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Hydrodynamic Characteristics of the Johnstone Estuary (North Queensland)

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HYDRODYNAMIC CHARACTERISTICS OF THE JOHNSTONE ESTUARY (NORTH QUEENSLAND)

BY

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ABSTRACT

The Johnstone River of North Queensland flows in two main branches through highly erodible caneland before discharging to the Coral Sea. The hydrodynamics and sedimentary processes of the Johnstone River estuary were analyzed to estimate the relationships between river dynamics and volume of sediment deposited in the estuary and discharged into the sea. Numerical models were used to analyze hydraulics of selected cross–sections of the river and to estimate the volume of sediment transport. Based on the results obtained from a hydro–sedimentological 1D model the average annual sediment discharged into the sea was estimated to be of the order of 11,000 to 22,000m^3.

Nomograms prepared from the results allow the estimation of the volume of sediment transport discharged into the sea for specified flow discharges in both branches of the river.

CONTENTS

1. INTRODUCTION

The Johnstone and South Johnstone Rivers in Northern Queensland join together near Innisfail, some 100km south of Cairns. Above the junction the former is commonly referred to as the North Johnstone River and this terminology will be retained for the remainder of this report. The layout of the overall catchment is shown in Figure 1 while some of the major local creeks in the lower catchment are shown in Figure 2.

The Johnstone River discharges its water to the Coral Sea at Flying Fish Point about 4.5km downstream from Innisfail. The lower reaches of the river are subject to tidal variation with ranges up to 3.4m.

This study is limited to the hydrodynamics of the reaches lying between the river mouth and the nearest water gauges located upstream of the region of tidal influence.

The North Johnstone gauge (GS112004A) is located at the Tung Oil Plantation, 29.0km upstream of the river mouth at Flying Fish Pt and has a catchment area of 930km^2. The South Johnstone gauge (GS112101B) is located at Upstream Central Mill, 18.2km upstream of the confluence of the river with the North Johnstone River at Innisfail and has a catchment area of 390km^2. Both gauges are operated by Water Resources Commission (WRC). The predominant industry in the catchment is sugar cane with 31,000ha of the area being canelands. A study by the Cameron McNamara (Cameron McNamara, 1985) investigating the stream aggradation effects of the South Johnstone Catchment and concluded:

- 5,490ha of the total 9,700ha of caneland in the South Johnstone Catchment are located in the highly erosion prone areas of steep basalts or steep metamorphics;
- Soil erosion rates in such areas have been measured at greater than 300 tonnes per hectare per year with value of 150 tonnes per hectare per annum has been accepted as a conservative estimate of the average value;
- The average aggradation in the river from 1942 to 1983 is estimated at 100,000 tonnes per annum;
- The estimate of sediment load from the upper catchment, based on sand size particles and the finding of studies in the Barron and Mulgrave Rivers, is 20,000 tonnes per annum.

These conclusions demonstrate the serious problem of the river aggradation caused by farm land erosion. From a hydrodynamic perspective of the problem it is important to consider the following questions:

(a) How do river dynamics influence the aggradation?

(b) How is sediment transported in the downstream region of the river?

(c) What quantity of that sediment is discharged into the sea?

(d) As eroded sediment from farmland is biologically rich and with large concentrations of nutrients, what is the quality of sediment accreted in the river and discharged into sea?

The purpose of this study is to find answers to the first three questions by analyzing the hydrology and hydrodynamics of the Johnstone estuary based on historical data and field measurements. Two numerical models have been adopted in an attempt to develop more general conclusions. One model is associated with analysis of the hydrological data for a particular cross–section. The other is associated with modelling the hydrodynamics and sediment transport in the whole estuary system. A more detailed description of these two models is presented later in this report. However, the development of an answer to question (d) requires more detailed sampling in order to obtain sufficient data for a comprehensive numerical analysis using the described models.

2. HISTORICAL HYDROLOGICAL INFORMATION

2.1 Tidal Characteristics

Tides can be characterized in terms of the RF ratio which relates the amplitudes of the main astronomical constituents:

$$RF = (K_1 + O_1)/(M_2 + S_2)$$

where: K_1 is soli–lunar constituents

O_1 is main lunar diurnal constituent

M_2 is main lunar semidiurnal constituent; and

S_2 is main solar semidiurnal constituent.

If: RF = 0 to 0.25 – the tide is semidiurnal;

= 0.25 to 1.5 – the tide is mixed, predominantly semidiurnal

= 1.5 to 3.0 – the tide is mixed, predominantly diurnal

= $\geq$ 3.0 – the tide is diurnal

Based on nearest astronomical constituents at Mourilyan Harbour the RF for the Flying Fish Pt has the value:

$$RF = (0.3152 + 0.1566)/(0.5751 + 0.3322) = 0.52$$

This value of 0.52 means that although the tide is mixed, it is predominantly semidiurnal in form having two high and low waters daily with strong inequalities in height and phase which reach a maximum with the maximum declination of the moon.

The mean spring tides have the range (in LWD datum):

Mean High Water Spring	MHWS = 2.2m
Mean Low Water Spring	MLWS = 0.2m

and the mean neap tides have the range:

Mean High Water Neap	MHWN = 1.6m
Mean Low Water Neap	MLWN = 1.1m

The monitoring tidal excursion, i.e., the average distance travelled by particles of water during the flood tide, is 18km and 20km upstream of Flying Fish Pt for the North Johnstone and South Johnstone Rivers respectively.

For the numerical analysis in this study additional tide level recorders were installed at the locations marked on Figure 2. A set of the records for the period January–February 1986, when cyclone Winifred passed Innisfail region, is included in Appendix A. This data was used for model calibration and estimations of sediment transport during that cyclone period.

2.2 Characteristics of the River

2.2.1 Bathimetric Survey

The only detailed echo–sounding available for the Johnstone River (North and South) was conducted by Cameron McNamara in July 1986. The profile of the deepest parts of the river defined by this survey is shown in Figures 3 and 4. The positions of the temporary WL gauges and WRC gauging stations are also marked in these Figures. The South and North Johnstone Rivers have similar average bottom slopes: 0.6m/km up to 18km upstream from the river mouth to 0.1m/km between the 18–th km and Innisfail township. The North Johnstone River has two significant local deep regions.

2.2.2 Rating Curves

The rating curve for 1990 year prepared by WRC has the following characteristics:

Gauge Station 112004A – North Johnstone
Gauge Zero = 9.040m, State Datum (8.532m AHD)

Gauge Height [m]	Discharge [cumecs]
0.734	2.00
1.176	30.00
2.159	160.00
3.210	370.00
5.300	920.00
11.000	5120.00

Gauge Station 112101B – South Johnstone
Gauge Zero = 4.392 m AHD

Gauge Height [m]	Discharge [cumecs]
0.615	1.00
1.500	18.50
2.400	74.00
11.700	2140.00

2.2.3 River Discharges

Recorded water levels and water levels based on the rating curve equivalent discharges were used in the present study for the mathematical simulation of the hydrodynamics of the estuary.

Some general hydrological data, based on the hydrological records for the two gauging stations (WRC), are presented in Table I.

Table 1

Hydrological characteristics of the North and South Johnstone Rivers.

River	*Nth Johnstone*	*Sth Johnstone*
Period of record	*1966 – date*	*1916 – date*
Max. annual discharge	,852,301 Ml	1,573,769 Ml
Min. annual discharge	1,059,399 Ml	199,997 Ml
Mean. annual discharge	1,880,011 Ml	809,319 Ml
Instantaneous flow [cumecs]:		
maximum	4,517.00	1,848.00
minimum	3.83	1.30
Mean annual runoff(mm)	2,022.00	2,075.00
Mean annual catchment rainfall	4,851.00mm (1919 – 1969)	

Figures 5 and 6 show annual runoff plotted as a time series. Assuming discharge to have a linear relation with runoff, the figures indicate the fluctuation of the flow in rivers. The runoff data is analyzed by means of a five–year moving mean of the annual runoff. In this case it happens that a five year average is sufficient to damp out most of the random components leaving only the effects of longer term wet and dry cycles in the record. During a wet period, the five–year moving mean line is always above the long term mean, whereas for a drought period it is always below.

Plotting the 5–year means shows the following drought periods for that region:

1923 – 1934; 1939 – 1956; 1961 – 1966;
1969 – 1973; 1984 – 1988

with a continuous tendency to drought for the following years

2.2.4 Water Quality in River

The following general information was obtained from routine sampling carried out by WRC at regular intervals at the gauging stations:

Salinity: The range of salinity observed on North and South Johnstone Rivers is from 110 microho/cm for discharges below 10 cumecs to 30 microho/cm at a discharge of 400 cumecs. This range is stable for the whole period of observations covering the period from 1971 to 1989. As estuarian environments typically range from 1,000 to 50,000 microho/cm these values indicate that there has been no salt intrusion at the gauges from tidal action.

pH: The pH levels in the vicinity of the gauging stations were in the range 6.5 to 7.8 which is also below that usually found in estuaries (7.8 to 10.0)

Chemical components: Other standard components measured during routine sampling did not indicate any falling or rising tendencies.

The set of water quality data is presented in Appendix B.

3.0 FIELD MEASUREMENTS

3.1 Background

Estuaries typically experience great spatial variation, seasonal and semidiurnal oscillations in material concentration, water level and flow velocity. These variations and oscillations are due primarily to the combination of tidal influence, fresh–water discharge rate, meteorological forces and the constraints imposed by the configuration and geology of the estuary. Thus, the representativeness of any estuary correlations obtained from any set of estuarine measurements is highly dependent on both the sampling design and a rational procedure of analysis and synthesis of the data.

For a mixed type of tide, as is the case in the Johnstone estuary, the selection of a suitable sampling duration to determine time–averaged estuarian conditions is critical. Elliott's (1976) study points out the extreme variability in time–averaged estuarine currents which may be observed from one tidal cycle to another, and shows how the time–averaged current direction frequently reverses. It is likely that in most estuaries the greatest portion of the variability occurring on time scales from 2 to 20 days, occurs in response to meteorological forces such as wind stress and atmospheric pressure fluctuations.

To achieve a good representation of the time averaged conditions in the estuary the duration of continuous sampling duration should exceed five tidal cycles. However, it was not possible to undertake such a detailed sampling program during this study. A single set of measurements undertaken during one tide period can really be considered only as an experiment for development of a rational procedure of analysis. On the other hand because hydrodynamics of the Johnstone River estuary are poorly defined and understood, any possible measurement in the region has to be included in the analysis.

Based on the experience in this study the following method of analysis of measured data is recommended for future studies.

After completion of hydrographic measurements, it is desirable to manipulate the recorded data to permit a standardized analysis procedure.

In this case the measured data were analyzed by the numerical program PROFILE (Kjerfve, 1979). PROFILE uses measured values of current speed and direction, temperature and electrical conductivity at various depths as input. The program fits vertical profiles through each set of data points, computes salinity and density profiles and gives, as the final output, the values of the horizontal velocity components, temperature, salinity and density at 11 equally spaced depths, beginning at the surface and ending at the bottom. In addition, it computes friction velocity, bottom shear stress, and dynamic roughness from the velocity profile. Thus the program is able to interpolate the shape of each vertical profile and then read off the data values at regular spaced depth intervals for further analysis such as estimation of net velocity, net discharge and net flux of specific constituents.

3.2 Measurements

On the 6th December 1990 hydrographical measurements were undertaken at the confluence of the North and South Johnstone Rivers. Velocity, salinity, temperature and pH were measured at two cross–sections located as shown in Figure 7. Water samples were also taken for chemical analysis.

The cross–sections at the measured profiles are shown in Figure 8. Two stations were located in each profile. Water levels at these cross–sections were assumed equal to those observed on the nearest water gauge located as shown in Figure 7. The observed and predicted by Tide Book (1990) water levels are shown in Figure 9. As the measurements were undertaken with good weather conditions and no wind, fair to good agreement between observed and predicted water level changes were obtained. The predicted water level at Flying Fishing Point (Johnstone River mouth) is also shown on the same figure. The measurements in these figures were undertaken between hours 7:00 and 20:00 (LW slack and the next LW slack) The flow conditions in the rivers recorded by WRC for that day were as follow:

Gauge Station 112004 – North Johnstone: daily volume 650.3Ml/day ($7.5m^3/s$)

Gauge Station 112101 – South Johnstone: daily volume 327.3Ml/day ($3.8m^3/s$)

3.3 Results of Analysis

The analysis of the field results presented in this chapter is based on the method presented by Kjerfve.

3.3.1 Standardization of Data Output from Program PROFILE

The measured input data, which could be velocity or velocity and temperature or velocity, temperature and conductivity, provide the output data of these parameters at 11 equally spaced depths beginning at the surface. The shape of each vertical data profile is interpolated between the top–most and bottom–most data points using a spline interpolation procedure. The results for each station are presented in Appendices 3 and 4. In these results the density is expressed in σ_T units as:

$$\sigma_T = (\rho - 1000)$$

where ρ is actual water density in kg/m^3

and calculated with the Knudsen's method based on temperature and salinity data (in Kjerfve, 1979).

3.3.2 Velocity Averaging

The velocity at each station can be averaged over time and associated with different depths. A depth–averaged velocity for each time is required in the calculation of discharge. The depth averaged velocities determined from the data in Appendices 3 and 4 are in Figure 10. The results indicate a very uniform distribution of velocity across each branch of the river. It is therefore permissible to simplify the calculation of the total instantaneous discharges.

The time–averaged velocity at each station, calculated from standardized values shown in Appendix C, is shown in Table 1 and Figure 11 for each relative depth. These velocities were calculated from:

$$\langle V(di) \rangle = \Sigma(V(di)_1)/n$$

where $\langle V(di) \rangle$ is average velocity at a particular depth di (di = 0..10);

$V(di)_1$ is velocity at depth di at time $(_1)$ $(_1 = 1..n)$

Thus the time–averaged velocity at the water surface of the North Johnstone River at station 1 becomes (data from Appendix C):

$$<V(d0)> = (-36-29-30-38+6+70+90+82+51)/9 = 18.4 cm/s$$

Table 2

Time Averaged Net Velocity (cm/s)

Relative Depth	*North Johnstone*		*South Johnstone*	
	Station 1	*Station 2*	*Station 1*	*Station 2*
0.0	18.4	14.5	6.1	8.4
0.1	13.4	9.8	6.2	7.1
0.2	7.8	5.3	5.5	6.4
0.3	1.9	1.2	4.6	6.2
0.4	–1.1	–2.3	4.0	5.7
0.5	–4.6	–3.4	2.7	4.5
0.6	–7.2	–5.2	1.2	2.5
0.7	–8.2	–6.7	0.4	1.2
0.8	–8.0	–7.8	0.4	0.8
0.9	–7.1	–7.1	1.5	–0.5
1.0	0.0	0.0	0.0	0.0
<V>	–0.4	–0.9	3.0	3.8
Circular parameter	46.0	16.1	2.0	2.2

The non–dimensional circular parameter shown in Table 2 is computed as the net surface velocity over the depth–averaged velocity:

$$\frac{<V(d0)>}{<V>}$$

(For example: for Station 1 on North Johnstone River the circular parameter is equal to 18.4/0.4 = 46.0)

The value of the non–dimensional circular parameter for the North Johnstone River indicates strong gravitational circulation in North Johnstone River while the value in the South Johnstone River indicates a weak gravitational circulation in that river.

3.3.3 Salinity Averaging

The time–averaged net salinity, <S> was computed in a similar fashion as the time averaged velocities. The results of the salinity averaging are shown in Table 3 and Figure 12. The difference in salinity profiles between stations on South Johnstone River is caused by difference in depth of the stations. As station 1 is much deeper the higher salinity values occur at the bottom.

Table 3

Time Averaged Net Velocity (PPT)

Relative Depth	*North Johnstone*		*South Johnstone*	
	Station 1	*Station 2*	*Station 1*	*Station 2*
0.0	13.1	14.6	15.3	14.8
0.1	13.9	15.7	16.8	16.1
0.2	14.8	16.8	18.0	17.2
0.3	15.6	17.8	18.9	18.2
0.4	16.7	18.7	19.9	18.9
0.5	17.5	19.5	21.1	19.4
0.6	18.4	20.2	22.3	19.9
0.7	19.3	20.8	23.5	20.5
0.8	20.0	21.4	24.3	21.1
0.9	20.9	21.9	25.1	21.7
1.0	21.8	22.6	25.9	22.3
<S>	17.5	19.1	21.0	19.1
stratification parameter	0.5	0.42	0.5	0.4

The non–dimensional stratification parameter is computed as the difference between net bottom and net surface salinities over the depth–averaged net salinity:

$$\frac{\langle S(d10)\rangle - \langle S(d0)\rangle}{\langle S\rangle}$$

(For example: for Station 1 on North Johnstone River the value is equal to $(21.8 - 13.1)/17.5 = 0.5$

The calculated stratification parameters shown in Table 3 indicate the existence of a well mixed type of estuary.

3.3.4 Net discharge

Using the average "depth–averaged" velocity in each cross–section and relevant cross–sectional area, the net discharge was calculated for the whole tidal period. The results of the calculations are shown in Table 4 and Figure 10.

Table 4

Net discharge in [m3/s] observed
at December 6, 1990
(Note: sign "–" represents flood tide discharge)

Time [hr]	W.L. [m]	Area [m2]	Mean Vel [m/s]	Discharge [m3/s]	Total Discharge
North Johnstone River					
7:00	–1.00	580	–0.05	–29	–29
8:00	–0.85	613	–0.23	–141	–170
9:00	–0.65	657	–0.33	–217	–387
10:00	–0.30	734	–0.38	–279	–666
11:00	0.20	844	–0.40	–338	–1004
12:00	0.65	943	–0.35	–330	–1334
13:00	1.05	1031	–0.20	–206	–1540
14:00	1.05	1031	0.00	0	–1540
15:00	0.95	1009	0.20	202	–1338
16:00	0.80	976	0.33	322	–1016
17:00	0.45	908	0.38	345	–671
18:00	0.20	844	0.40	338	–333
19:00	–0.15	767	0.35	269	–46
20:00	–0.30	734	0.25	184	120
Mean net discharge: 120/14 = 8.6m³/s					
South Johnstone R					
7:00	–1.00	510	+0.15	77	77
8:00	–0.85	527	+0.03	16	93
9:00	–0.65	549	–0.10	–55	38
10:00	–0.30	587	–0.22	–129	–91
11:00	0.20	644	–0.30	–193	–284
12:00	0.65	691	–0.32	–221	–505
13:00	1.05	736	–0.22	–162	–667
14:00	1.05	736	–0.05	–37	–704
15:00	0.95	725	0.07	51	–653
16:00	0.80	708	0.20	142	–511
17:00	0.45	670	0.27	181	–330
18:00	0.20	644	0.27	174	–156
19:00	–0.15	604	0.23	139	–17
20:00	–0.30	587	0.19	112	95
Mean net discharge: 95/14 = 6.8m³/s					

Note: The net discharge from South Johnstone River includes discharge from Bamboo Creek.

3.3.5 Net Salt Flux

The goal of many biological, chemical and geological investigations of estuaries is determined by the time–averaged fluxes of various dissolved or suspended constituents. The net flux per unit width, <F> in [kg/ms], of an arbitrary constituent may be written:

$$\langle F \rangle = 1/T \int_0^T \overline{\rho(t)\ C(t)\ V(t)}\ d(t)\ dt$$

where C(t) is the dissolved and/or suspended concentration of interest expressed as mass per mass of estuarine water,

$\rho(t)$ is water density. (In flux computation $\rho(t)$ can often be considered constant at 1,020kg/m^3 as $\rho(t)$ varies slightly compared to C(t) and V(t))

V(t) is velocity and d(t) depth.

The bar in the equation represents a depth–average of the product of three instantaneous quantities.

The concentration of a particular constituent must be measured at several depths simultaneously with the measurements of the other parameters used to calculate the flux at that station. During field measurements in this study, salinity was measured so that the net salt flux might be estimated. The results of numerical calculation of the salt flux are shown in Table 5.

3.3.6 Remarks

On the basis of one set of field measurements it is difficult, if not impossible to make any general conclusions. To obtain the full hydrological characteristics of a particular estuary the measurements must be repeated in monthly intervals over a complete water year. Therefore the intention of this chapter was only to present the results of analysis based on the adopted program from Kjerfve. That program allows analysis of the field data and presentation of the net characteristics of flow, discharge and salinity of the estuary as defined by that field data.

An extension of the measurement period to cover wet and dry years is highly recommended. More general conclusions based on a longer period of record can than be presented. Measurement of the concentrations of other constituents such as nitrogen and suspended sediment must also be included in the extended period of measurements if the flux of those constituents is of interest.

Table 5

Net salt flux calculation

Time [hr]	Area [m^2]	X(t) [g/cm^{2}s]	Flux [kg/s]	Total Flux [kg/s]
North Johnstone River				
7:00	580	–0.060	–348	–348
8:00	613	–0.130	–797	–1145
9:00	657	–0.300	–1971	–3116
10:00	734	–0.570	–4184	–7300
11:00	844	–0.800	–6752	–14052
12:00	943	–0.850	–8016	–22068
13:00	1031	–0.200	–2062	–24130
14:00	1031	0.000	000	–24130
15:00	1009	0.440	4440	–19690
16:00	976	0.620	6051	–13639
17:00	908	0.700	6356	–7283
18:00	844	0.710	5992	–1291
19:00	767	0.560	4295	3004
20:00	734	0.310	2275	5279
Net Salt Flux directed toward ocean: 5279/14 = 377kg/s				

Table 5 (continued)

Net salt flux calculation

Time [hr]	Area [m²]	X(t) [g/cm²s]	Flux [kg/s]	Total Flux [kg/s]
South Johnstone River				
7:00	510	0.240	1224	1224
8:00	527	0.040	103	1327
9:00	549	–0.150	–824	503
10:00	587	–0.350	–2055	–1552
11:00	644	–0.540	–3478	–5030
12:00	691	–0.680	–4700	–9730
13:00	736	–0.510	3754	–13484
14:00	736	–0.150	–1104	–14588
15:00	725	0.240	1740	–12848
16:00	708	0.700	4956	–7892
17:00	670	0.660	4422	–3470
18:00	644	0.560	3606	136
19:00	604	0.440	2658	2794
20:00	587	0.300	1761	4555
Net Salt Flux directed toward ocean: 4555/14 = 325kg/s				

Note: $X(t) = \rho(t)\, C(t)\, V(t)$ (data in Appendix C and D)
Flux = X(t) * Area

4. NUMERICAL MODELLING OF THE SEDIMENTARY PROCESSES IN JOHNSTONE ESTUARY

4.1 Mathematical Model

Consideration of only the hydraulic aspects (i.e., water motion) may be sufficient for short–term modelling of sedimentary processes. However, in situations where movement of fluvial sediment is occurring, predictions should be based on both hydraulic and sedimentary processes. The interaction of these two phases is of special importance for long–term predictions and situations in which large movements of sediment occur over short time periods. In most cases this type of prediction is complex and has only become possible and economically feasible with the advent of computers with sufficient speed and memory storage to undertake such tasks.

Apelt and Piorewicz (1987) detailed a case study of an estuary using an earlier version of the model used in this study. That model has been improved recently by Apelt and Ryall (1989). The early version of that model used a one–dimensional (1D) hydrodynamical approach developed by Apelt (1982) and required that the waterway modelled be primarily confined to a single channel. The new model is able to describe the hydraulic processes for interconnection of a number of channels and large storage areas and is based on the one–dimensional hydrodynamic program developed by Muller (1984). Sedimentary processes were added to the program by introducing the equation of conservation of sediment.

Fluid motion is calculated within the model from equations of continuity and momentum by numerical integration using the Preissman implicit finite difference scheme. The hydraulic parameters calculated by these equations are then passed to the sediment module which solves the equation of conservation of sediment to determine the new bed levels at each cross–section of the model. The sediment equation requires the knowledge of the sediment transport rate at each cross–section. The simplified sediment transport formulae of Van Rijn (1984) were used to calculate this information.

A method of tidal prediction based on the "harmonic analysis" technique was used to reproduce the tidal water surface levels which are used as the external boundary conditions at the entrance of the estuary.

This new version of the hydro–sedimentological model and its calibration is fully described by Ryall (1989). It should be noted that this model is still being developed and the major portion of this development work is concentrated on achieving a higher level of accuracy in the quantity of sediment transported and its redistribution in the channel. Even with its simplicity and approximations as a 1D approach the model has, however, been able to obtain over 60% agreement between observed and simulated results for the Tweed River (Apelt and Ryall, 1989).

The required input data for the model are:

(a) Geometry of the cross–sections in each branch of the waterway, the distances between the cross–sections and the Manning coefficients for each cross–section;

(b) Boundary conditions, giving discharges at the upstream end of the modelling area and water level fluctuations at the river mouth over the whole simulation period. Water level fluctuation can be simulated by introducing astronomical constituencies for a particular geographical region;

(c) Characteristics of the bottom material (density,d_{50}, d_{90} and standard deviation) for each cross–section;

(d) Initial conditions such as initial water levels and initial discharges.

The output from the model includes numerical and/or graphical representation of:

(a) Water level fluctuations at specified cross–sections;

(b) Water discharge at specified cross–sections;

(c) Longitudinal profiles of the water levels at particular times;

(d) Volumes of sediment discharged from the estuary;

(e) Volumes of sediment deposited/eroded between cross–sections.

The model was used to estimate the probable volumes of sediment passing through the Johnstone estuary during short events such as cyclones and over a whole year.

Due to the shortage of detailed data from field studies the simulation was based on several simplifications connected with the geometry and characteristics of the bottom material. However, the calculations are the first for the region and they therefore provide initial basic information about the magnitude of sediment discharged to the sea from the Johnstone River.

4.2 Model Calibration

A geometrical schematic of the Johnstone estuary as used in the numerical model is shown in Figure 13. The model was calibrated for the average flow conditions recorded on January 12, 1986. Boundary conditions were taken from water levels recorded by gauges J1, NJ5 and SJ5 (see Figure 2.for the location of these gauges). Gauge J4 was used for verification of the results. Only hydrodynamic conditions, i.e., water level and discharge, were considered. The results presented in Figures 14 and 15 indicate fair agreement with the recorded data.

