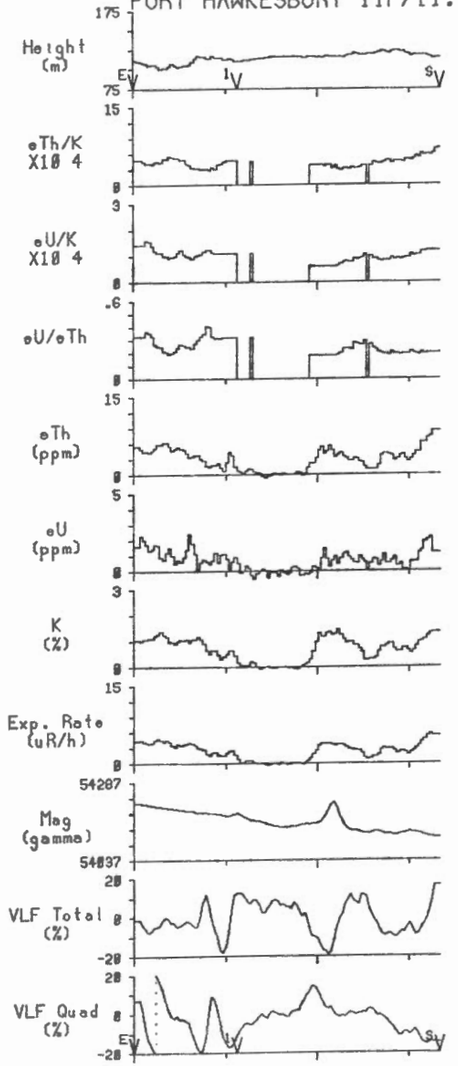
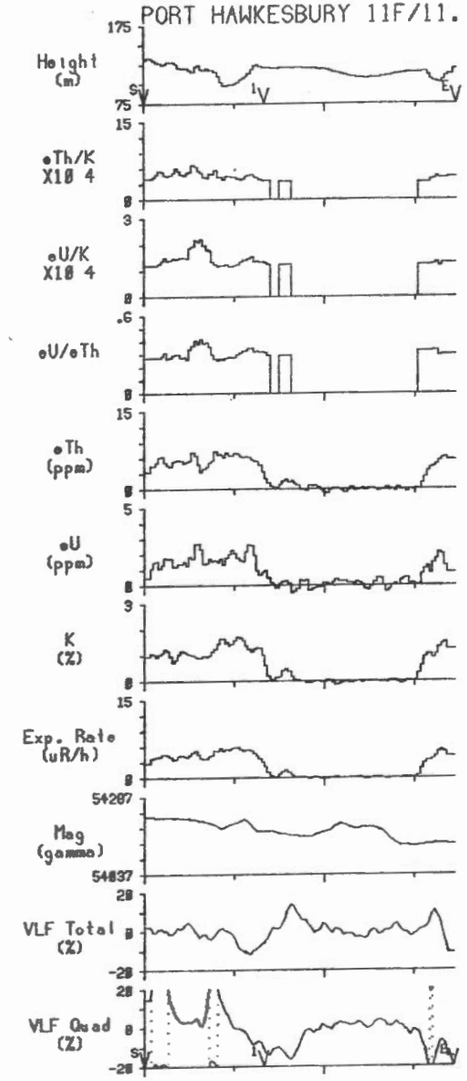
PORT HAWKESBURY 11F/11.



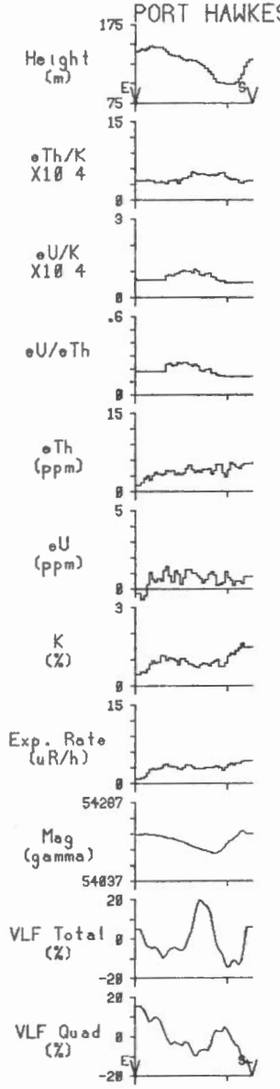

Line 96 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.




Line 97 2 km Scale 1:150000

Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)
PORT HAWKESBURY 11F/11.




Line 98 2 km Scale 1:150000