Another verification was performed on the basis of field measurements taken on December 6, 1991. The results of the analysis of that field data are presented in Section 3.3. The astronomical constituencies and discharge based on WRC gauges were taken as input data for the simulation. As shown in Figure 16 the simulation presents good agreement between the water level fluctuations but the amplitudes of the discharges are much lower than that obtained from field analysis. The main reason for this difference could lie in the relatively low number of stations in the cross–sections for the river. This low number of stations may result in the mean velocity applied to whole cross–section being overestimated. When using hydrographical measurements to obtain more accurate results it is more important to have more stations with less measuring points in each station than visa–versa.

As mentioned earlier, due to limited equipment and personnel, the main goal of the field measurements in this study was to verify the method of measurement and analysis. Simulation with the mathematical model indicated that goal was achieved. The model was then used to analyze hydrodynamics and sediment transport occurring during cyclone Winifred and for a whole year.

4.3 Simulation of Cyclone Winifred

Cyclone Winifred, which crossed the North Queensland coast between Cairns and Townsville on February 1, 1986, was the first severe cyclone in 14 years to have a major impact on Australia's east coast. It developed from a tropical low, first identified on the afternoon of January 27, approximately 450km north of Cairns. A storm surge of about 1 metre caused a rise in water level near Flying Fish Point above that expected from astronomical tides alone.

The Johnstone catchment was generally saturated by heavy rainfall associated with the developing low pressure several days before Winifred made landfall. Between Day 1 (January 27) and Day 7 total rainfall exceeding 500mm occurred. Water levels were recorded at all installed water gauges and discharges were estimated for the nearest ARC Gauging Stations. This data provided a good opportunity for numerical simulation of the cyclone event to estimate the order of sediment movement in the estuary as well as the volume of sediment discharged to the Coral Sea.

The results of the simulation of cyclone Winifred and the recorded data are shown in Figures 17 – 22. Examination of these figures reveals a high degree of agreement for the hydrodynamic component of the mathematical model (see Figures 17 – 19). The variations in water levels in selected profiles are shown in Figure 20 and variation of discharges in Figure 21. It is interesting to note that there were much higher rises in water levels in South Johnstone compared with North Johnstone at almost the same distance from the river mouth (see profiles 1 and 10 in Figure 20). This difference resulted in higher sediment transport along the South Johnstone even though it had a much smaller discharge (see Figure 22). A total of about 20,000cu.m were transported from South Johnstone compared with only about 10,000cu.m from North Johnstone. The sediment from North Johnstone was mainly deposited in the area of confluence of this two rivers. Along the Johnstone River, downstream of Innisfail, about 30,000cu.m was deposited. However, 65,000cu.m were still discharged to the sea.

The model also indicated that about 25,000cu.m had been transported into the system from the upper part of South Johnstone River and that this material was mainly deposited in the first section analyzed. On the other hand the material discharged into the sea is from the lower part of Johnstone River downstream from section 19. Thus it appears that the sediment is first redistributed along the estuary before it is discharged into the sea.

4.4 Prognostic Simulation of Sediment Transport

The mathematical model was then used to provide a prognosis of sediment transport for different flow conditions. The simulations were performed for a range of discharges and for the average tide amplitudes of MHWS =2.2m and MLWS = 0.4m LWD over two tide periods covering 24 hours. Each simulation was performed for constant upstream flow conditions. The grain size distribution assumed during simulation was as follows:

For North and South Johnstone River: D50 = 1.0mm and D90 = 2.0mm;
For Johnstone River: D50 = 0.6mm and D90 = 0.9mm.

The results of the analysis are presented in Table 6. For convenience the total sediment transport is expressed in cu.m/hour.

The results of these simulations permitted the preparation of the nomograms for estimation of sediment transport based on known discharges in both branches of the Johnstone River. The nomograms are shown on Figures 23 – 25. High discharges of 1500 and 2000m^3/s for South Johnstone River are included by extrapolation as such discharges cause flooding conditions. However, they occur for only short periods of time so any errors associated with a simple extrapolation are not likely to be very significant. Based on historical data recorded by WRC the extreme flows which occurred over the period of 1966 – 1989 were :

13/3/1967 between 6:00 and 15:00 hr
North Johnstone 1539 – 4517 – 3531m^3/s
South Johnstone 542 – 1464m^3/s

15/4/1982 between 5:28 and 6:42 hr
North Johnstone 3809 – 4395 – 3827m^3/s
South Johnstone 988 – 1043m^3/s

1/2/86 between 22:08 and 23:37 hr (Cyclone Winifred)
North Johnstone 4096– 4239 – 4011m^3/s
South Johnstone 1299 – 1550m^3/s

2/2/86 between 2:26 and 4:24 hr
North Johnstone 1979 – 1322m^3/s
South Johnstone 1799 – 1848 – 1792m^3/s

All extreme flow conditions happened for short periods of time, for only a few hours.

The nomograms in Figures 23 – 25 were used to estimate the order of sediment transport for an average year with and without a cyclone. It should be noted that for flows below 250m^3/s there is practically no sediment discharge into the sea. Such flow conditions occur from April to December.

Table 6

Sediment Transport in Johnstone River Estuary for Specified Flow Conditions

U/S inflow discharge [m^3/s]		Total U/S sediment inflow [m^3/h]	Total sediment passed to sea [m^3/h]		
Nth J.	*Sth J.*		*Bed*	*Sus*	*Total*
0	0	0.0	0.0	0.0	0.0
250	0	0.0	0.0	0.0	0.0
500	0	0.0	0.4	1.3	1.7
1000	0	8.0	10.0	31.0	41.0
2000	0	91.5	203.0	631.0	834.0
3000	0	179.0	967.0	3003.0	3970.0
0	250	31.0	0.0	0.0	0.0
500	250	31.0	2.5	7.9	10.4
1000	250	38.0	102.0	8.5	110.5
2000	250	120.0	325.0	1009.0	1334.0
3000	250	208.0	1287.0	3998.0	5285.0
4000	250	312.0	3128.0	9756.0	12884.
0	500	218.0	0.4	1.3	1.7
500	500	218.0	10.0	30.0	40.0
1000	500	225.0	60.0	188.0	248.0
2000	500	300.0	489.0	1518.0	2007.0
3000	500	382.0	1628.0	5167.0	6795.0
4000	500	481.0	3725.0	11632.0	15357.0
0	750	536.0	2.8	8.5	11.3
500	750	536.0	27.0	85.0	112.0
1000	750	539.0	117.0	363.0	480.0
2000	750	606.0	702.0	2179.0	2881.0
3000	750	680.0	2095.0	6520.0	8615.
4000	750	769.0	4373.0	13677.0	18050.
0	1000	869	10.0	31.0	41.0
500	1000	896.0	61.0	191.0	252.0
1000	1000	867.0	203	629.0	832.
2000	1000	928.0	966.0	3000.0	3966.0
3000	1000	998.0	2585.0	8052.0	10637.0
4000	1000	1080.0	5071.0	15881.0	20952.

With the mathematical model for a noncyclonic year, using 1976 year as an example, the total sediment discharge into the sea is about $1000m^3$, and for a cyclonic year such as 1986 the total sediment discharge into the sea was $65{,}600m^3$, including $65{,}000m^3$ during the cyclone period. The approximate calculation done with the nomograms based on discharges presented in Queensland Stream Flow Records published by WRC doubles these figures.

This very preliminary analysis of the cyclonic and non–cyclonic years for the period of 1966 – 1989 indicate five years (1967, 1977, 1979, 1981, 1986) with significant flows exceeding $2000m^3/s$. Thus the estimated average annual sediment transport into the sea, based on 33 years of observation is of the order of 11,000 to $22{,}000m^3$.

Sensitivity analysis of several empirical formulae for sediment transport done by Rijn (1984) indicates that the rather low accuracy of the field measurements together with the influence of the applied width–depth method and estimated period of uniform flow conditions, justify use of the simple formula. Under such conditions it is nearly impossible to predict the transport rate with an inaccuracy less than a factor of 2. This point has to be kept in mind when using the proposed nomograms.

The net sediment transport in the Johnstone Estuary was calculated using the nomograms. The results of this analysis which are shown in Figure 26 indicate a difference between the sediment discharged into the estuary at the upstream end and sediment discharged into the sea. Depending on flow conditions in the North Johnstone and South Johnstone there was a situation where the sediment from the rivers was deposited in the estuary. This deposited material was then discharged into the sea only under extreme flow conditions. Since on average in an average year, flows are very low for over 80% of the time, deposition of sediment occurs in the estuary for most of the time. The material is then eroded and discharged into the sea in extreme flow conditions which may happen once a year or even once every few years. It can therefore be concluded that the sediment transport mechanism in the estuary is a 2 phase process . In the first phase the sediment is transported into the estuary and remains there until it is transported out of the estuary in the second phase. This time lag could be very important for neutralizing biologically active components of the sediment before it is discharged into the sea.

5. CONCLUSIONS

The Johnstone River formed by the North Johnstone River with an average annual discharge of $59m^3/s$ and by the South Johnstone River with an average annual discharge of $25m^3/s$ is under the predominantly semidiurnal tidal influence with a range up to 3.4m.

The instantaneous flow in the North Johnstone River can oscillate between 4,517 and $3.8m^3/s$ and in the South Johnstone River between 1,848 and $1.3m^3/s$ and is characteristic of Australian rivers where $Q_{max}/Q_{min} >> 10 - 15$ which is characteristic of European and American rivers. The maximum instantaneous flow occurs for short periods of time (order of hours) but is very significant for sediment transport and its estimation.

The study concentrated on adoption of two numerical models that can be used to describe the hydrodynamics and sedimentary processes of the Johnstone River estuary. The available field data enables methodology to be verified but was not sufficient to generate final general conclusions. A more detailed study is therefore needed. This detailed study will require a higher level of financial and material involvement.

The PROFILE model used in the study allows analysis of a particular cross–section of the river to estimate distribution of the horizontal velocity, salinity, discharge and flux of arbitrary dissolved or suspended measured constituents. An analysis of the field data obtained from the field measurements on December 6, 1990 indicates that, during low flow conditions in the rivers, near the confluence of both rivers at Innisfail, there is a strong gravitational circulation in the North Johnstone and a weak one in the South Johnstone. The stratification parameter shows the estuary to be a well mixed type. This is an important conclusion for other 1D models of sedimentary processes where vertical variation in density can not be included. The calculation of the net salt flux, presented in 3.3.5, is an example of the possibility of analyzing the net flux of an arbitrary constituent if field data are available.

The numerical model of the hydrodynamics and sedimentary processes is a 1D model representing the simplest approach to estimation of volume and distribution of the sediment transport in an estuary. A verification study for the model in the Tweed River shows over 60% agreement between observed and simulated results. In the case of Johnstone River it was used to analyse the cyclone Winifred event. The hydrodynamic part of the model associated with the simulation of the water levels revealed a high level of agreement between observed and simulated data. This result indicates that the geometry of the rivers had not changed significantly since 1986, when echo–sounding was undertaken.

The model estimates that 65,000m^3 of sediment was discharged into the sea in conjunction with the cyclone. It appears that the majority of that sediment was eroded from the lower part of the River, downstream of Innisfail. Higher sediment transport than that along the North Johnstone River were also found along the South Johnstone River. Simulation for the whole 1986 year shown that only about another 600m^3 discharged into the sea for the rest of that year.

A prognostic simulation of the sediment transport was undertaken to estimate the flow conditions when significant sediment transport occurs in the Johnstone River estuary. The simulation allowed the preparation of nomograms for estimation of sediment transport based on known discharges on both branches of the Johnstone River. It indicates that for discharge up to 500m^3/s in the North Johnstone River and up to 250m^3/s in the South Johnstone River, the volume of sediment inflow from the upper part of the rivers exceeds the volume of sediment discharged into the sea. Thus the sediment transport in the estuary may be regarded as a two phase process.

For the majority of the time the discharges in the rivers are below the values of 500m^3/s and 250m^3/s respectively and sediment is transported into the estuary where it remains (phase one) until extreme events such as cyclones occur. At this time the second phase takes place and the sediment is transported out of the estuary in the second phase. Thus aggradation is the main process occurring in the rivers and estuary as, except in cyclonic events, the river flow has insufficient energy to discharge the sediment into the sea. The time over which sediment is deposited in the estuary could be an important factor in quality analysis of water and sediment discharged into the sea.

Due to rather low accuracy in both sediment transport measurement techniques and applied empirical formulae which have to be carefully verified for a particular geographical site, the prediction of sediment transport is still characterized with high inaccuracy of the order of a factor of 2. Keeping this in mind it can still be concluded that based on the numerical analysis and 33 years of hydrological data for Johnstone River the estimated sediment transported into the sea is of the order of 11,000 to 22,000m^3 per annum. Compared with the average aggradation estimated by Cameron McNamara (Cameron McNamara, 1985) it can be concluded that the Johnstone River estuary is in a permanent aggradation of the order of 30,000 to 40,000m^3 per annum corresponding to an average siltation of the order of 20mm.

6. ACKNOWLEDGEMENT

This work was carried out with the support of funds from the Australian Research Council Grant Scheme. This support is gratefully acknowledged.

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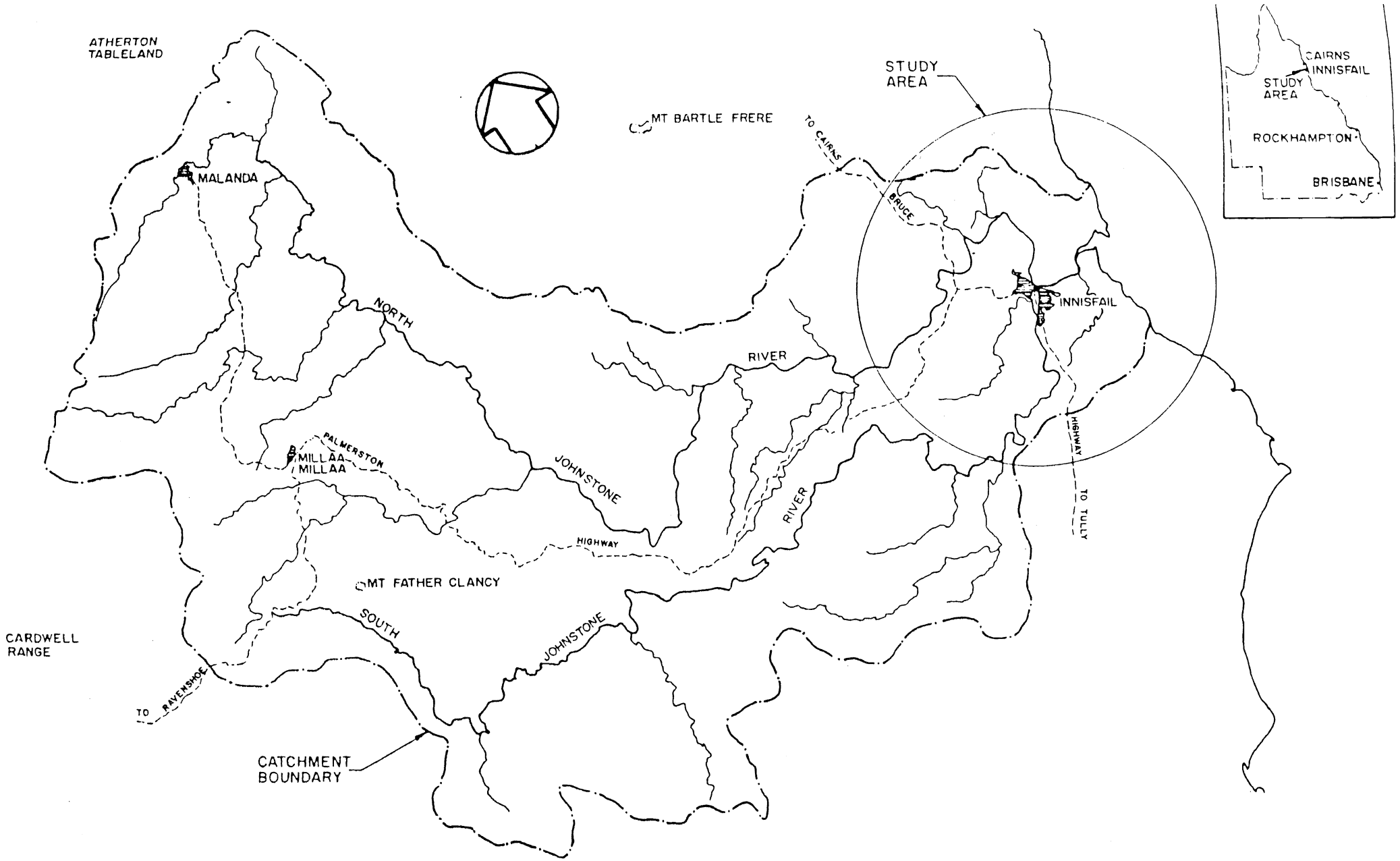
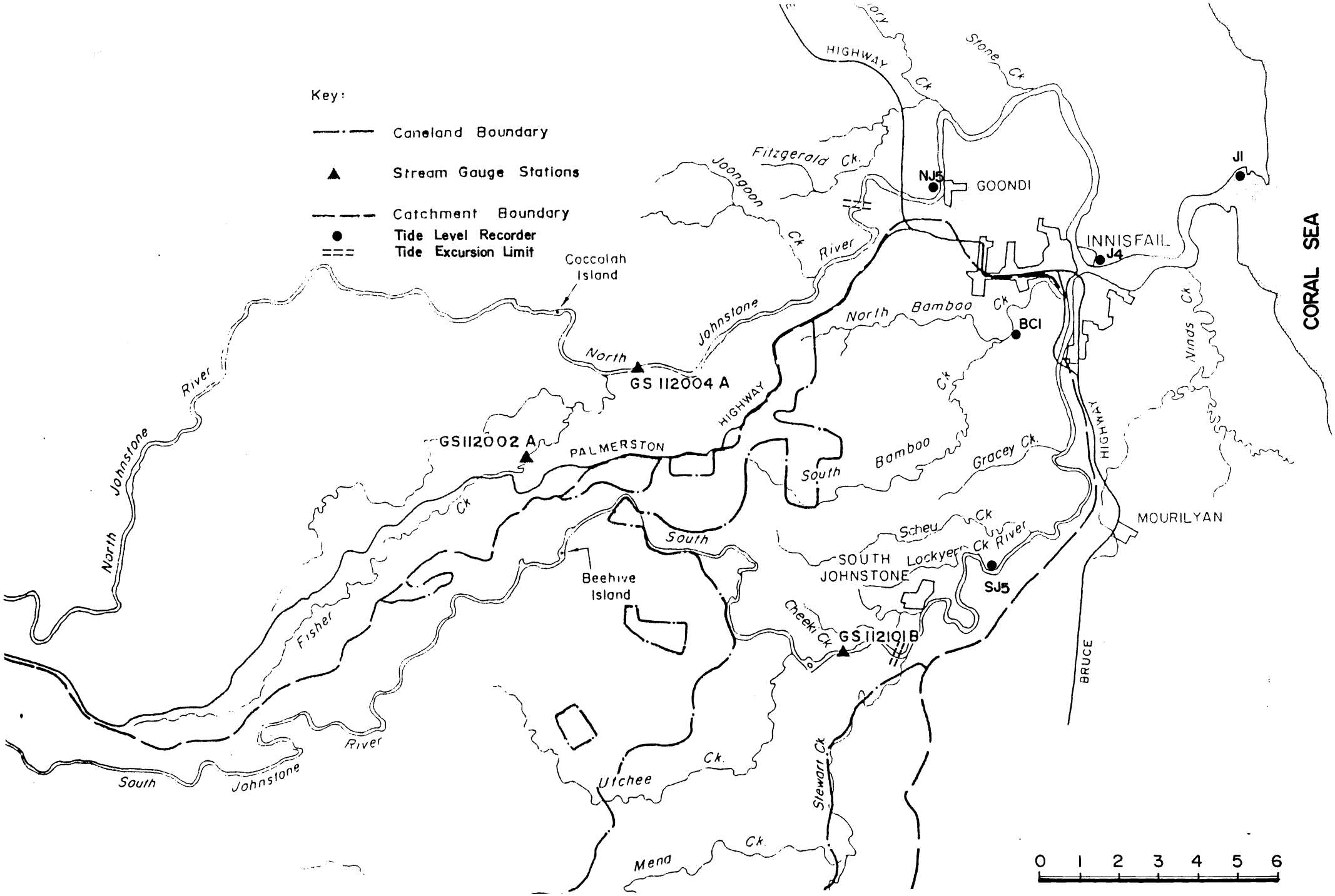


Figure 1: Johnstone River catchment.


Key:
Caneland Boundary
Stream Gauge Stations
Catchment Boundary
Tide Level Recorder
Tide Excursion Limit
HIGHWAY
Stone Ck
Fitzgerald Ck
Joongoon Ck
River
NJ5
GOONDI
J1
INNISFAIL
J4
CORAL SEA
Coccolah Island
Johnstone
North
GS 112004 A
North Bamboo Ck
BCI
Ivinds Ck
River
North Johnstone
GS112002 A
PALMERSTON
HIGHWAY
Ck
South Bamboo
Gracey Ck
HIGHWAY
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MOURILYAN
South
SOUTH JOHNSTONE
Lockyer Ck
River
SJ5
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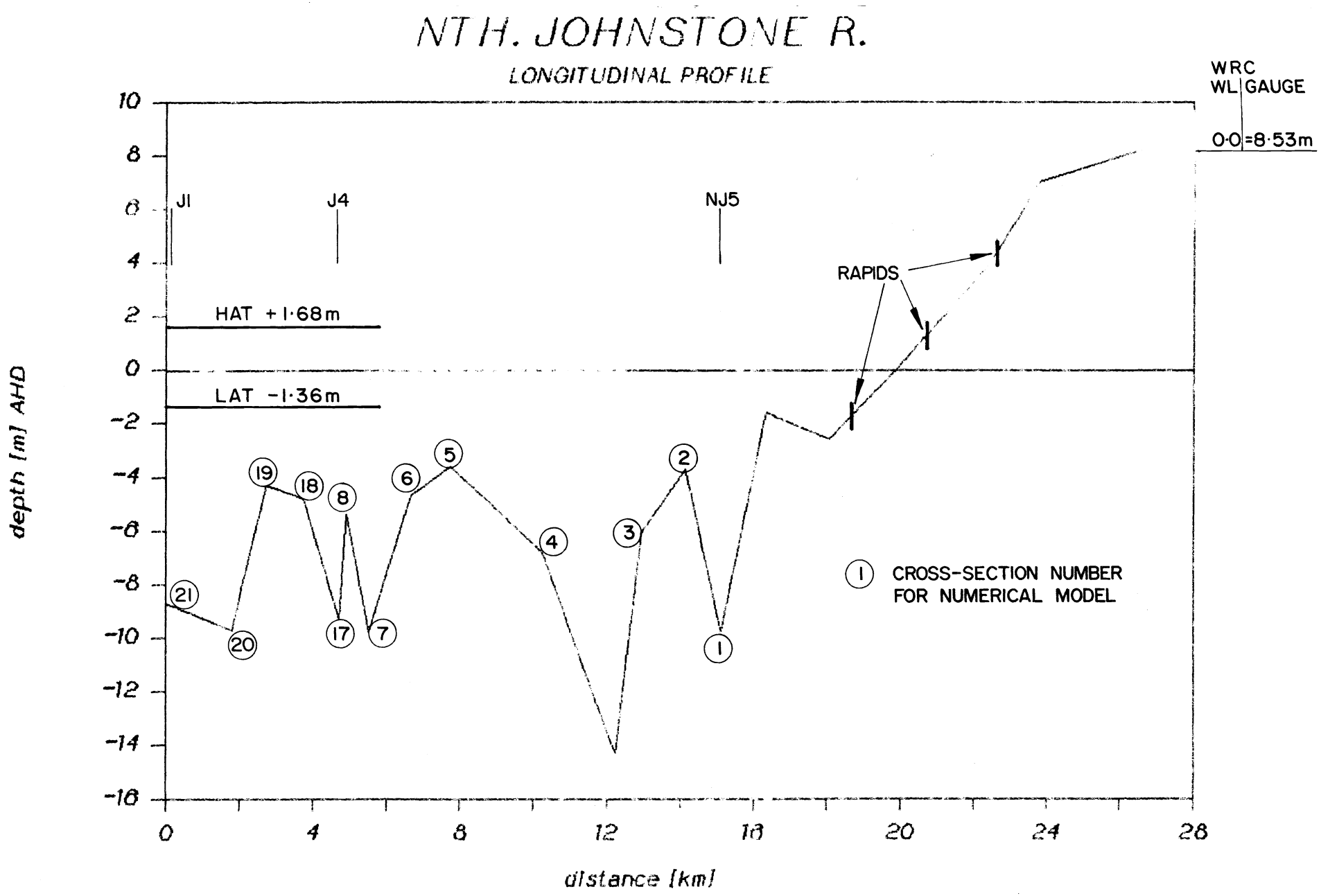


Figure 3: North Johnstone River – longitudinal profile through the deepest parts of the river.

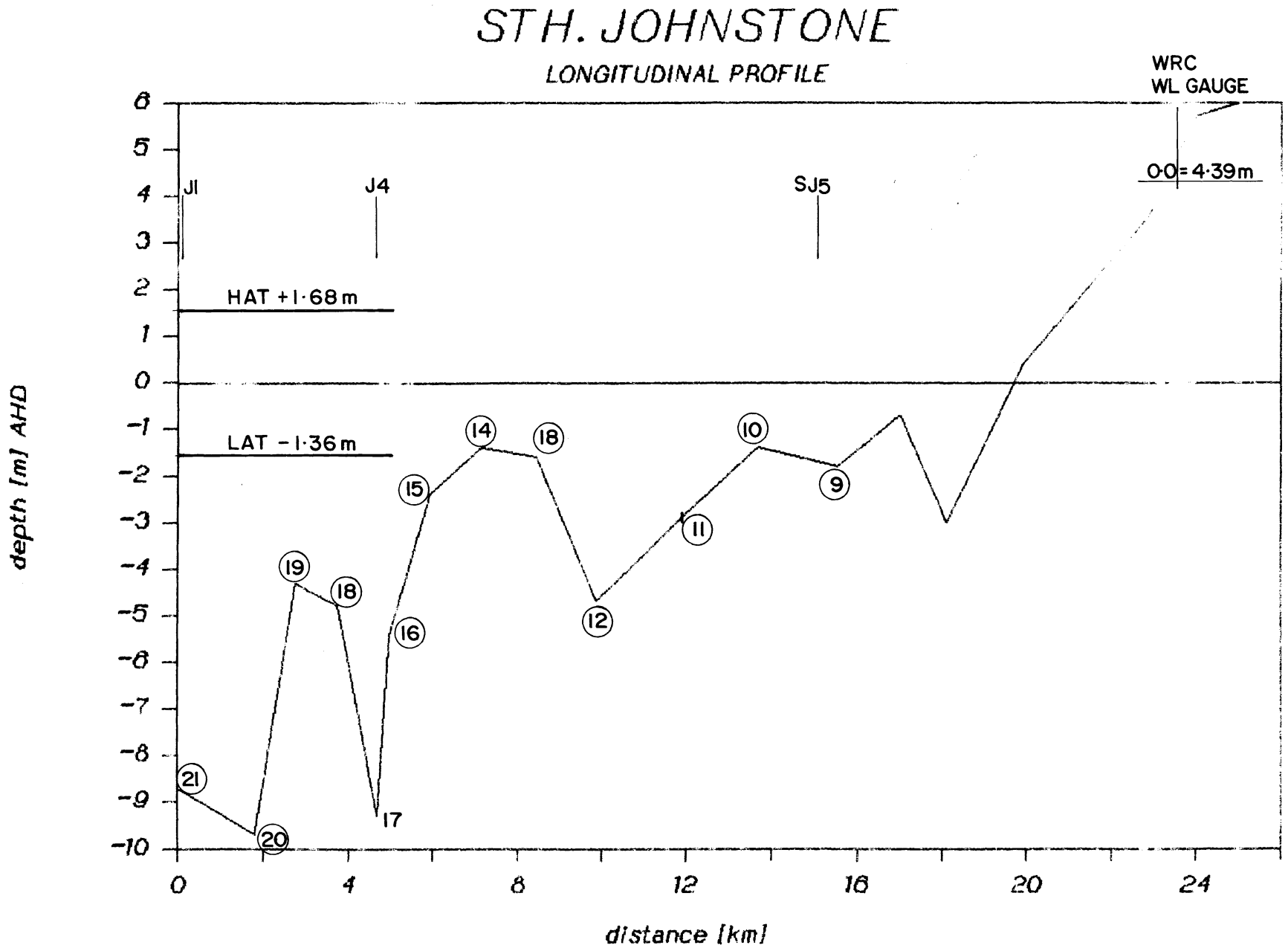


Figure 4: South Johnstone River — longitudinal profile through the deepest parts of the river.

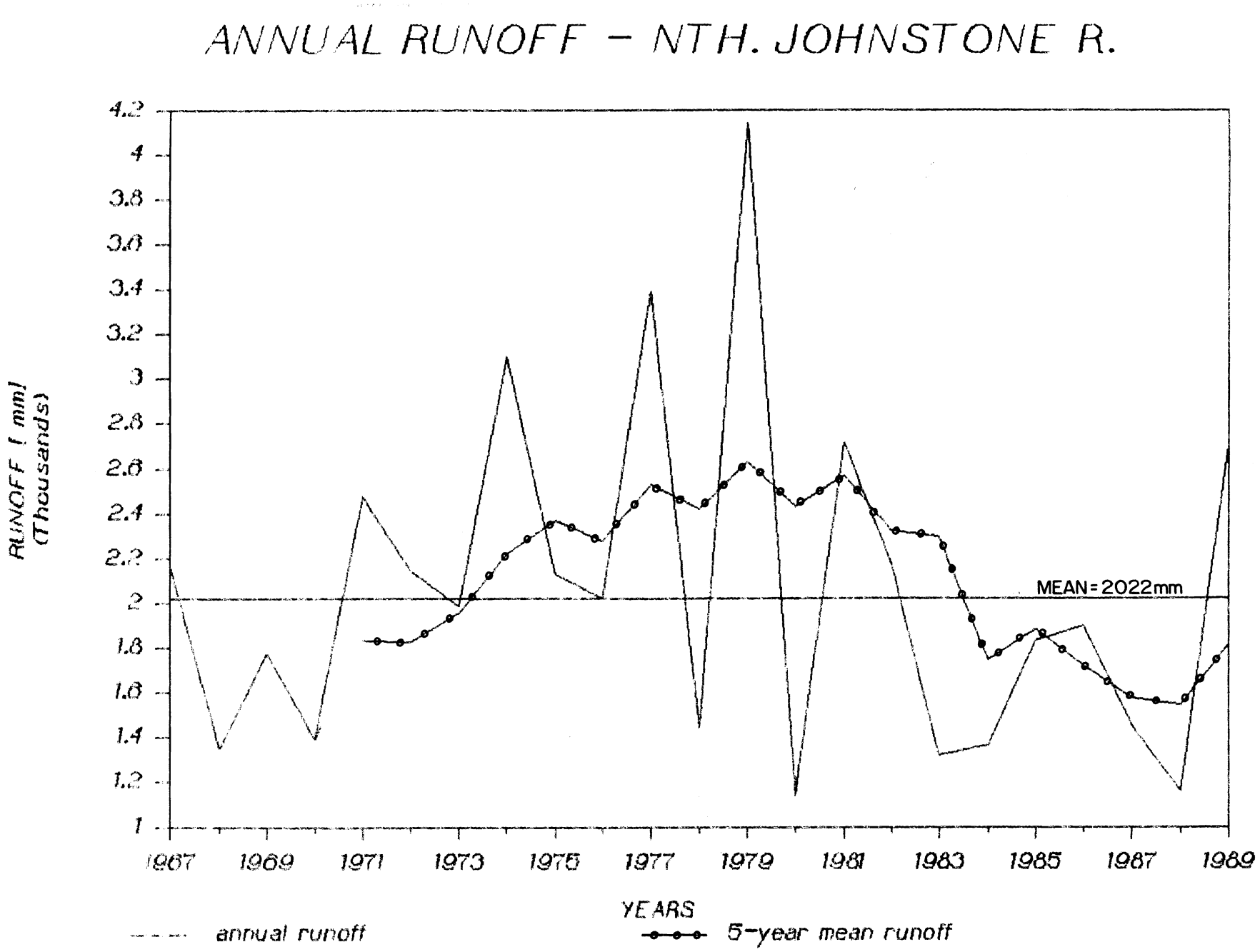


Figure 5: North Johnstone River – annual runoff and 5 years moving mean of the annual runoff.

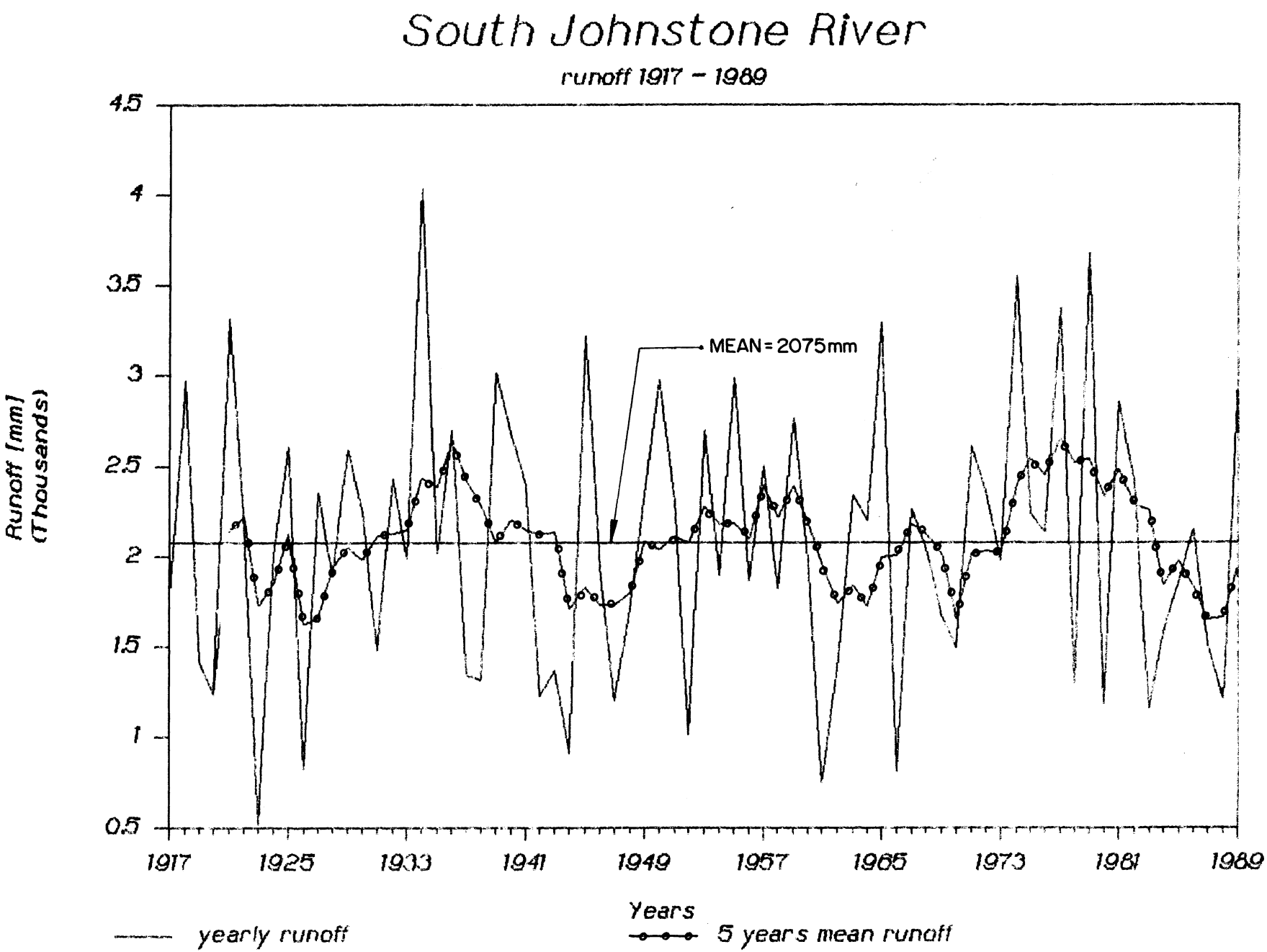


Figure 6: South Johnstone River – annual runoff and 5 years moving mean of the annual runoff

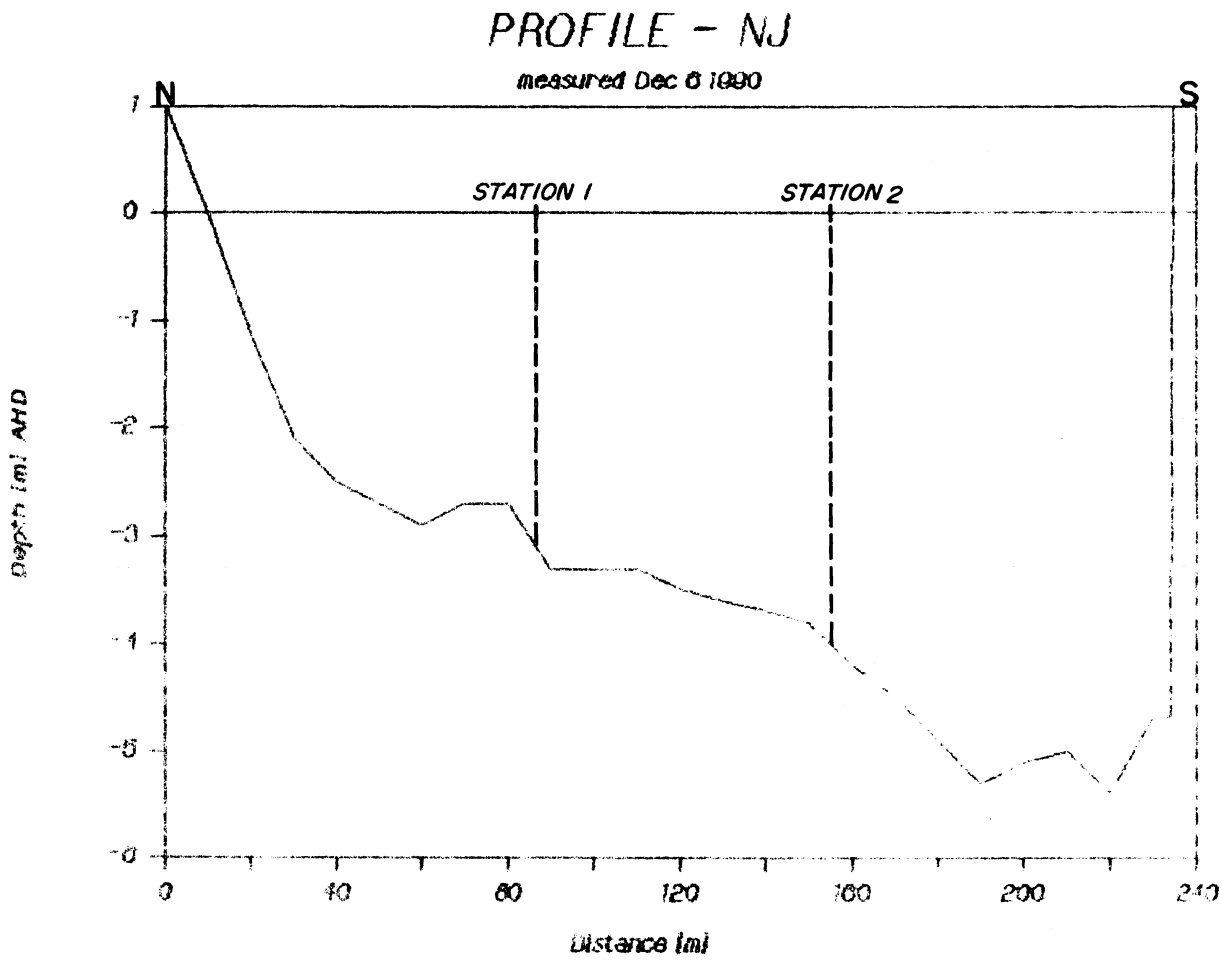
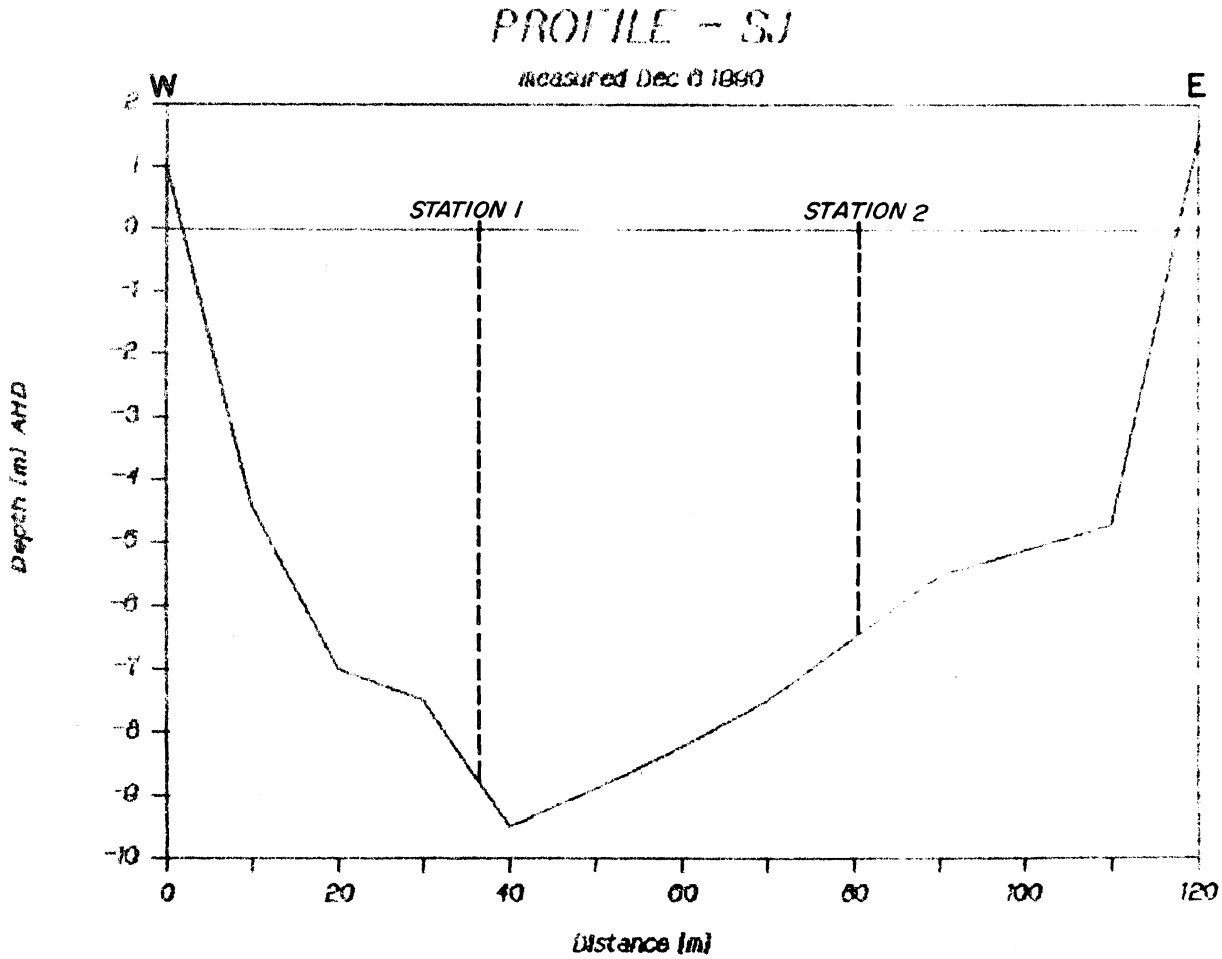


Figure 8: Cross–sections of the measured profiles.



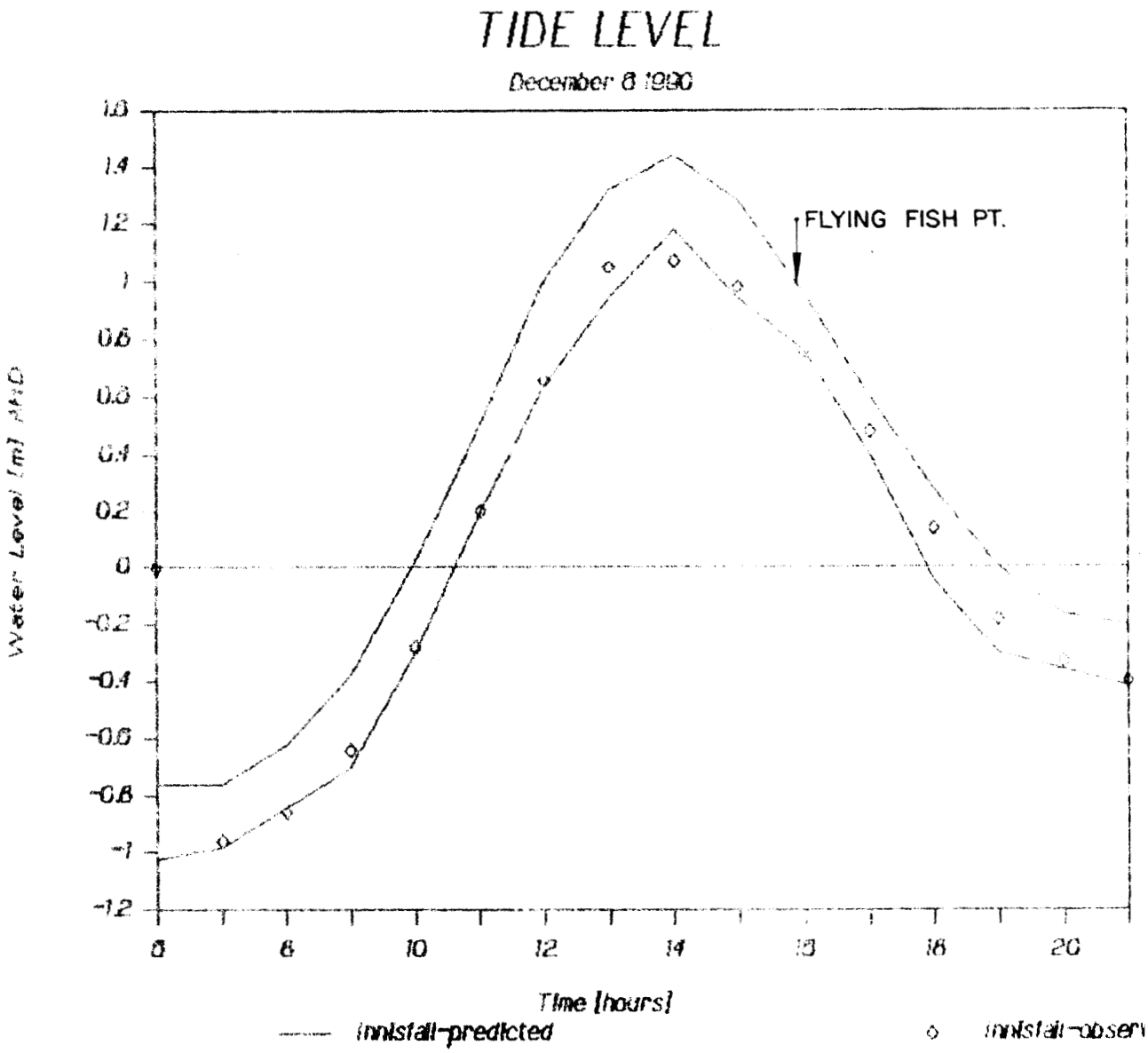


Figure 9: Water level changes during measurement on Dec. 6 1990.

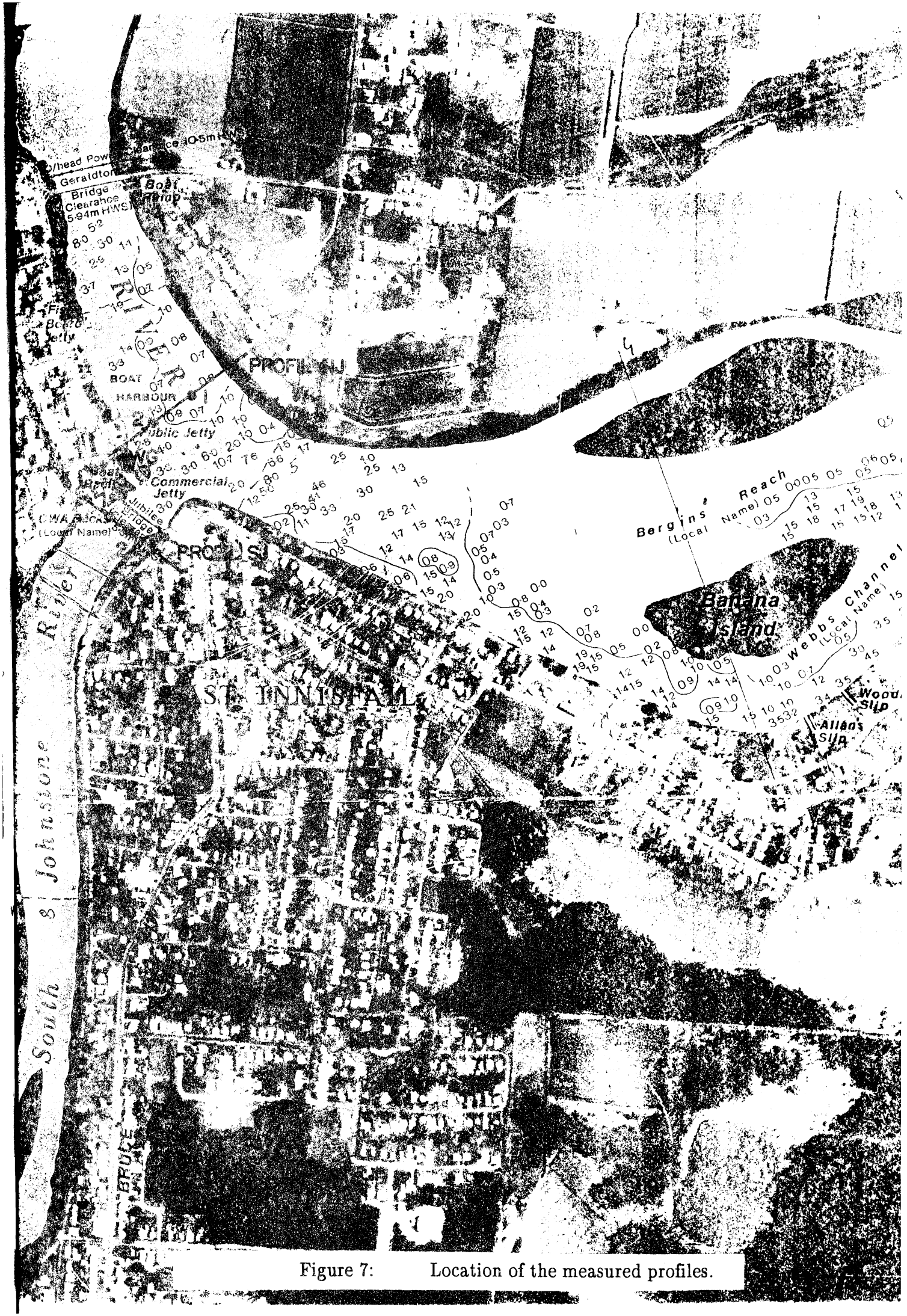


Figure 7: Location of the measured profiles.

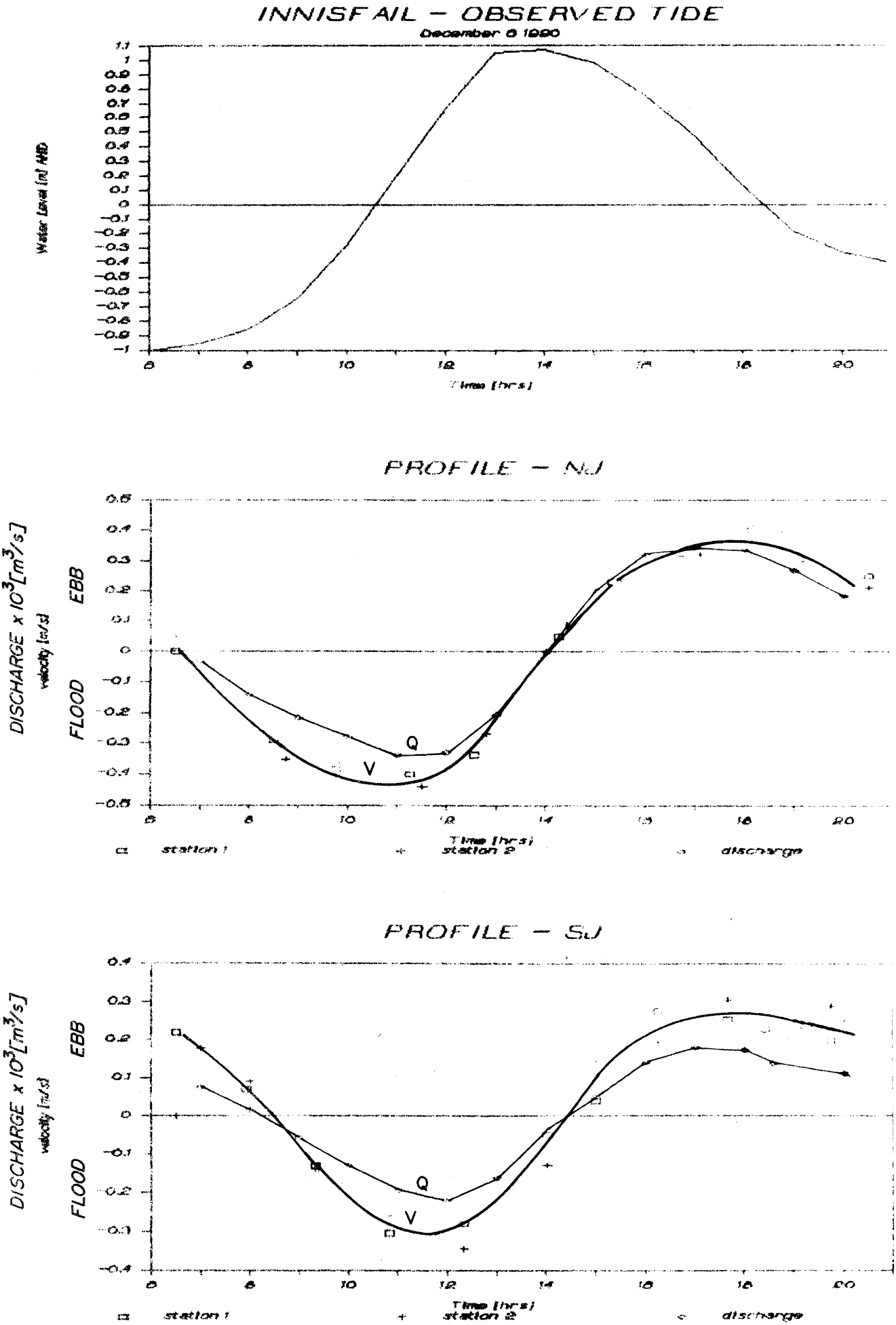
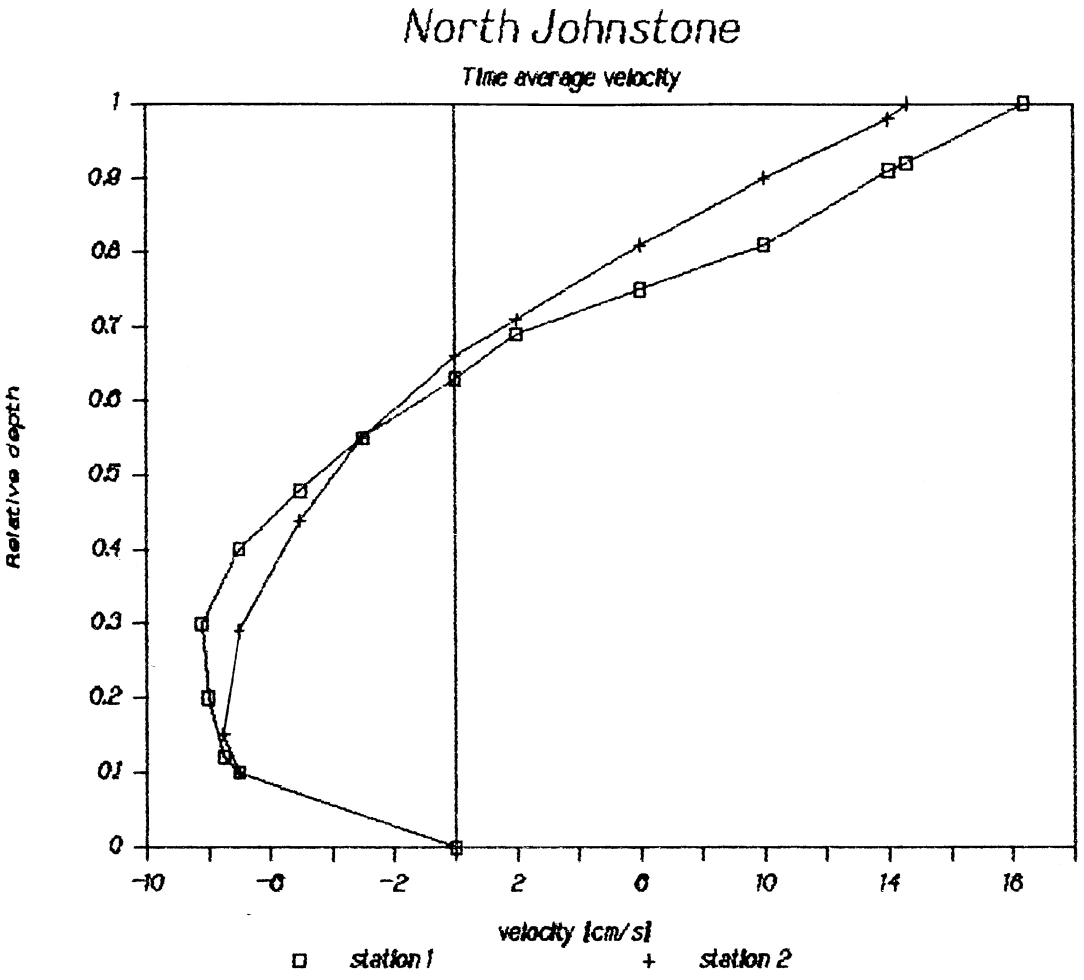


Figure 10: Depth averaged velocities and discharges based on measurement on Dec. 6 1990.



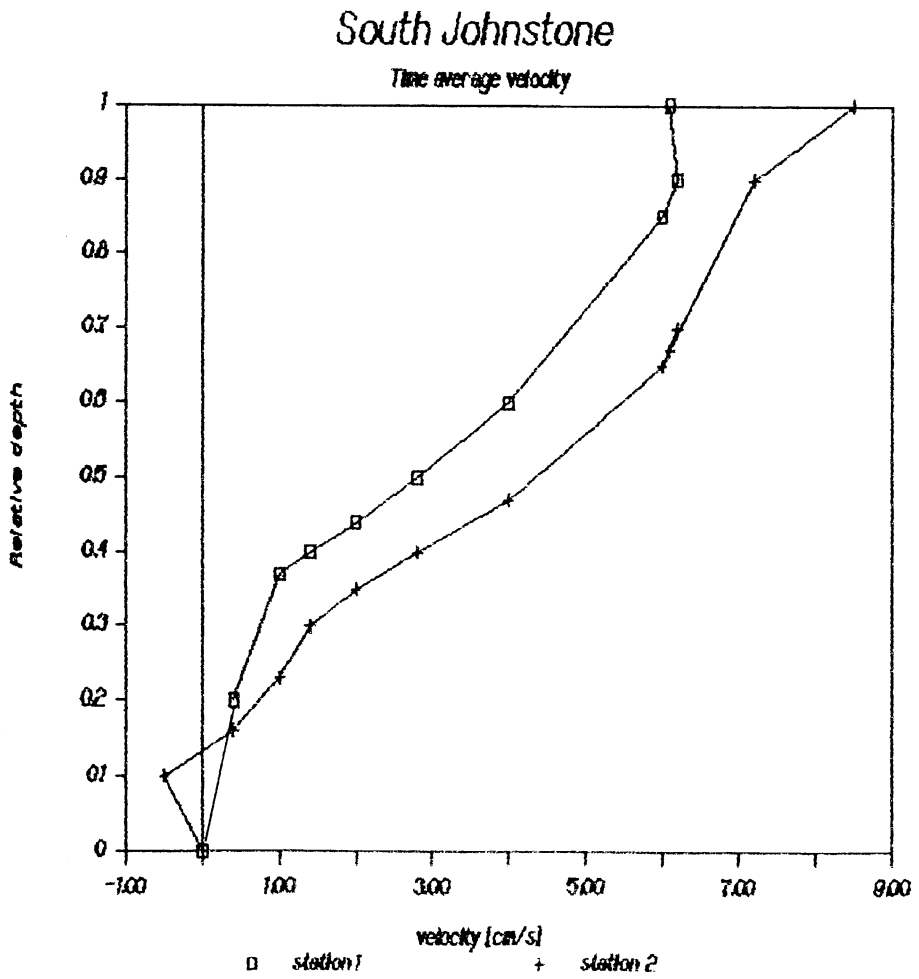
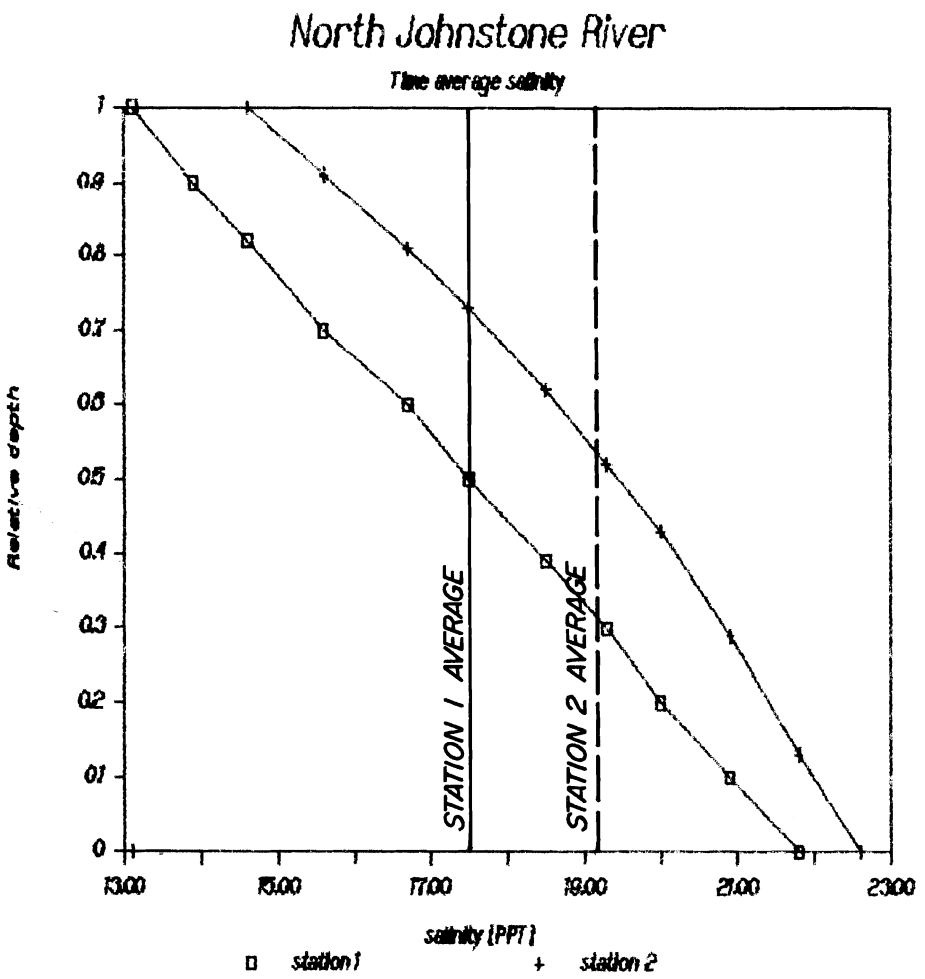


Figure 11: Time averaged velocities based on measurement on Dec. 6 1990.



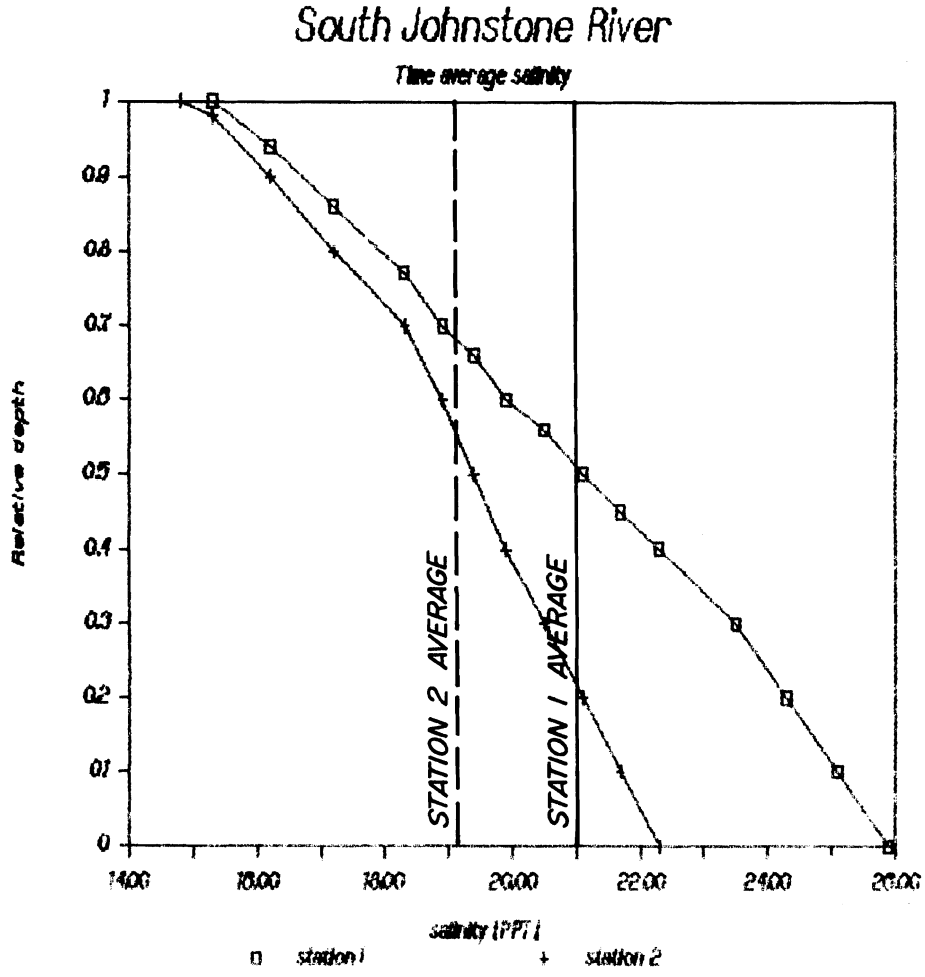


Figure 12: Time averaged salinity based on measurement on Dec. 6 1990.

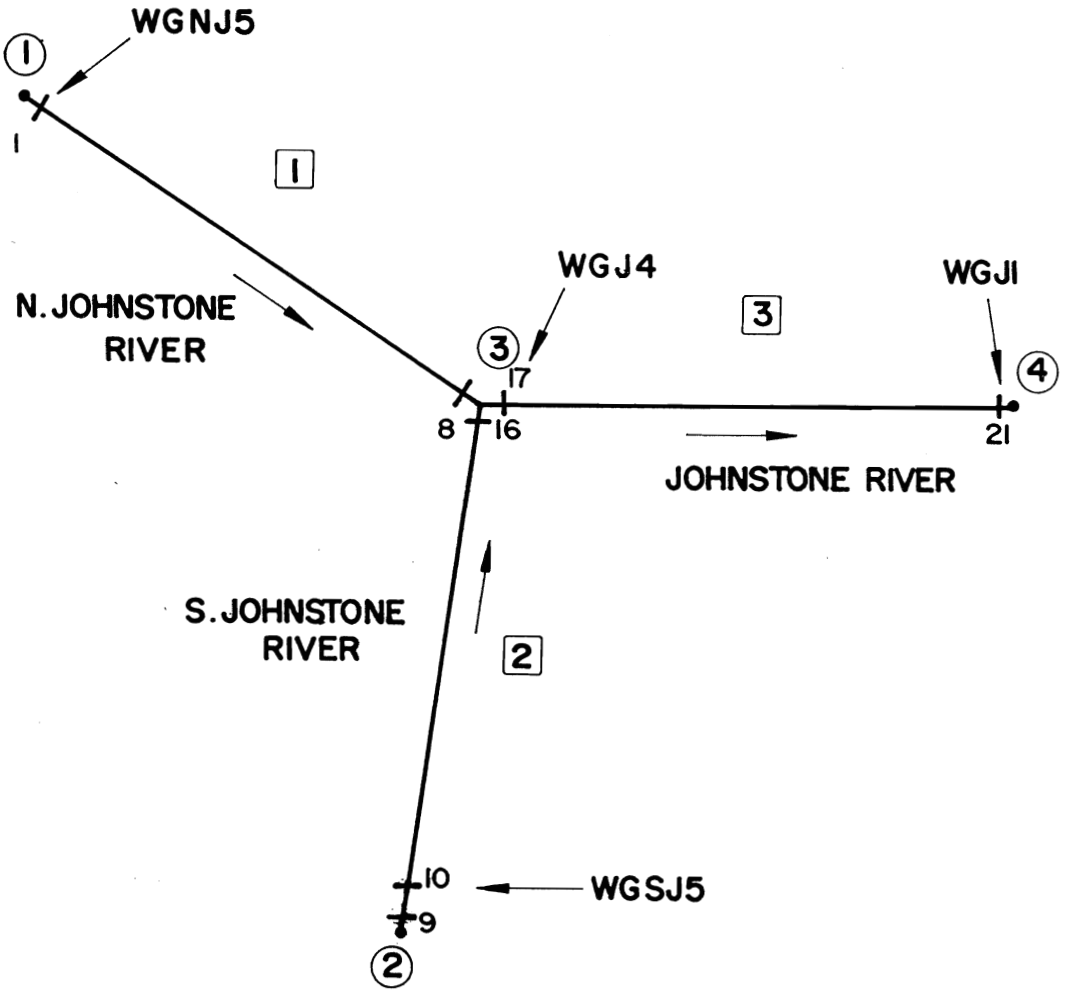


Figure 13: Schematization of the Johnstone River estuary for mathematical model.

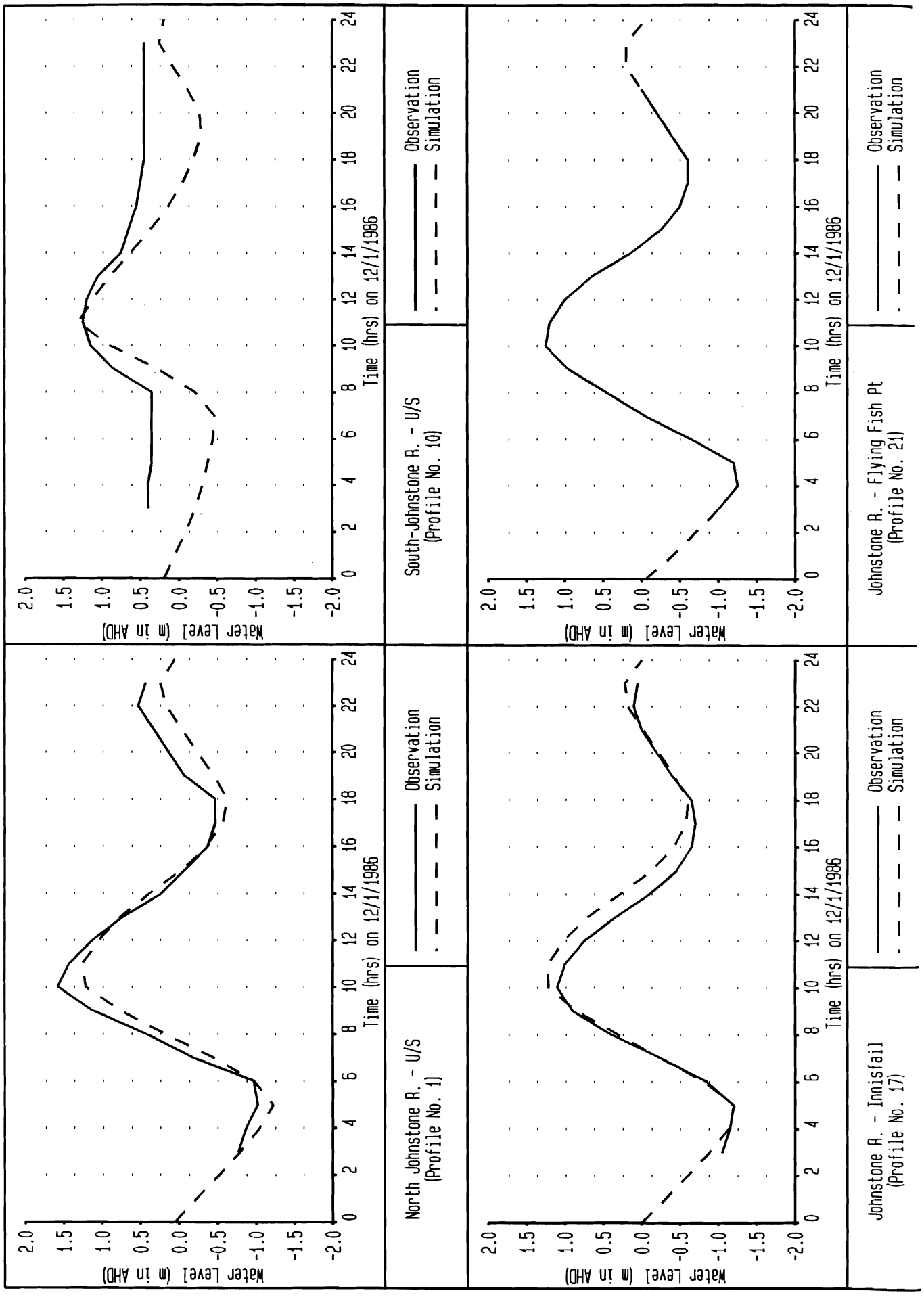


Figure 14: Hydro–sedimentological model calibration based on data for Jan. 12 1986 – Water level fluctuation.

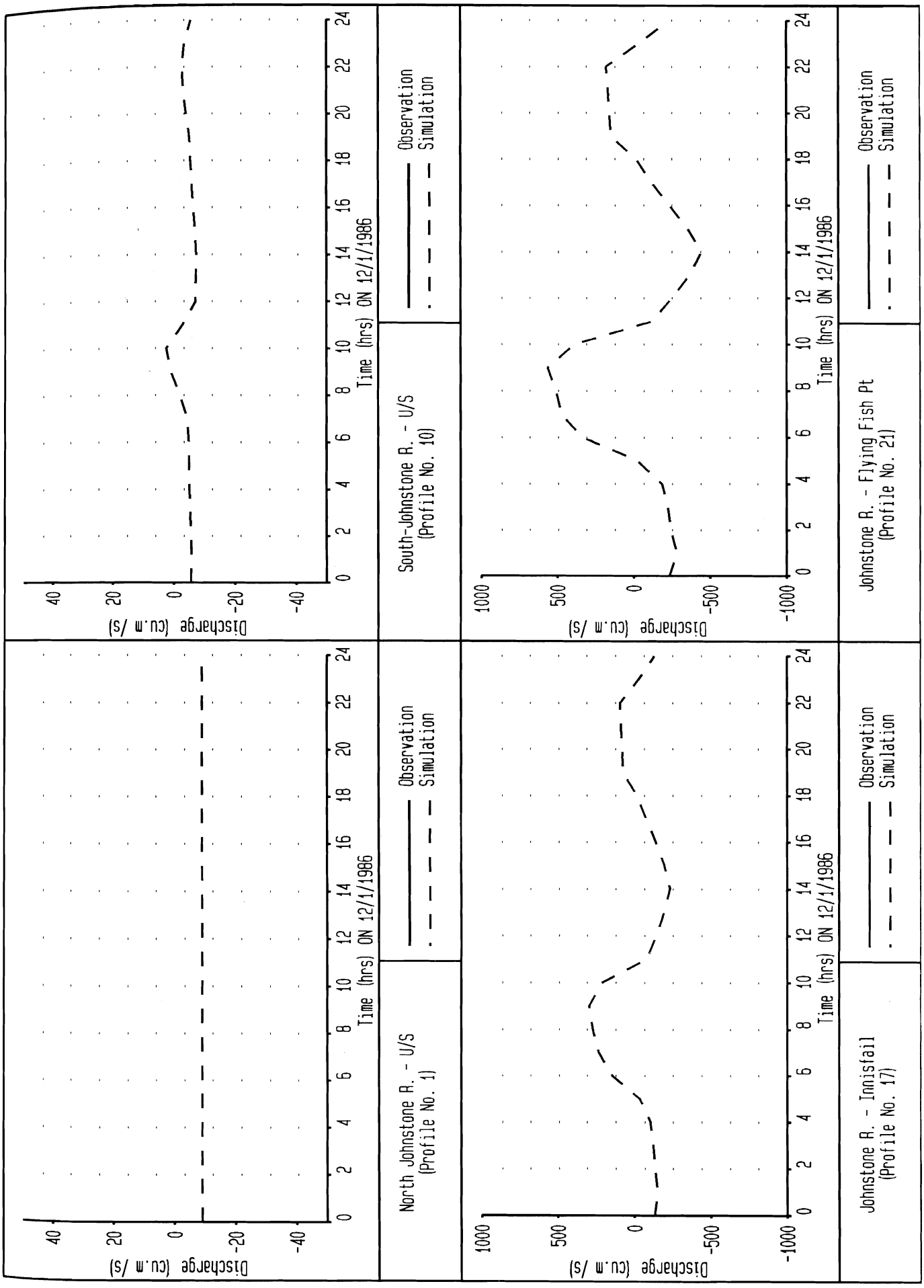


Figure 15: Hydro–sedimentological model calibration based on data for Jan. 12 1986 – Discharges.

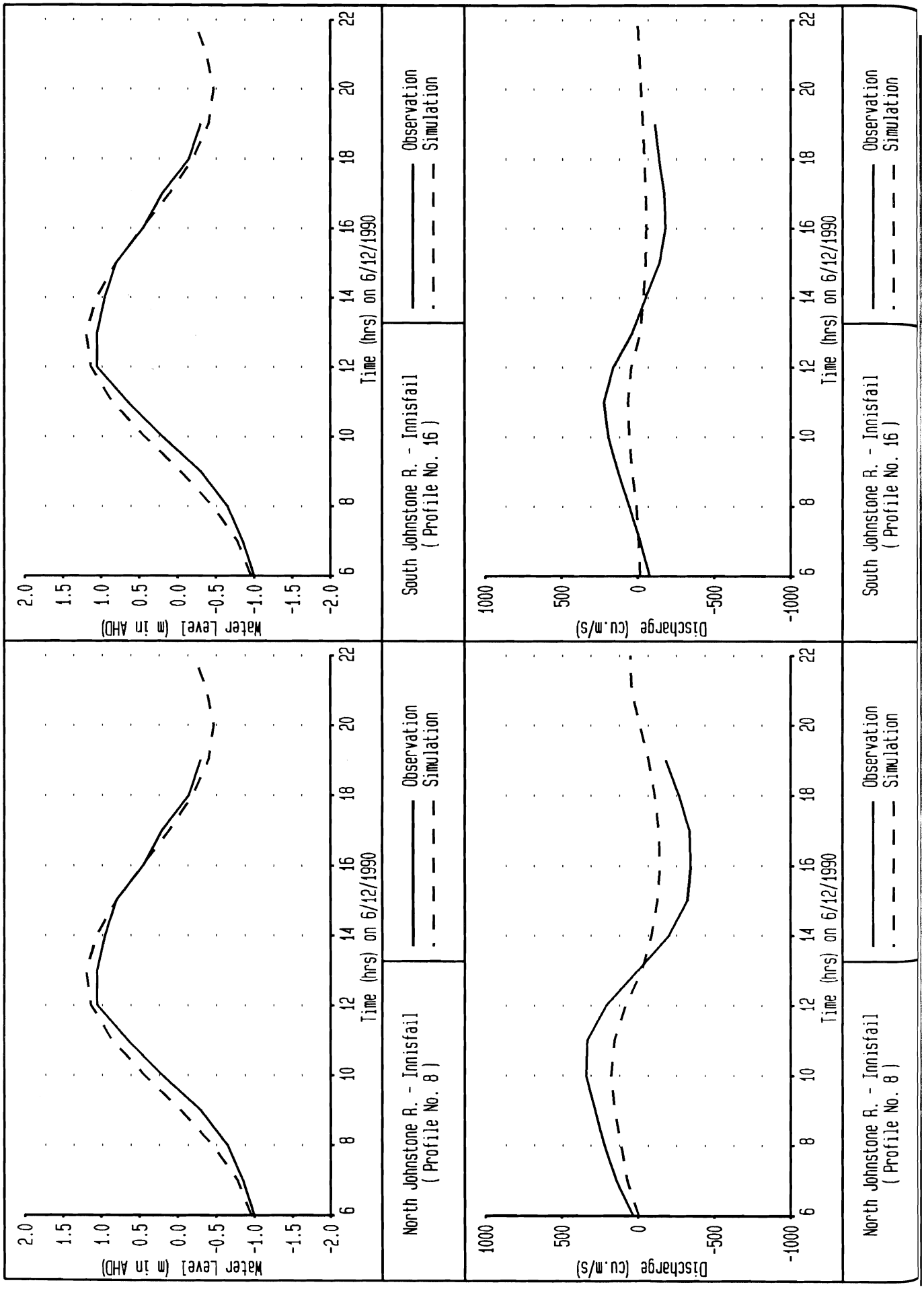


Figure 16: Results of hydro–sedimentological simulation and field measurements on Dec. 6 1990.

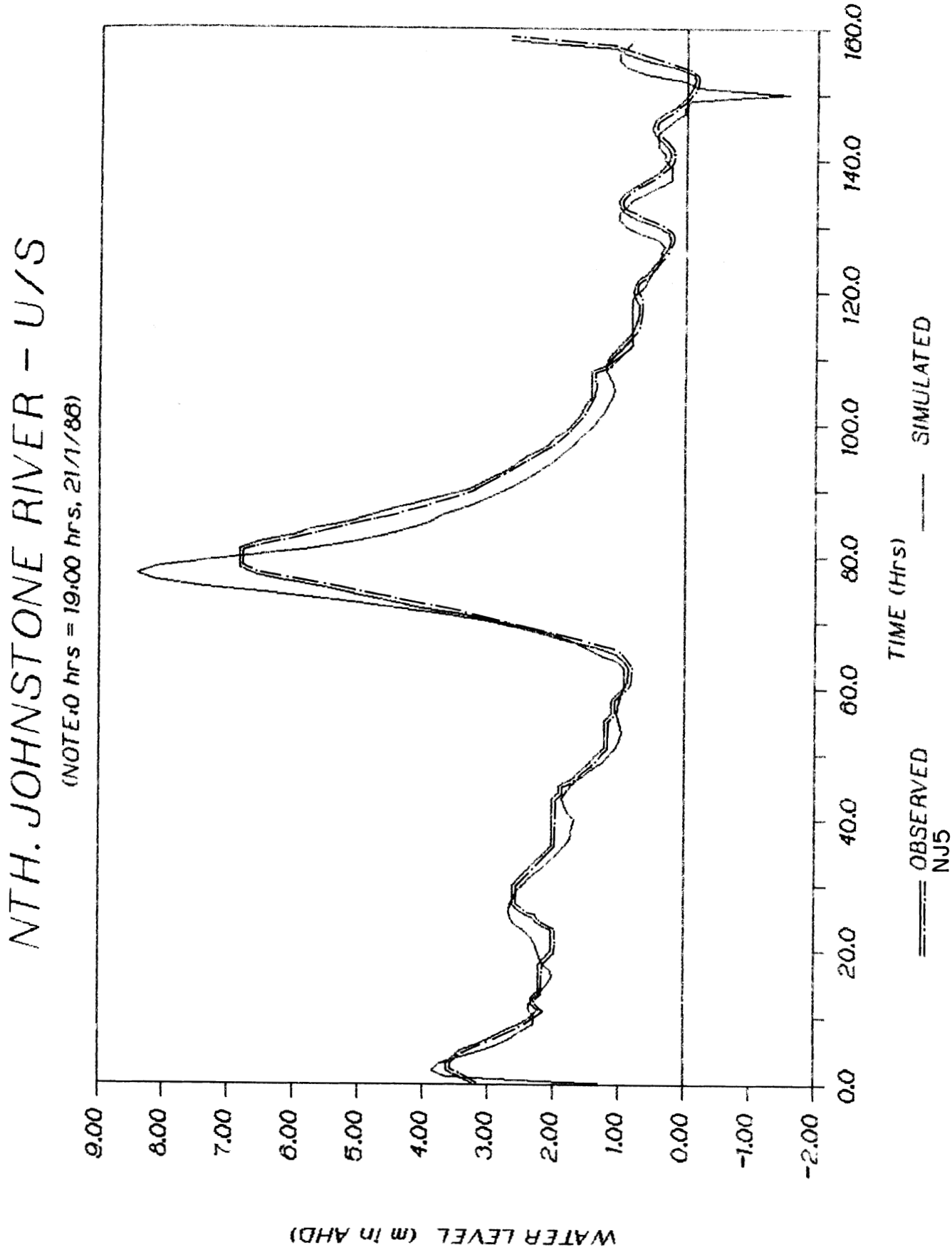


Figure 17: Cyclone Winifred – comparison of simulated and recorded data for the North Johnstone River, upstream profile No 1.

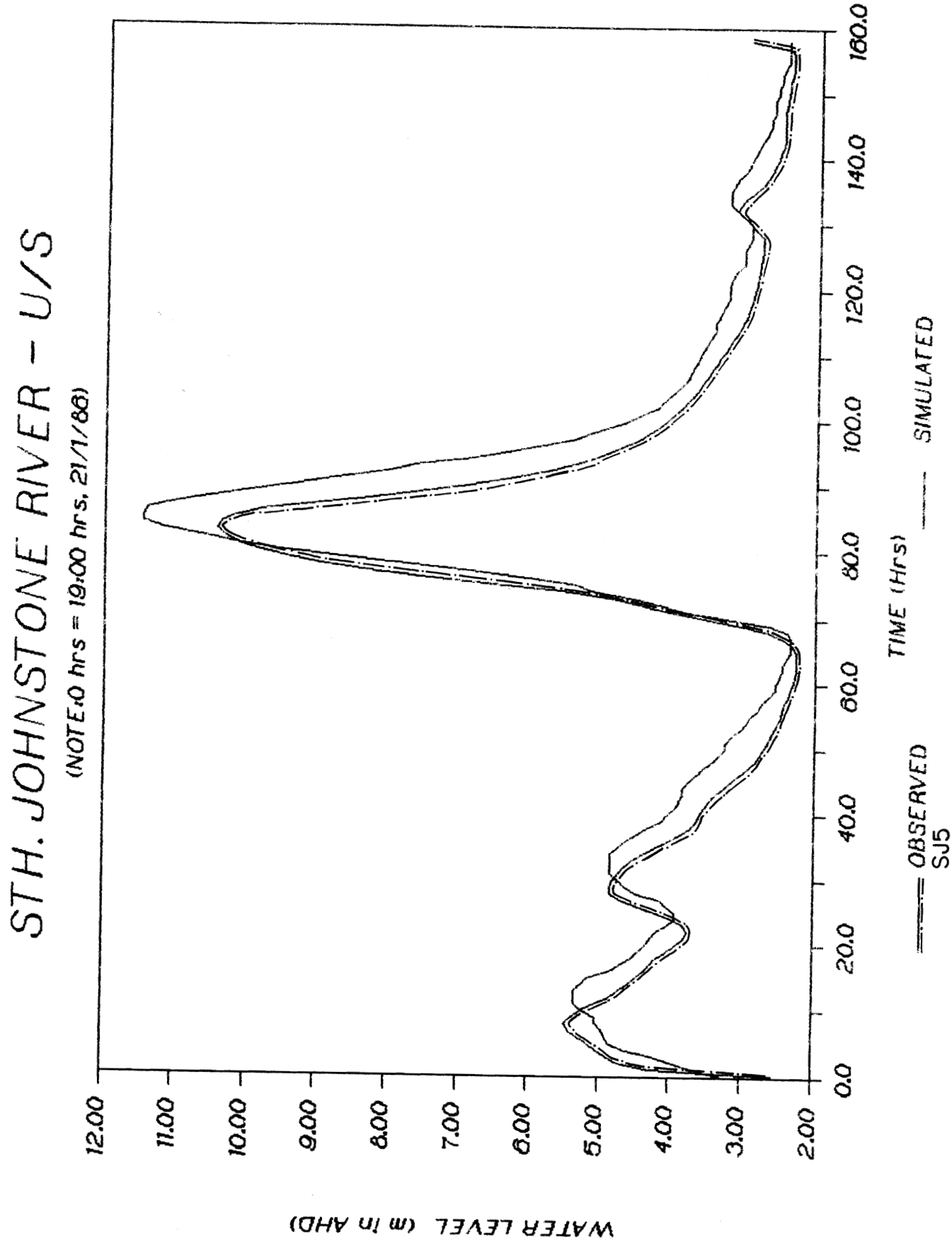


Figure 18: Cyclone Winifred – comparison of simulated and recorded data for the South Johnstone River, upstream profile No 10.

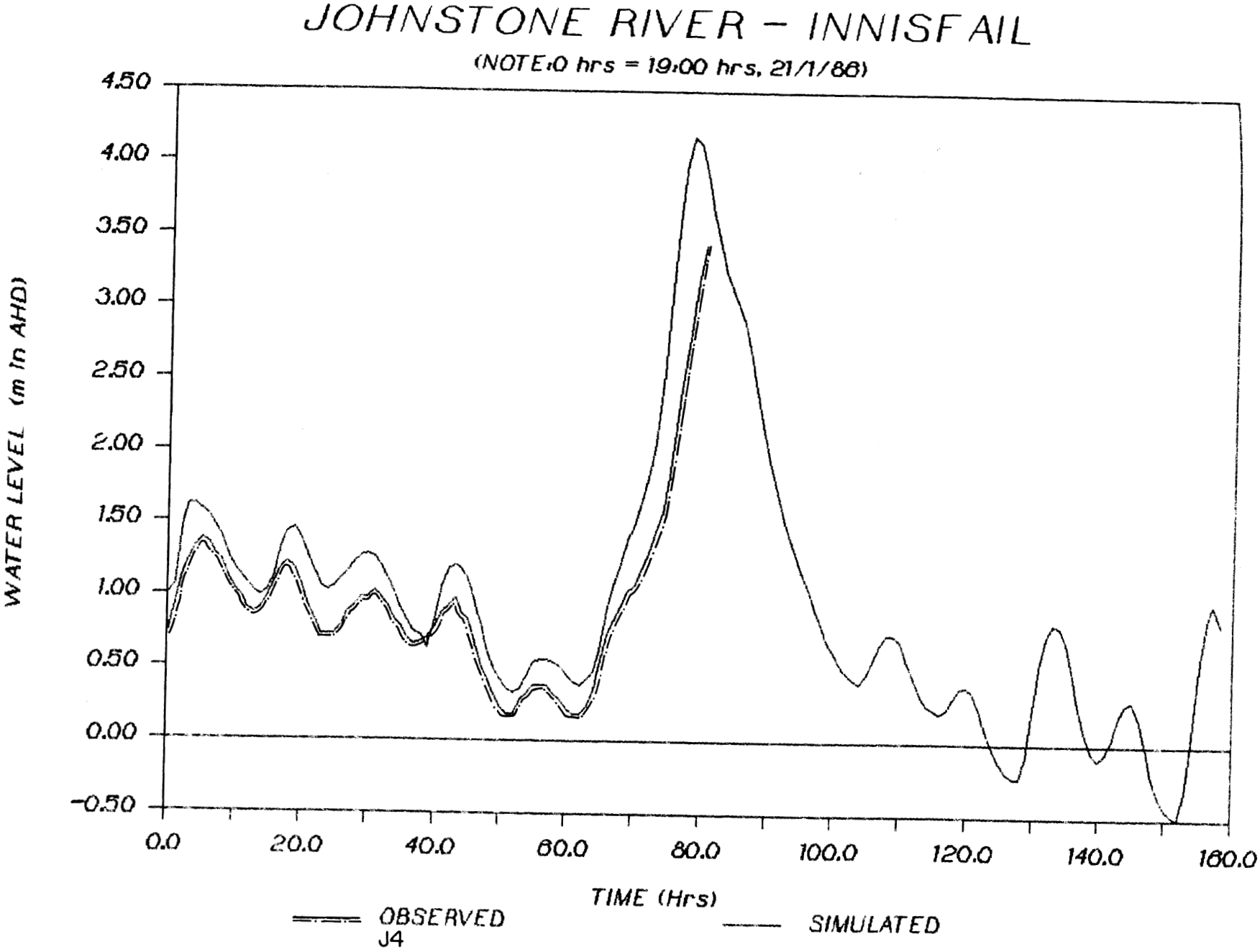


Figure 19: Cyclone Winifred – comparison of simulated and recorded data for the Johnstone River at Innisfail, profile No 17.

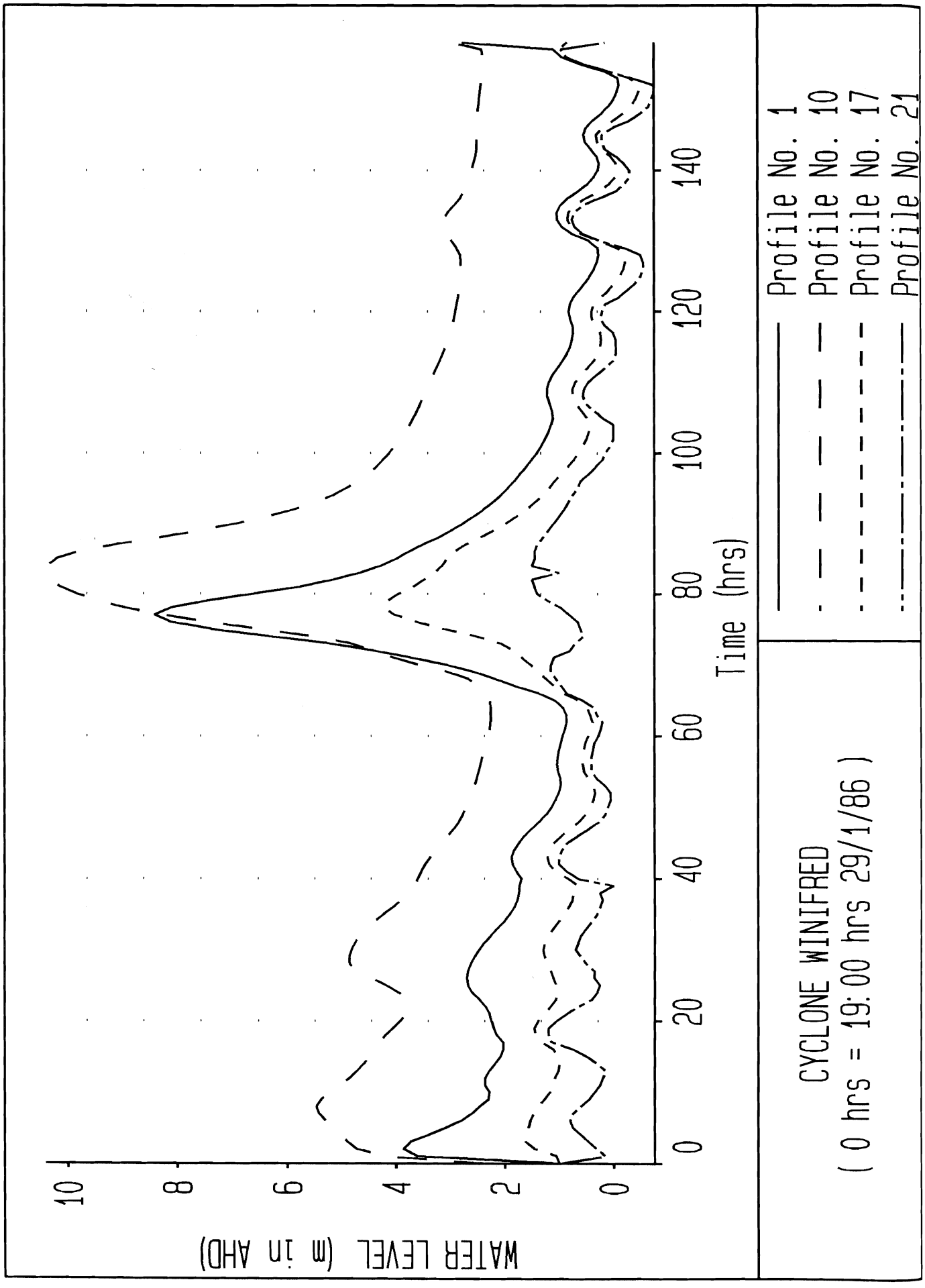


Figure 20: Cyclone Winifred – water level fluctuation in selected profiles (simulated).

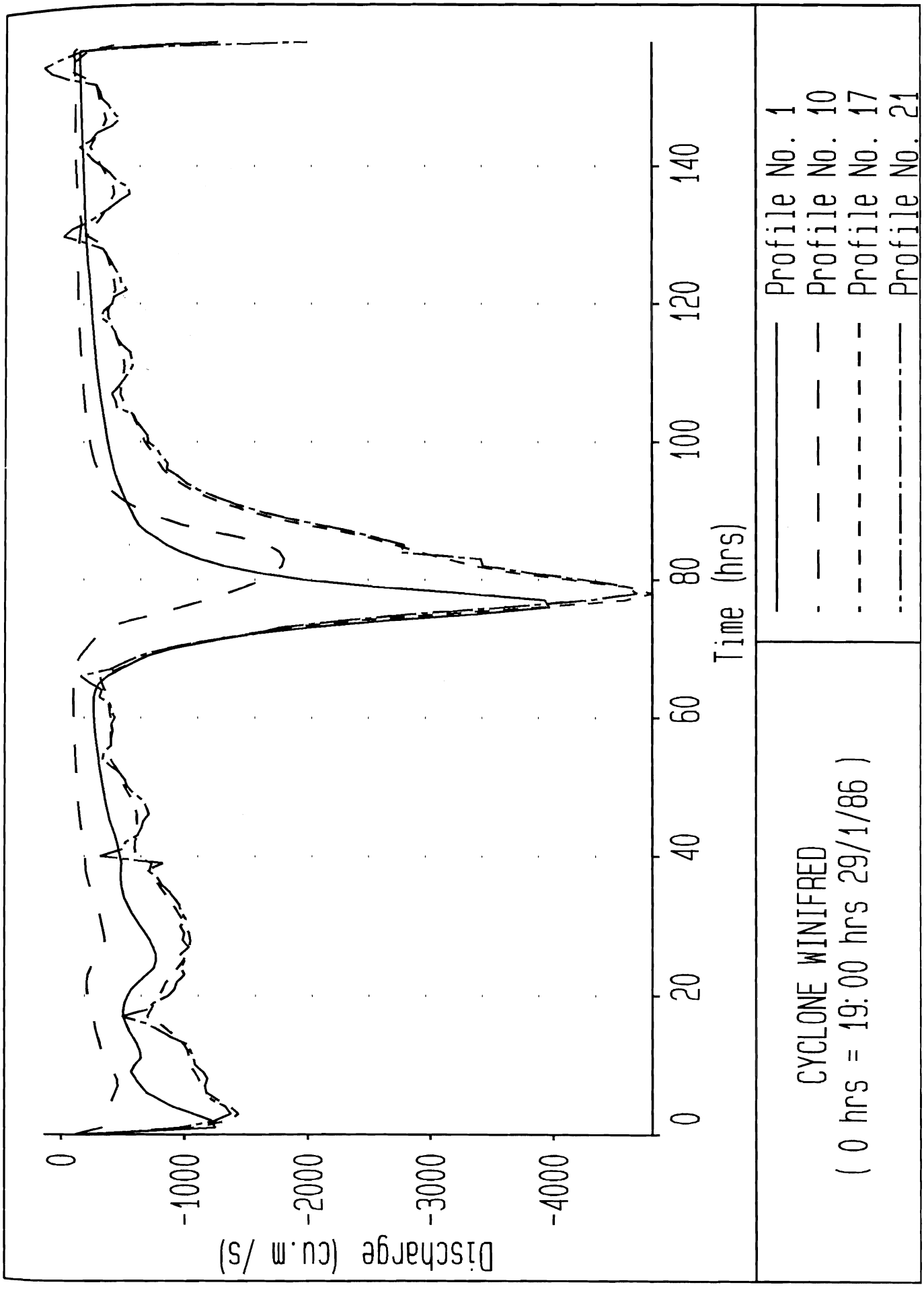


Figure 21: Cyclone Winifred – discharges in selected profiles (simulated).

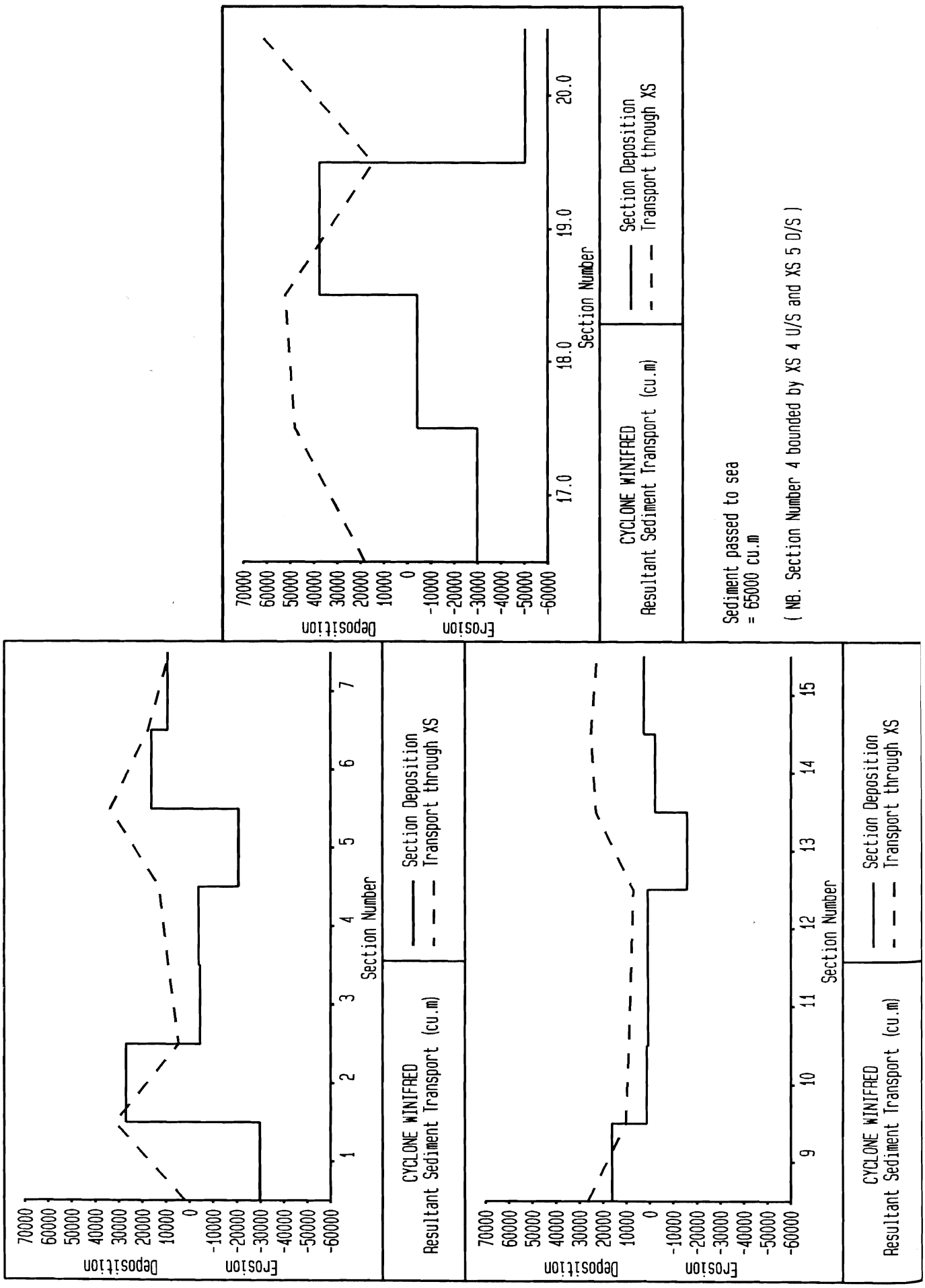


Figure 22: Cyclone Winifred – sediment transport in the Johnstone River estuary (simulated).

Figure 23: Nomogram for total sediment input into the Johnstone estuary as a function of water discharges in the North and South Johnstone River.

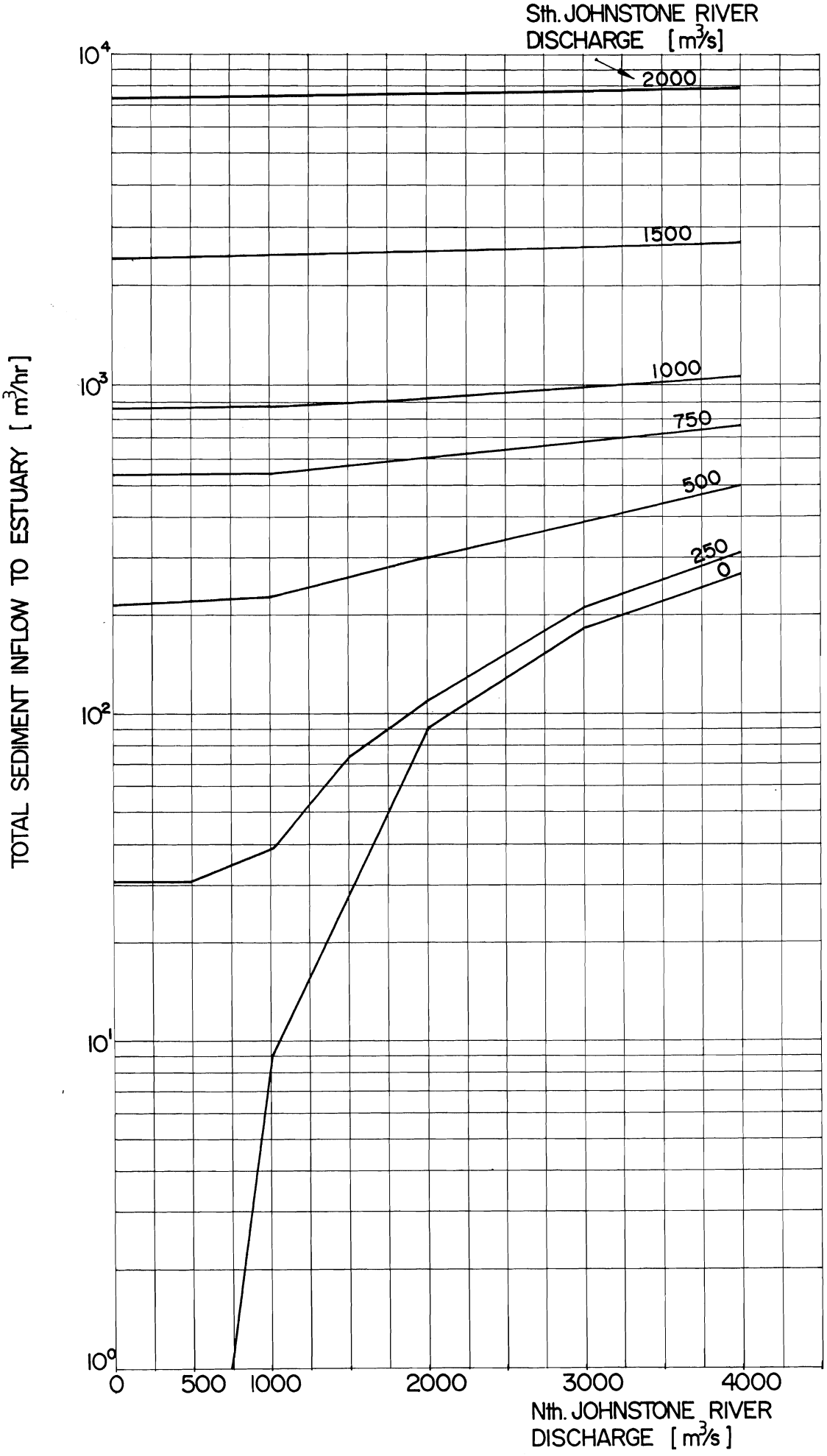
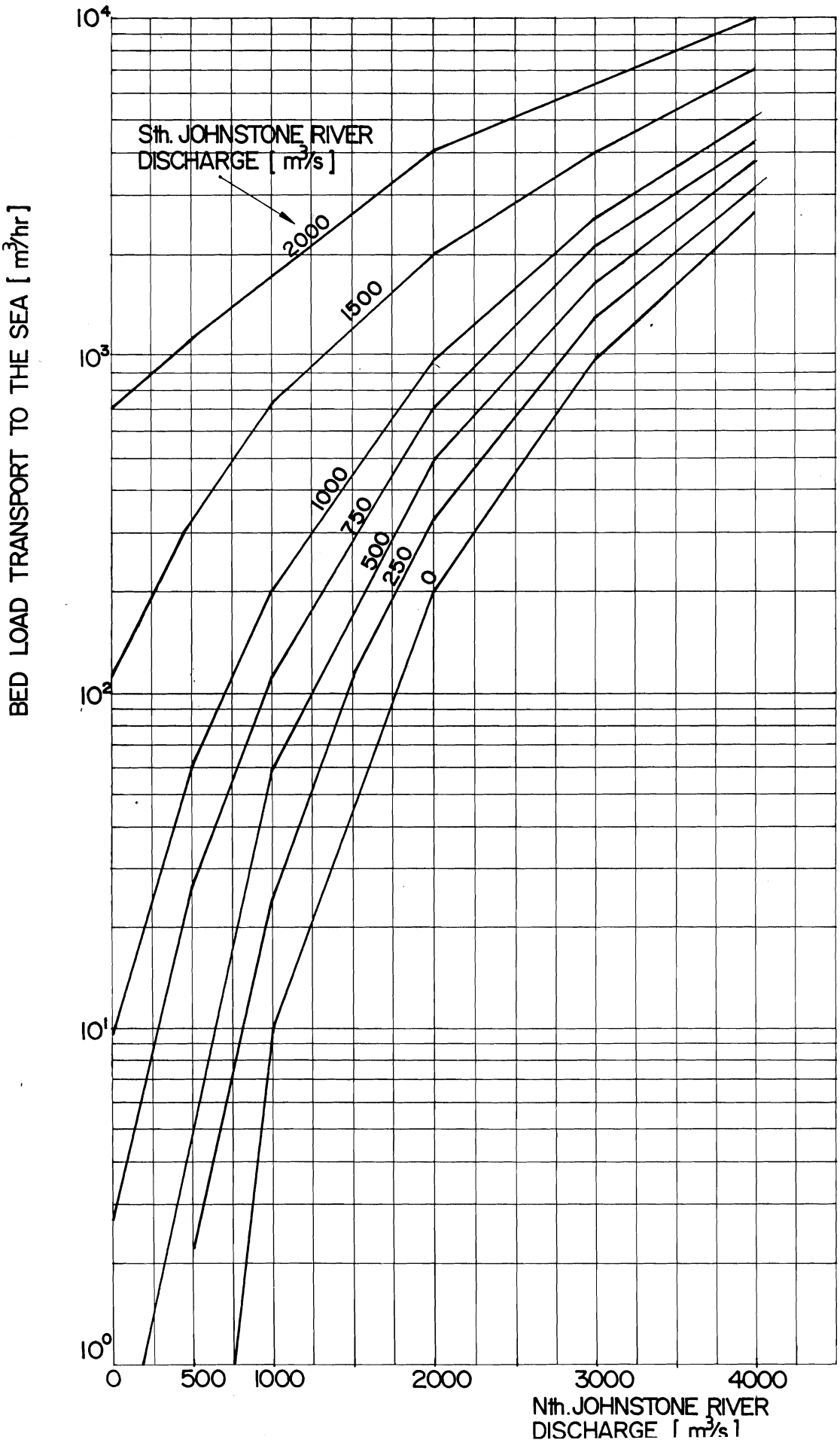


Figure 24: Nomogram for bed sediment transport discharged from the Johnstone estuary into the sea as a function of water discharges in the North and South Johnstone River.



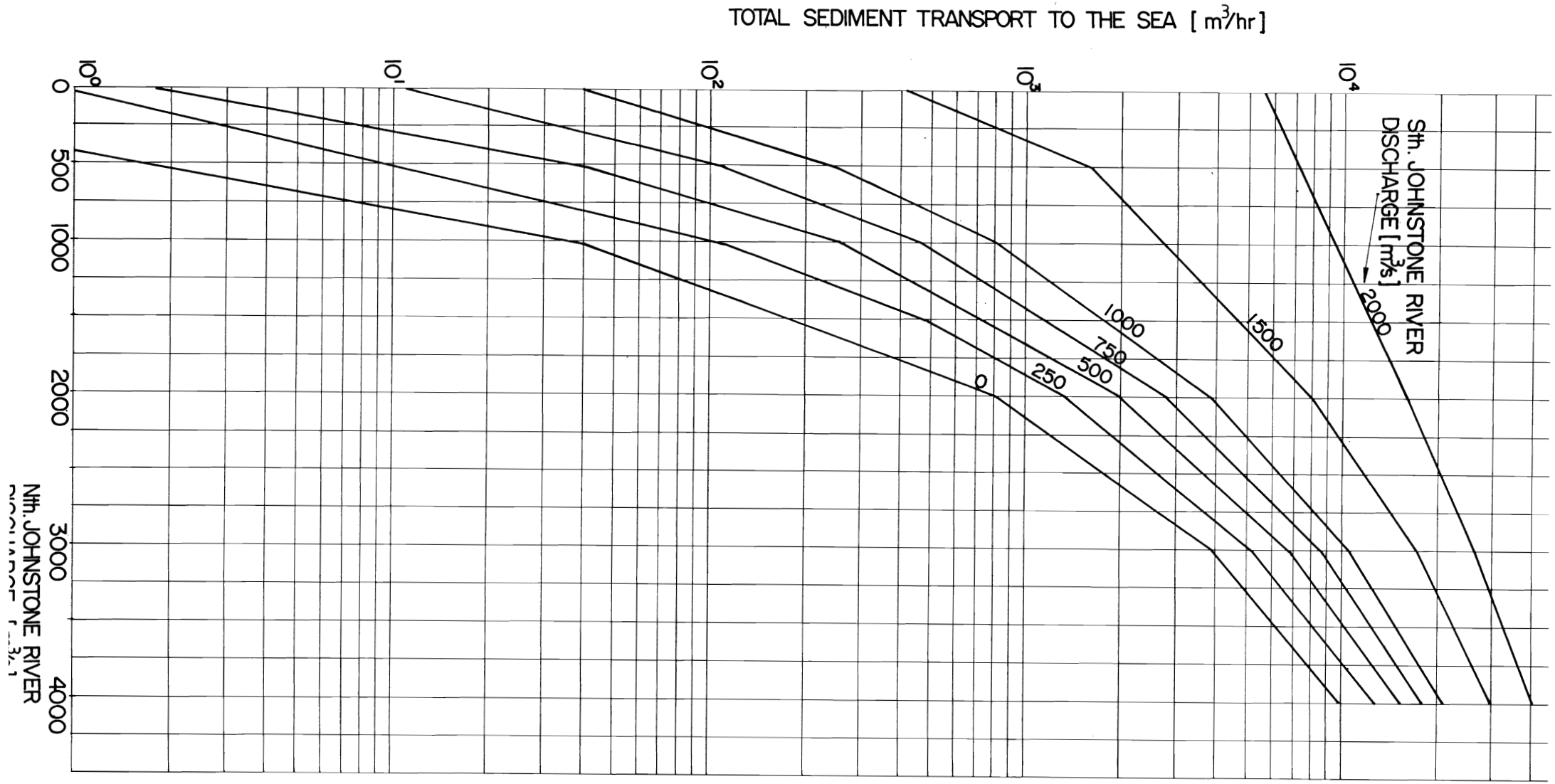


Figure 25: Nomogram for total sediment transport discharged from the Johnstone estuary into the sea as a function of water discharges in the North and South Johnstone River.

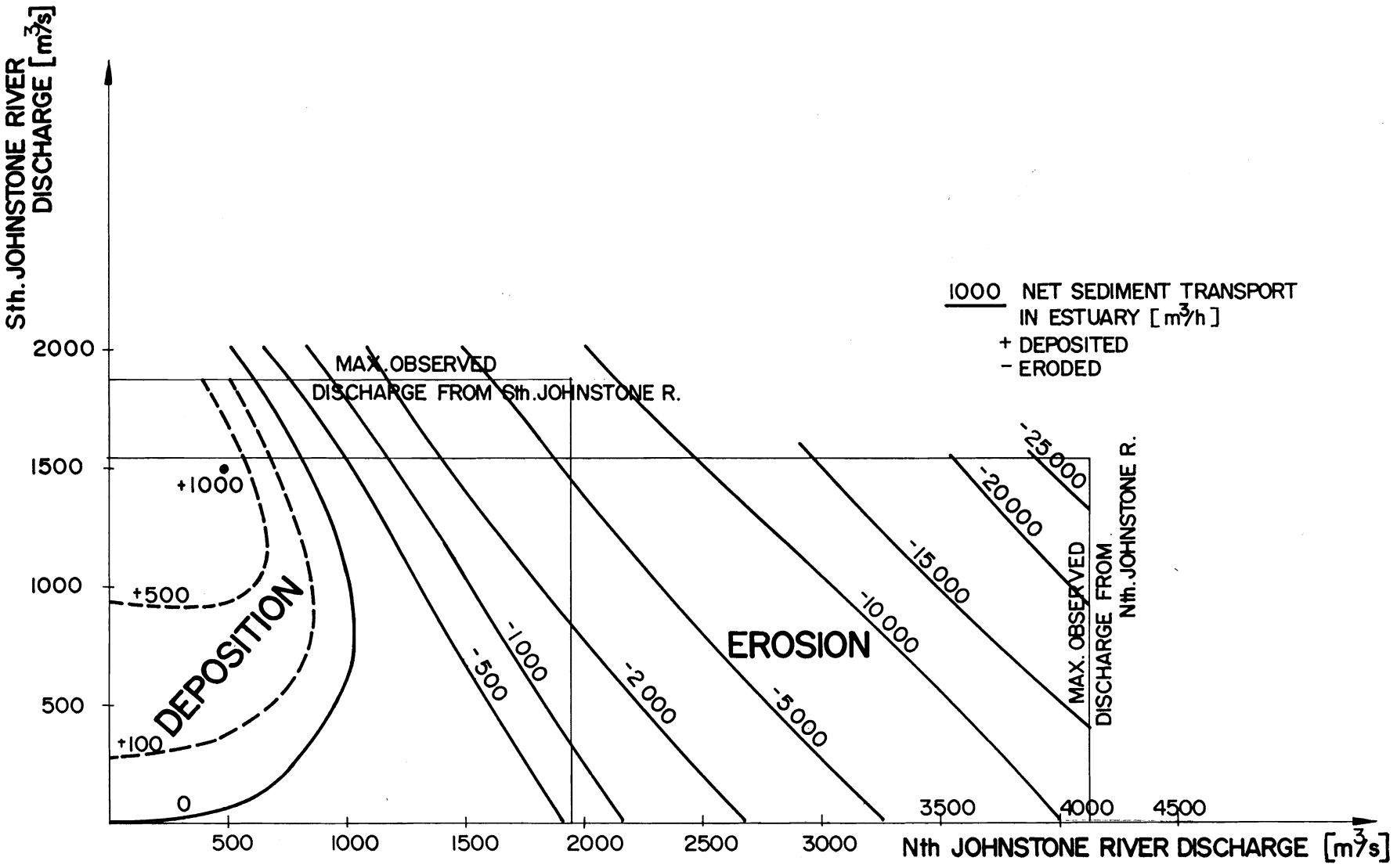


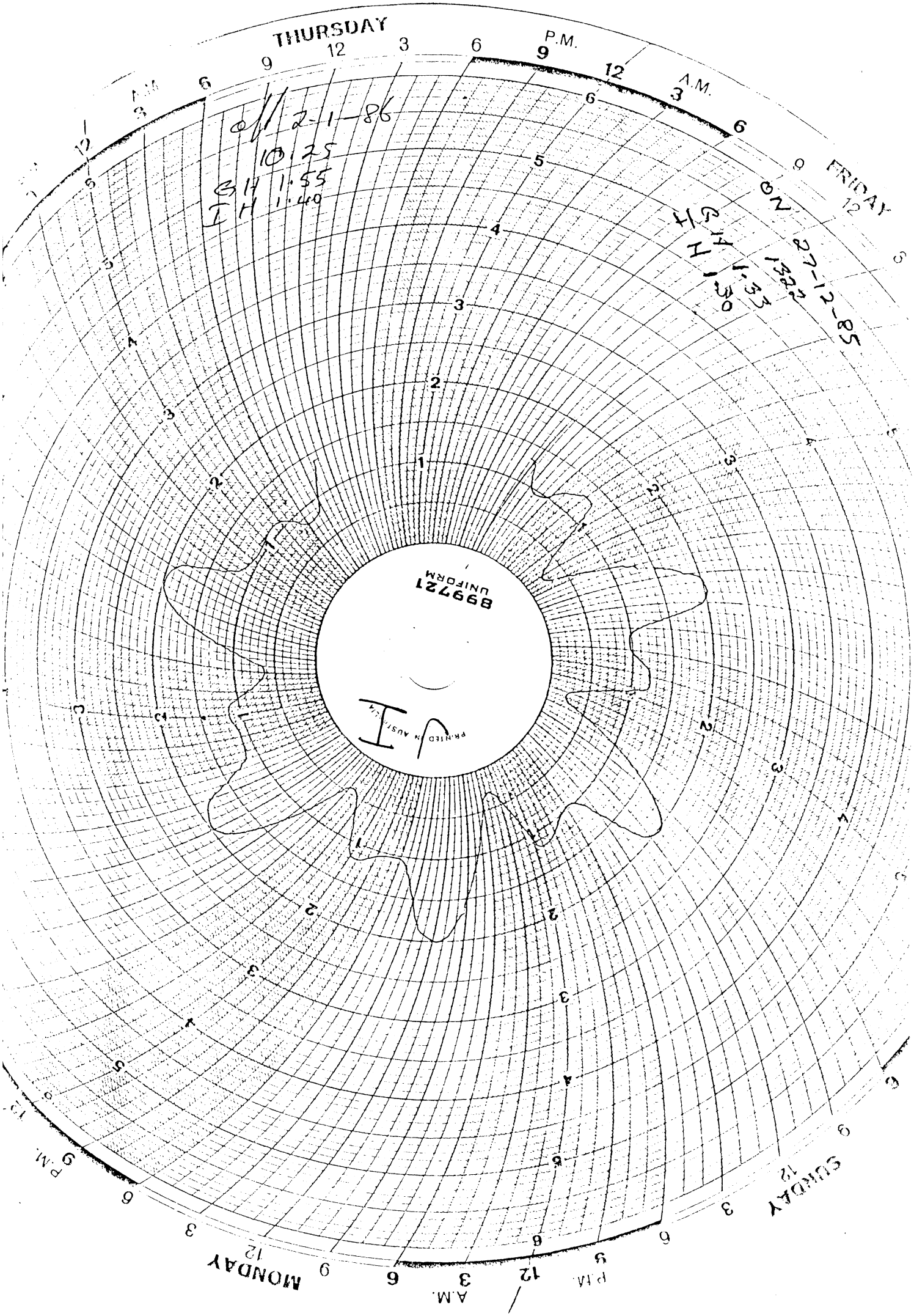
Figure 26: Net sediment transport in the Johnstone River estuary.

APPENDIX A

WATER LEVELS IN THE JOHNSTONE RIVER ESTUARY RECORDED FOR THE PERIOD DECEMBER 27 1985 TO FEBRUARY 26 1986.

This appendix contains water levels as recorded by temporary installed water gauges in the locations shown in Figure 2. Symbols and datum used for the gauges are as follows:

Gauge symbol	Distance from River mouth	Gauge Zero (AHD Datum)	Page
J1	0.0	–1.362	A.2 – A.10
J4	4.6	–2.119	A.11 – A.16
NJ5	15.0	–1.565	A.17 – A.25
SJ5	15.0	–0.151	A.26 – A.34
BC1	7.3	–0.937	A.35 – A.43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FRIDAY
SATURDAY
SUNDAY
MONDAY
A.M.
P.M.
12
3
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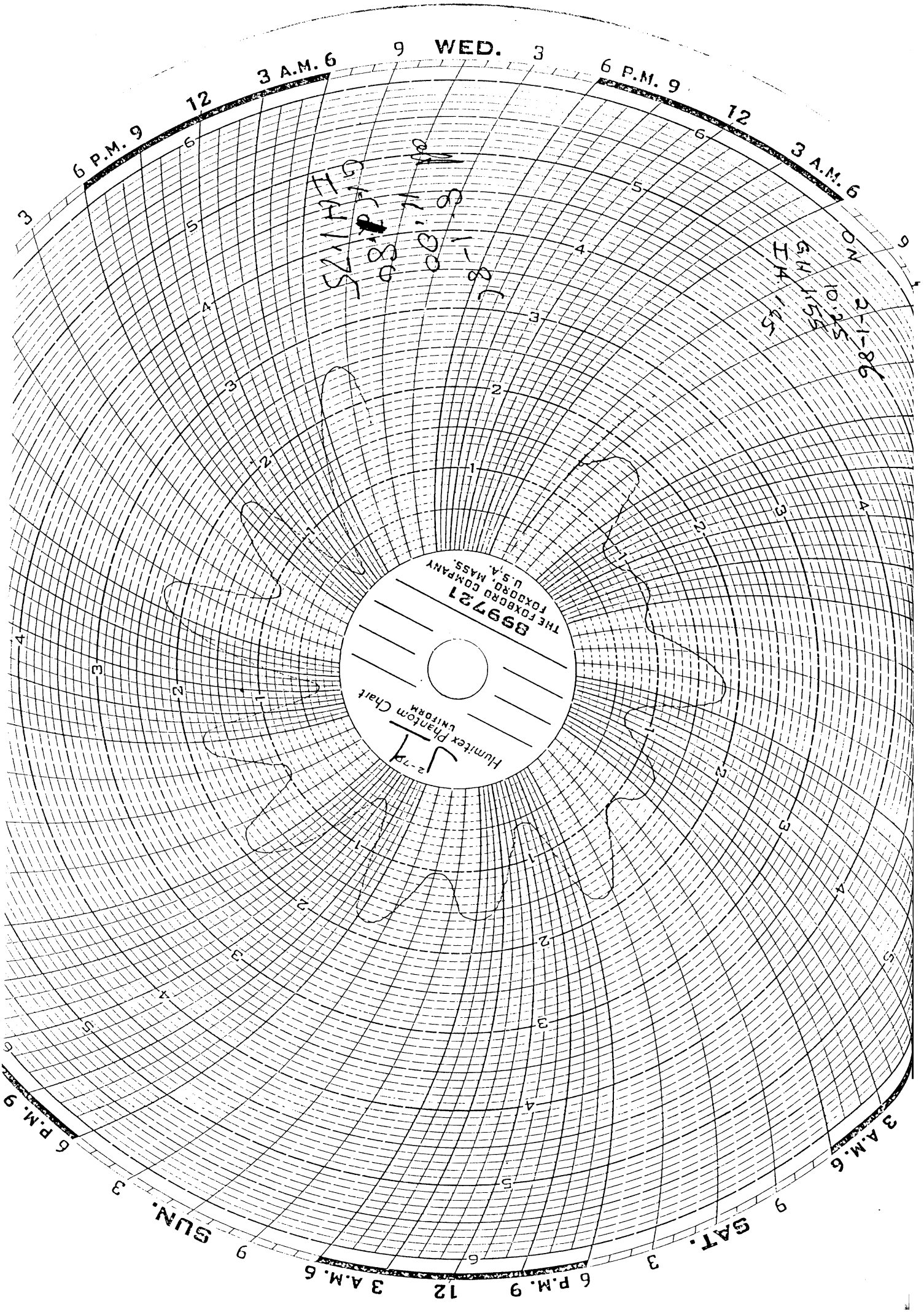
B99721
UNIFORM
PRINTED IN AUSTRALIA
off 2-1-86
10:25
SH 1:55
IH 1:40
ON 27-12-85
1322
SH 1:33
IH 1:30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3 A.M. 6
6 P.M. 9
SAT.
3 A.M. 6
6 P.M. 9
12
3 A.M. 6
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THE FOXBORO COMPANY
FOXBORO, MASS.
U.S.A.
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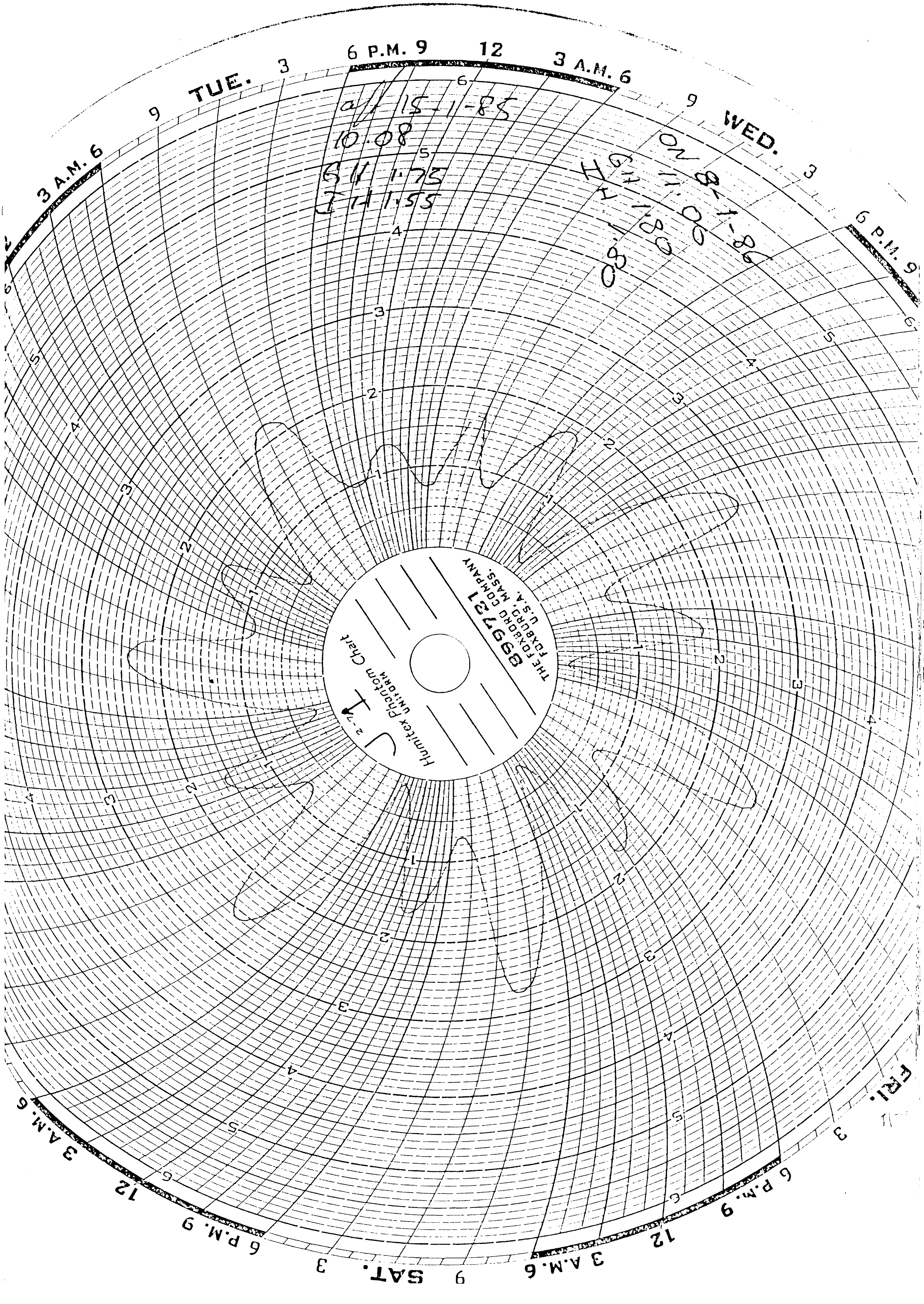
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FOXBORO, MASS. U.S.A.
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FOXBORO, MASS.
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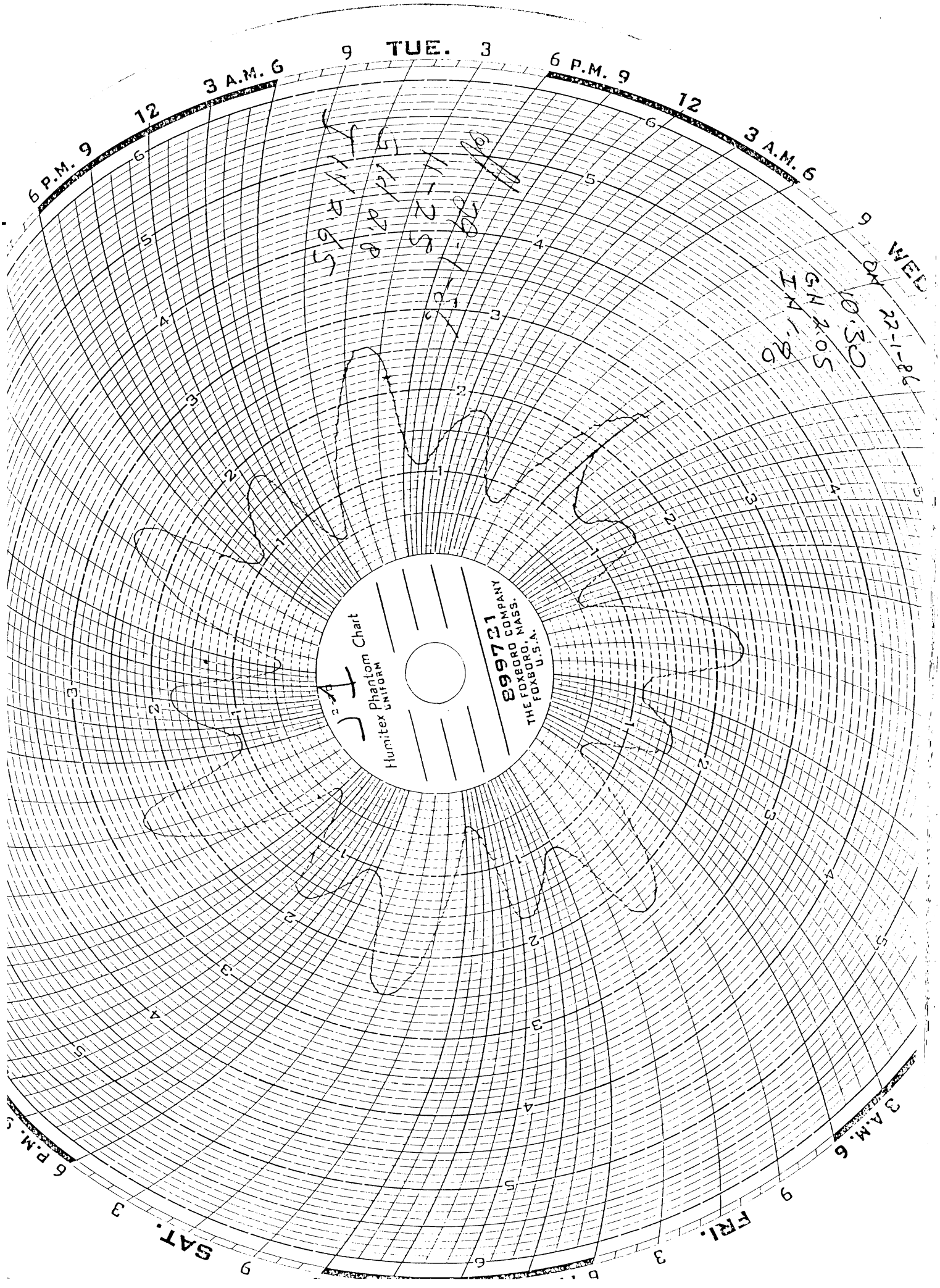
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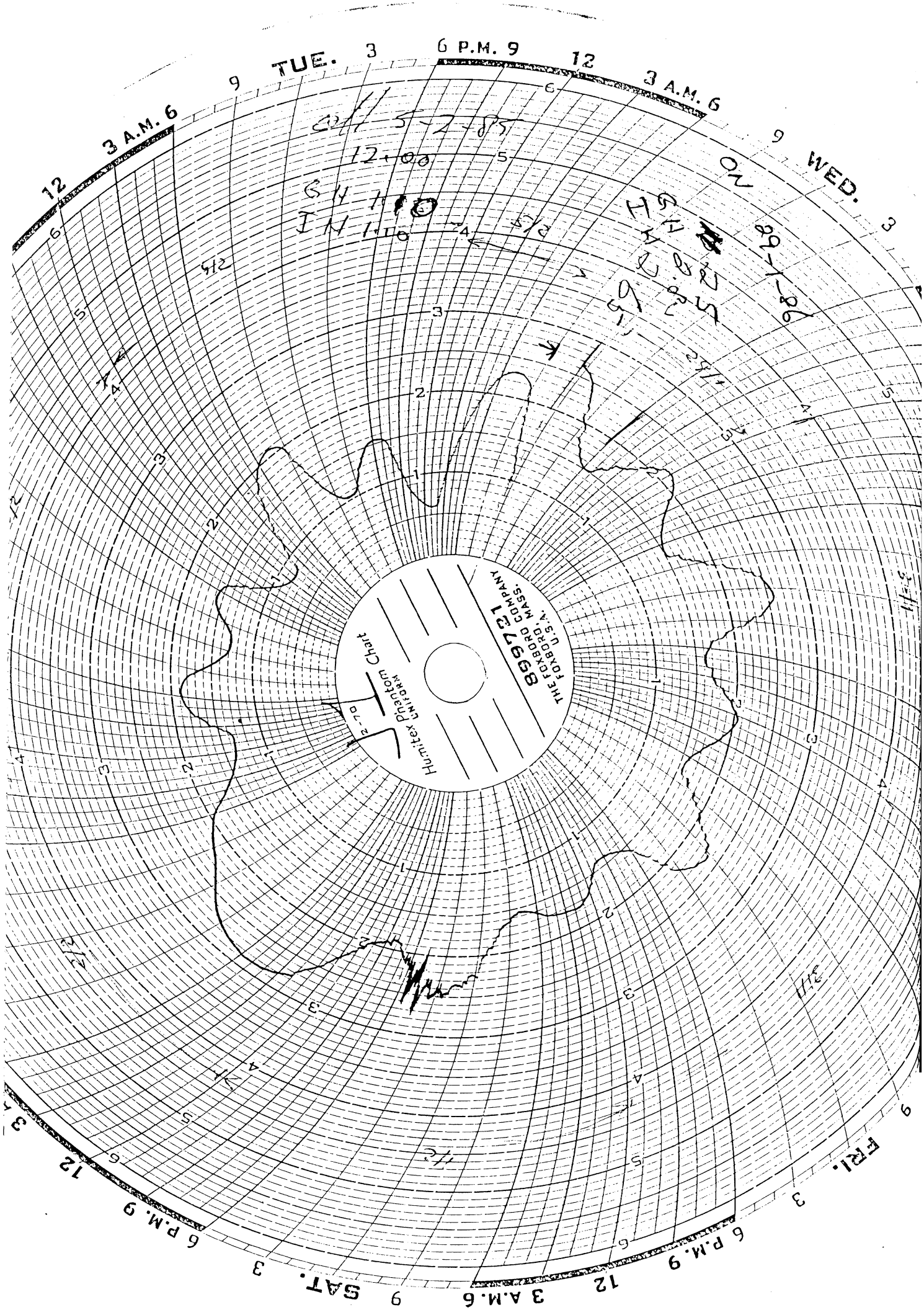
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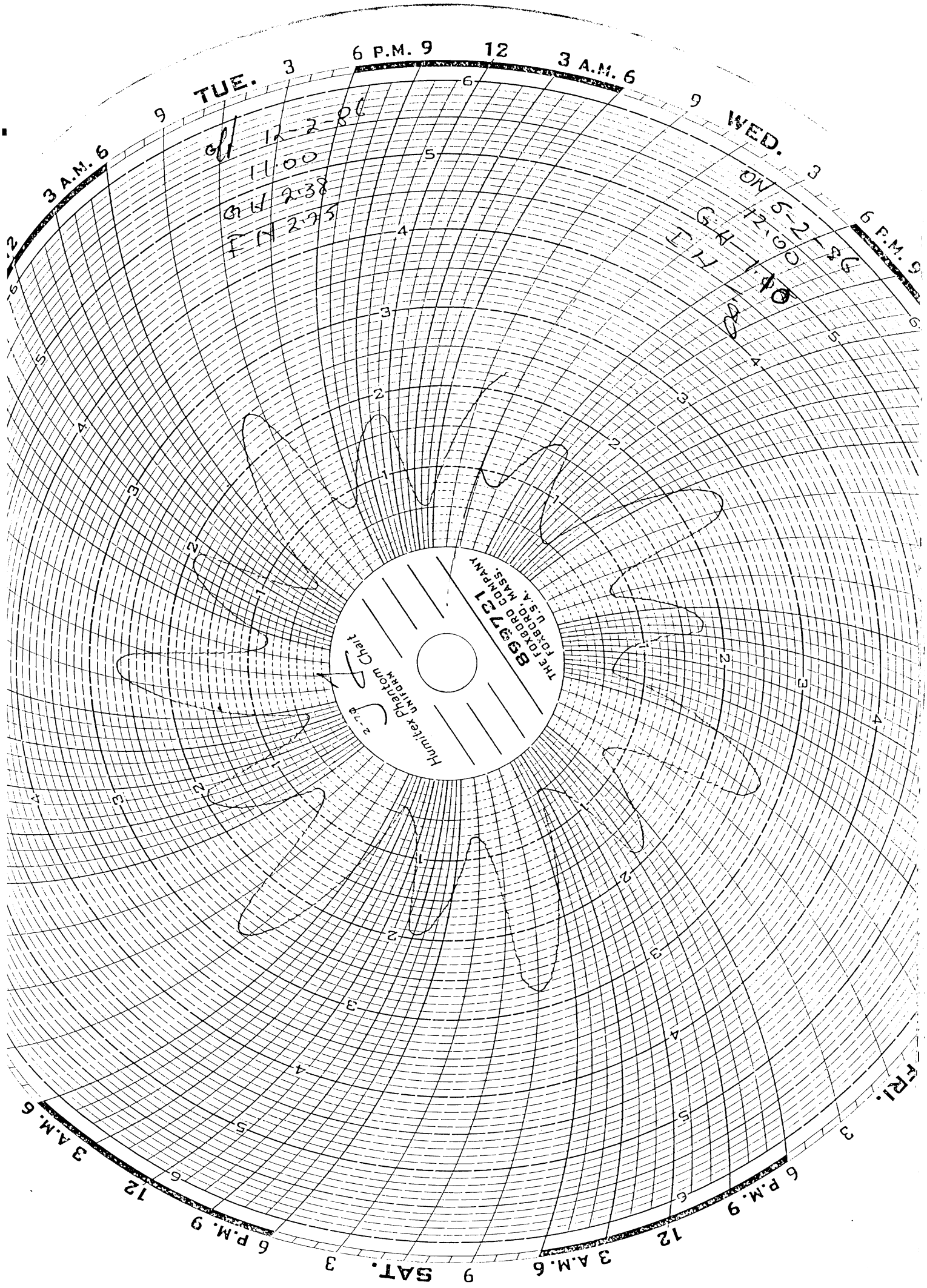
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off 12-2-80
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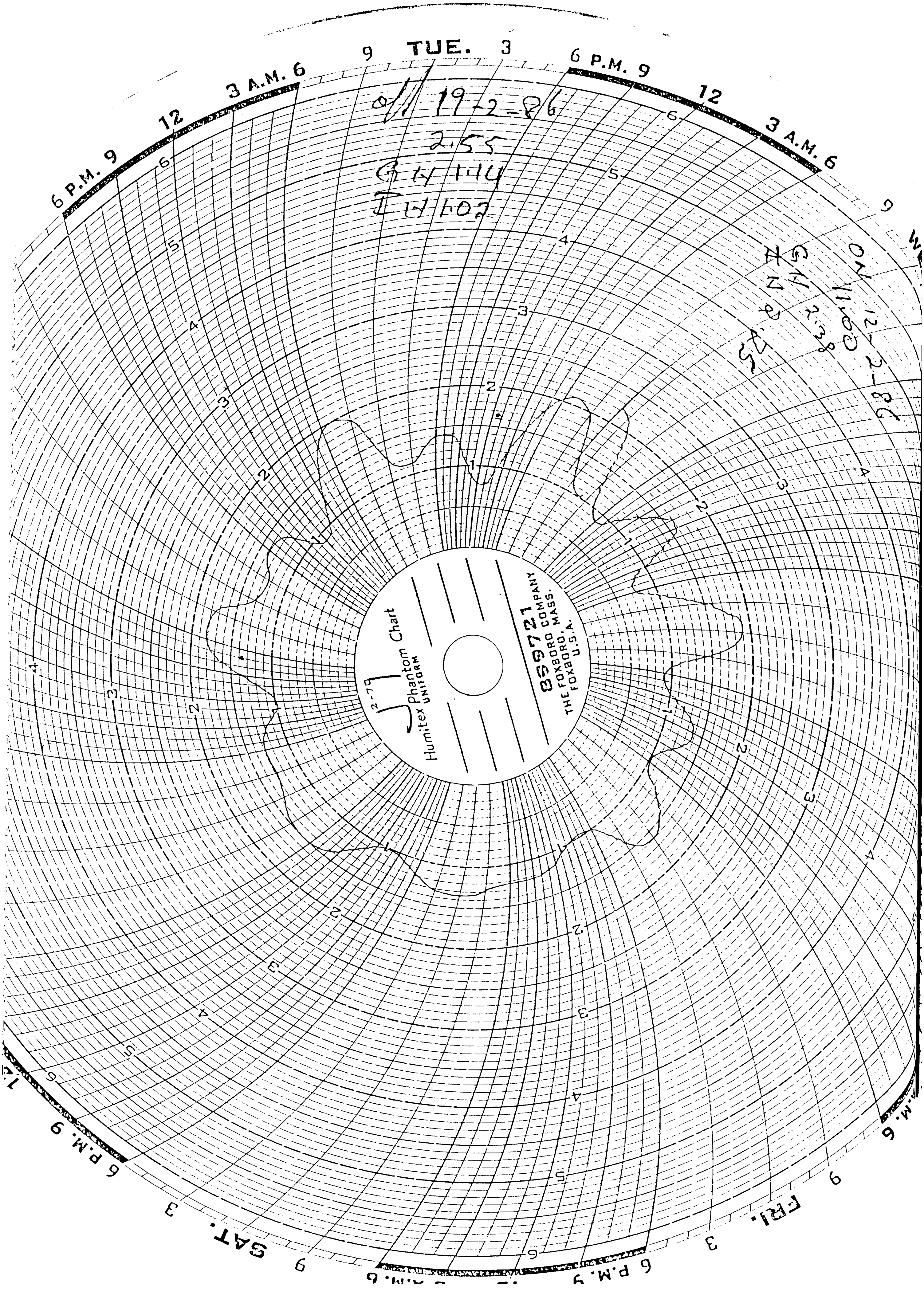
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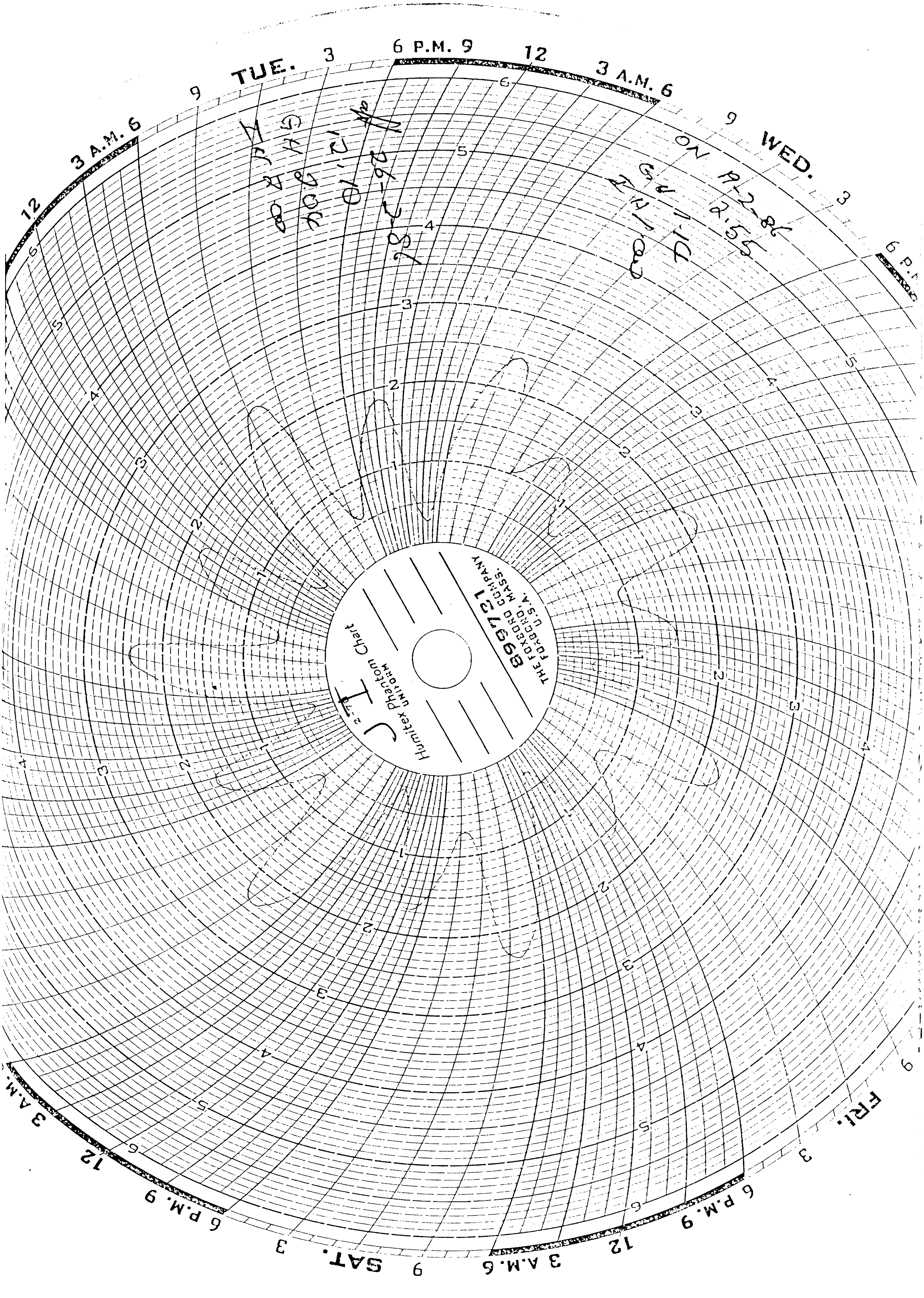
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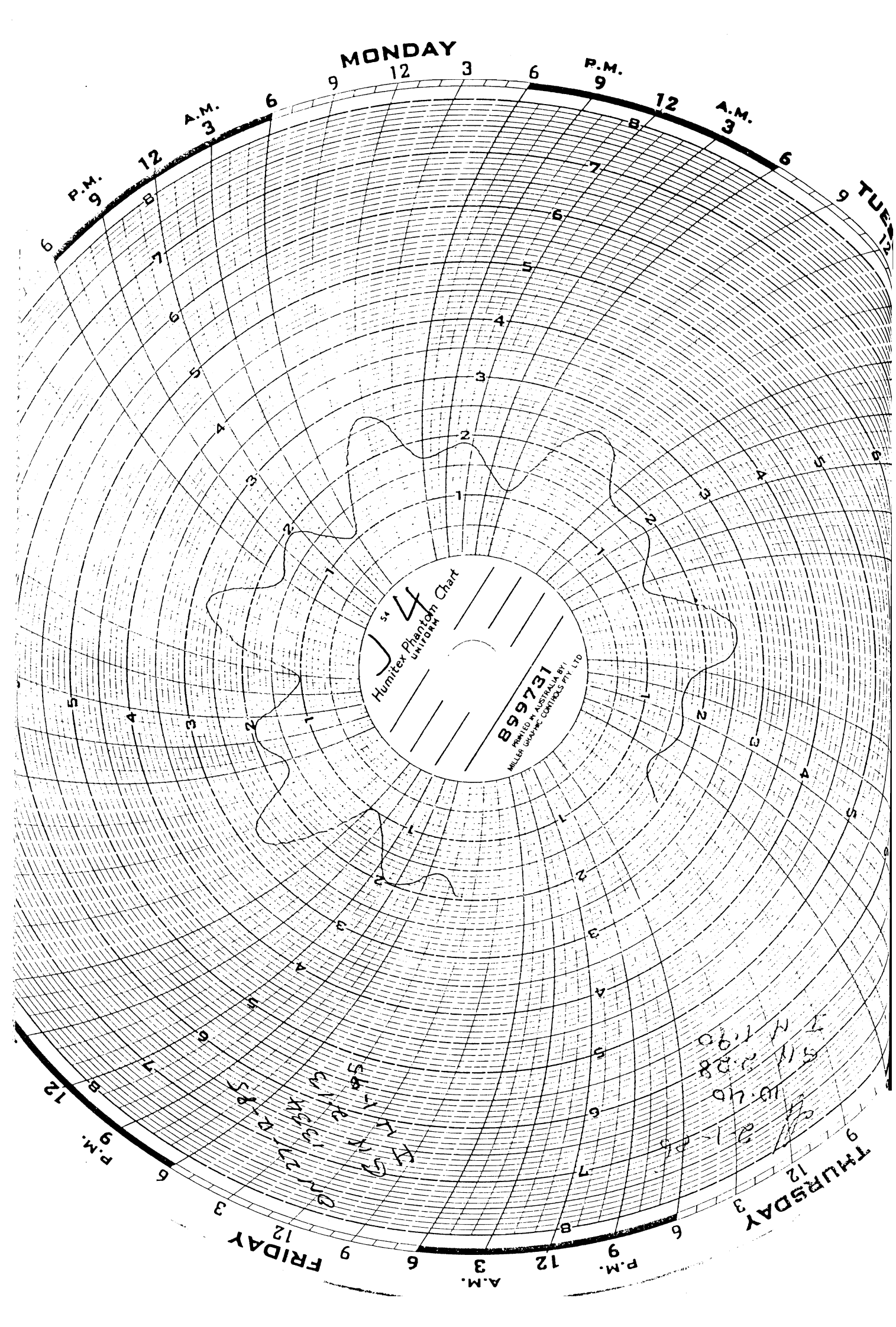
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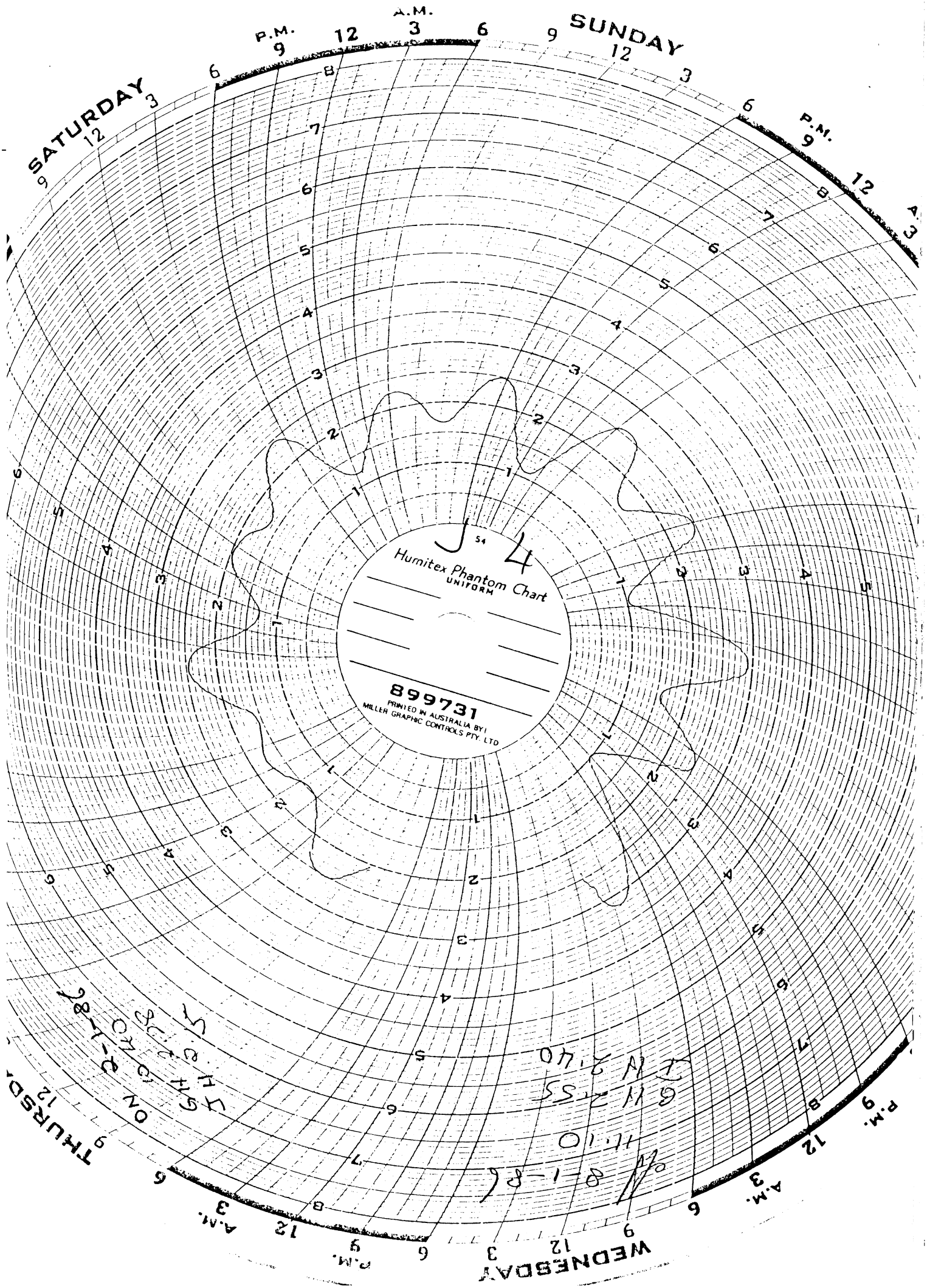
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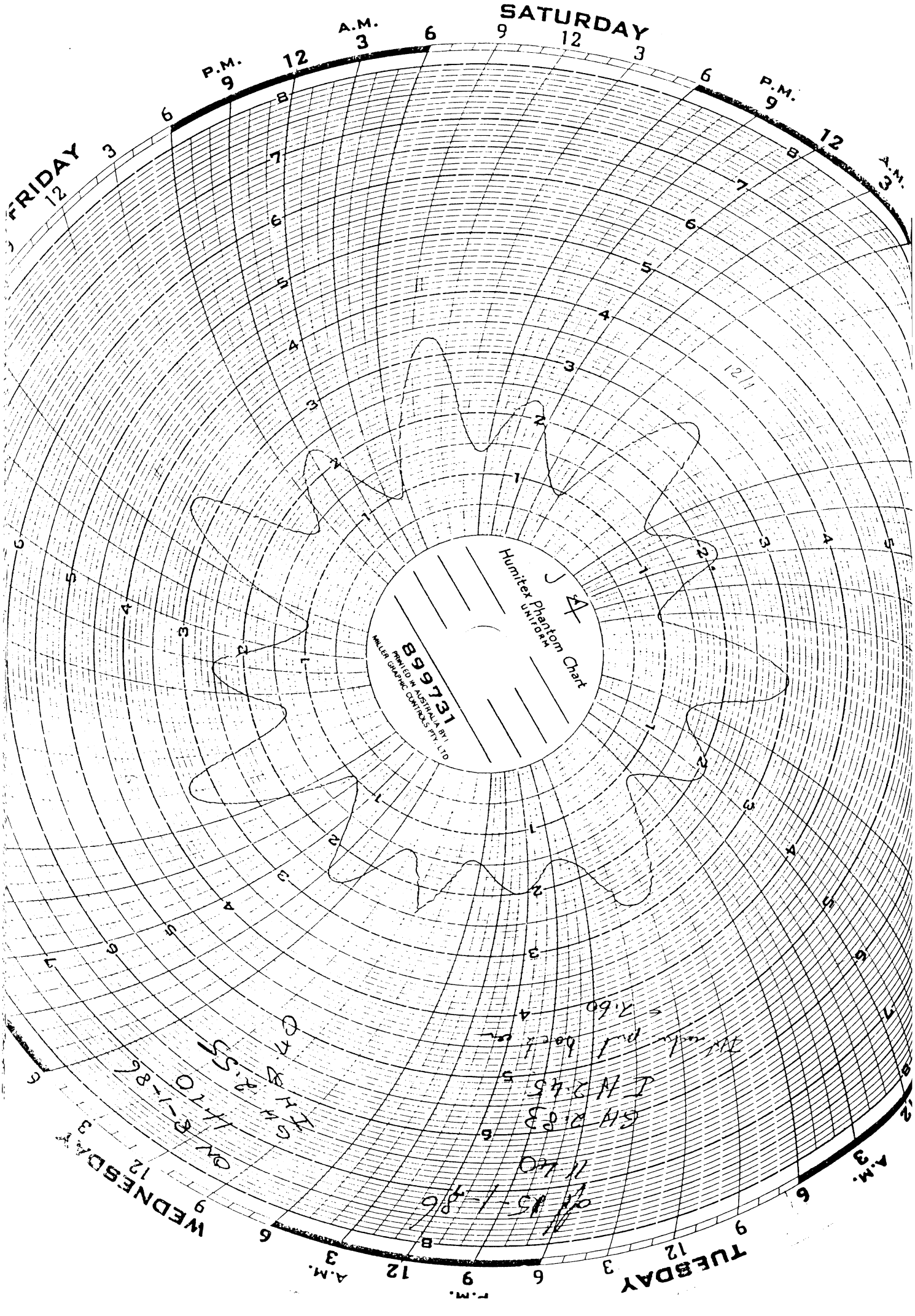
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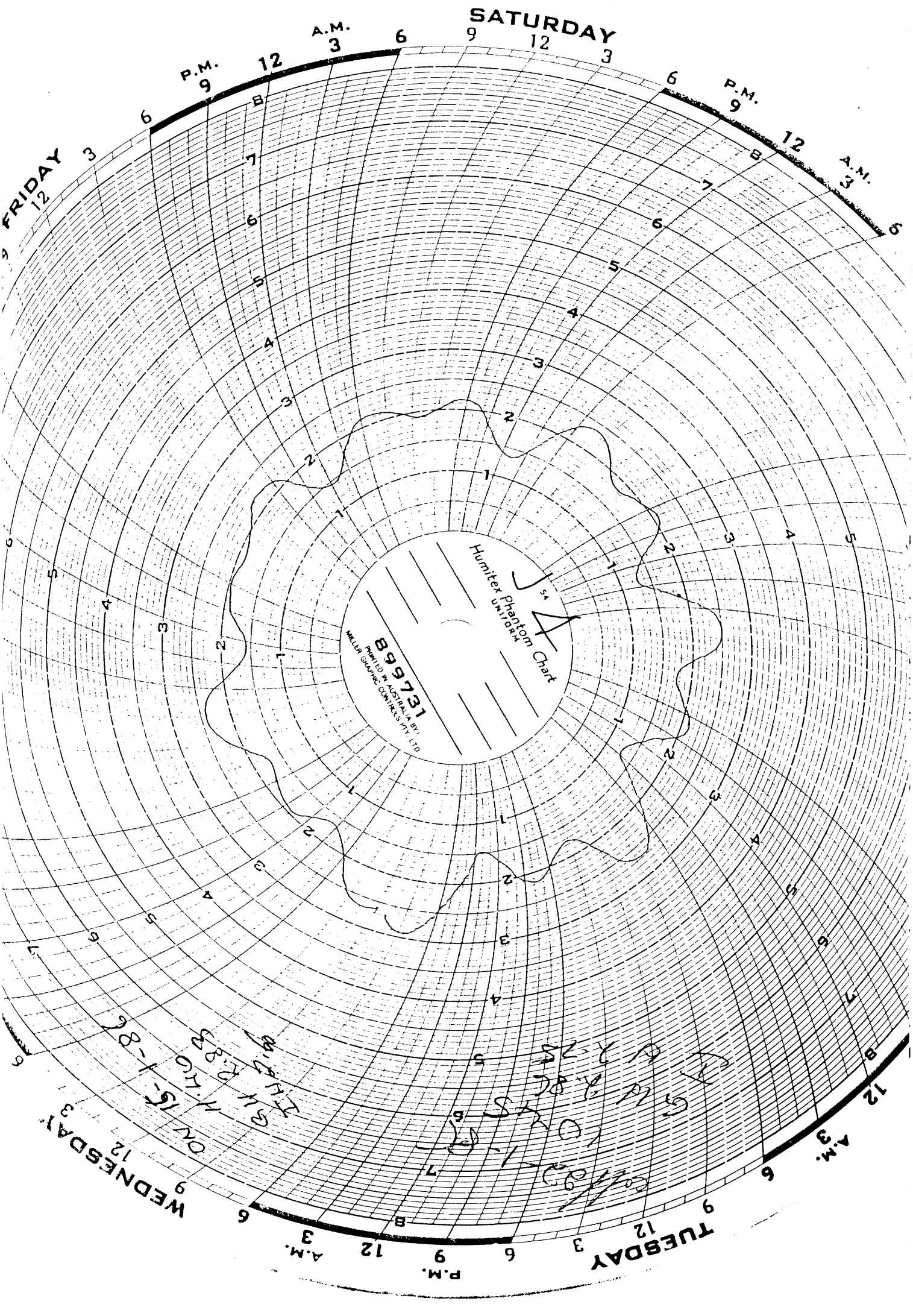
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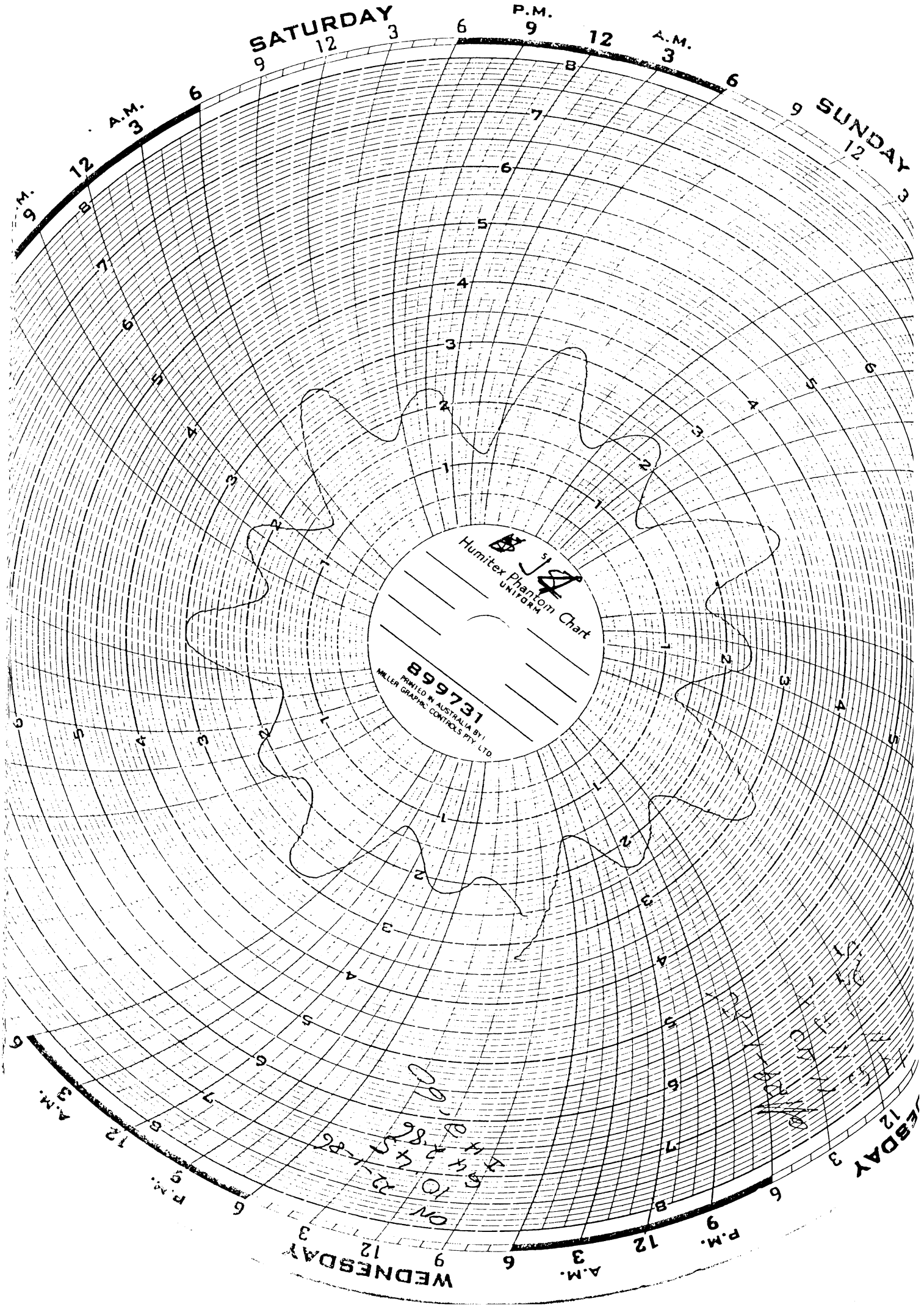
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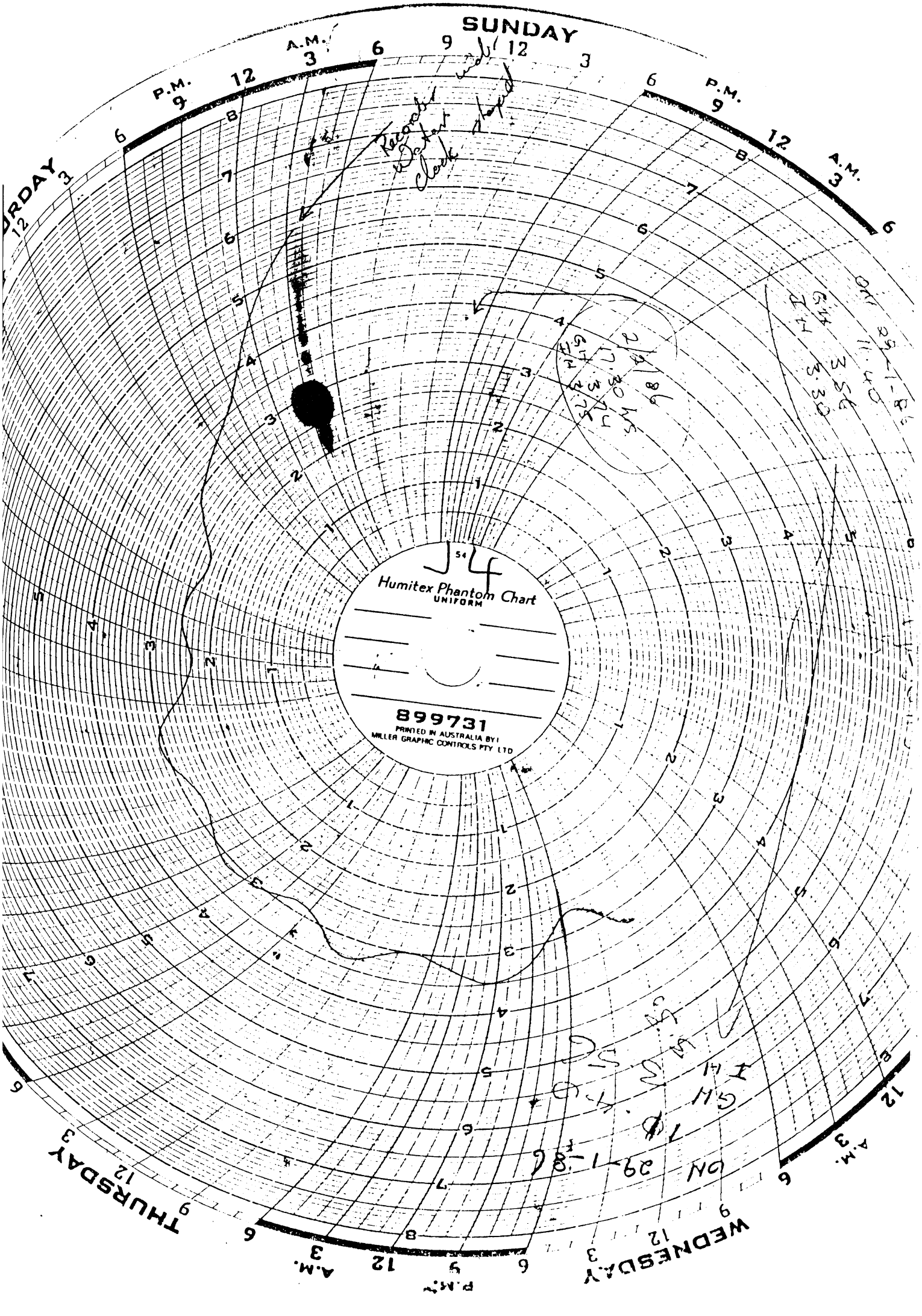
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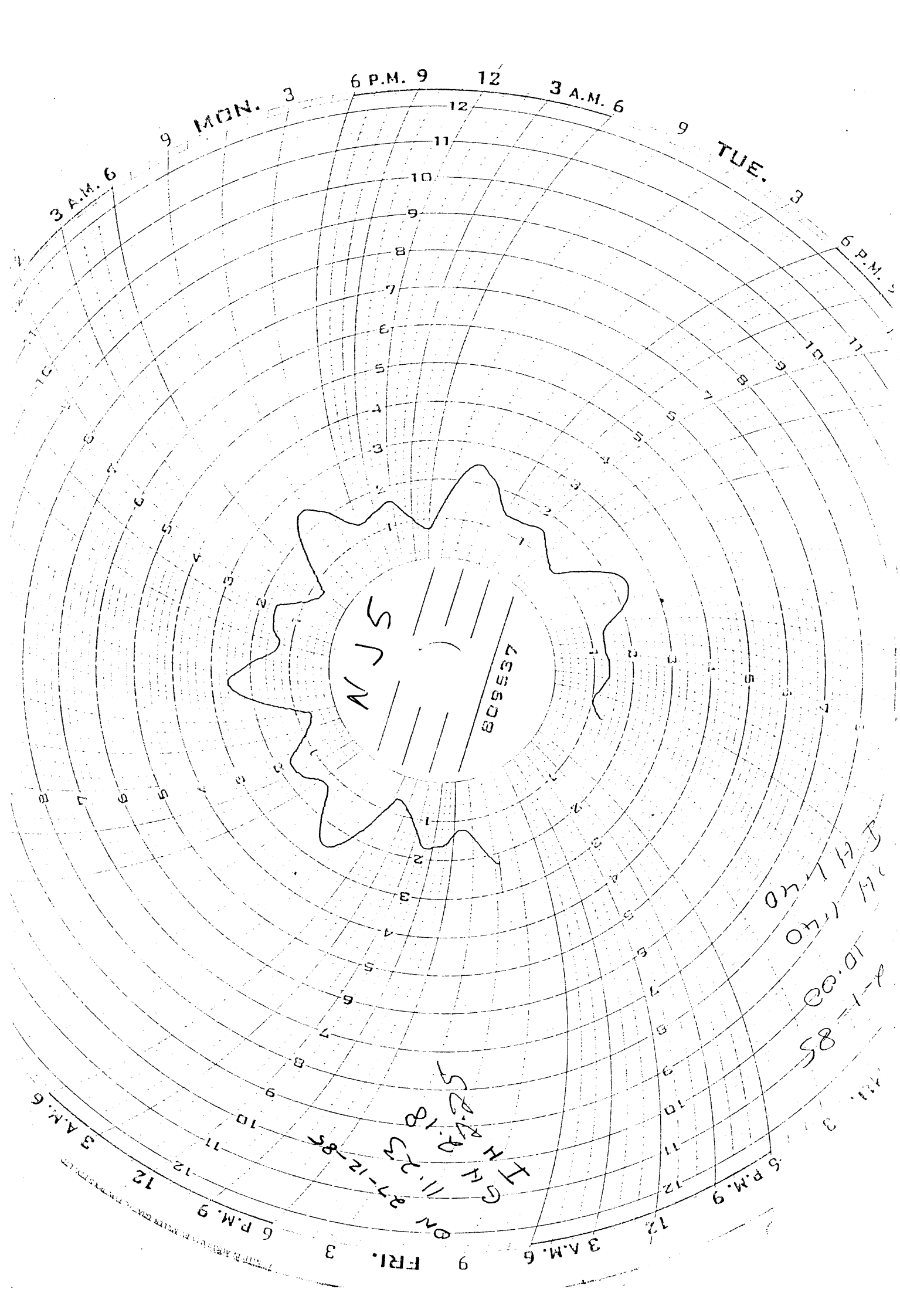
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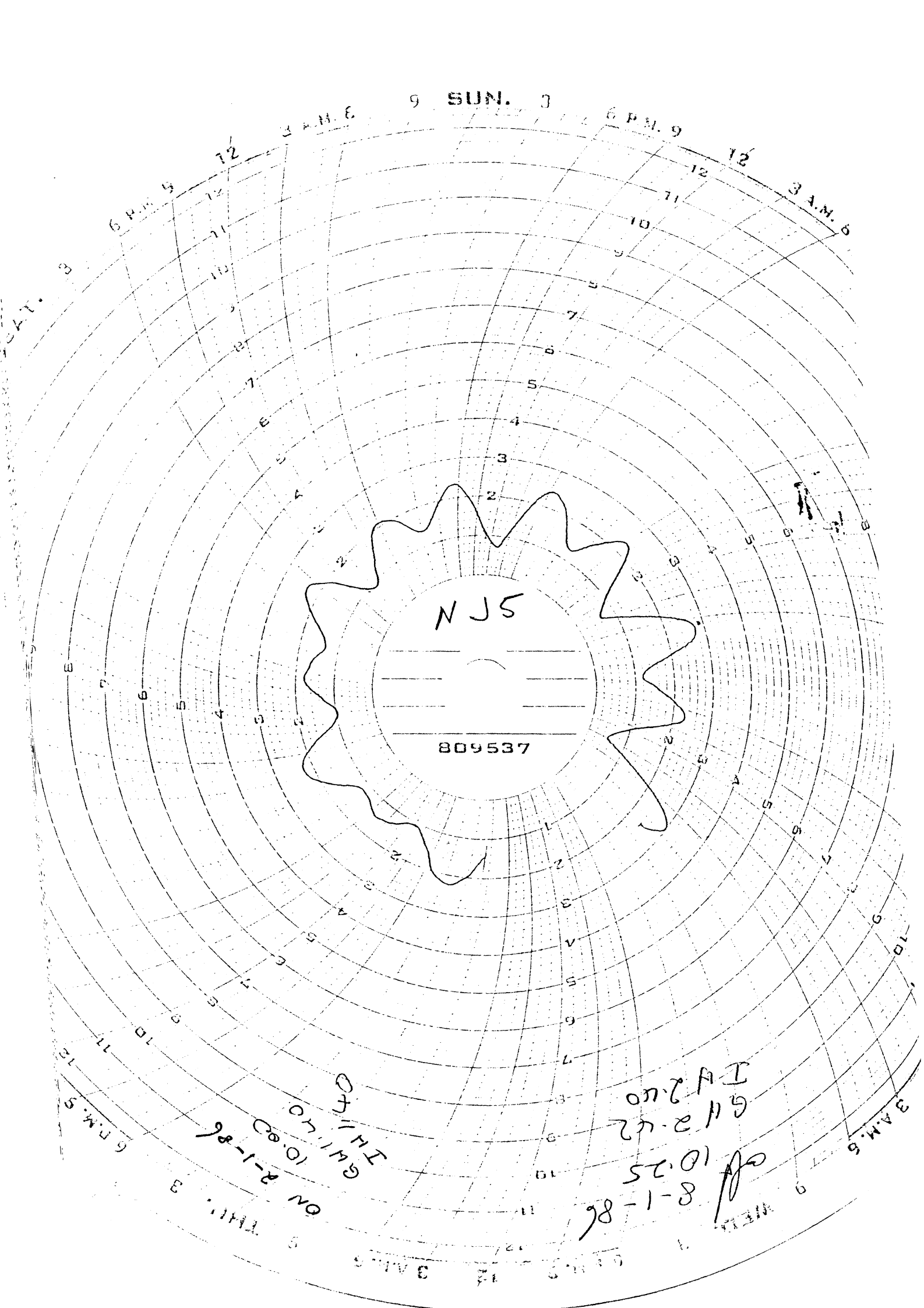
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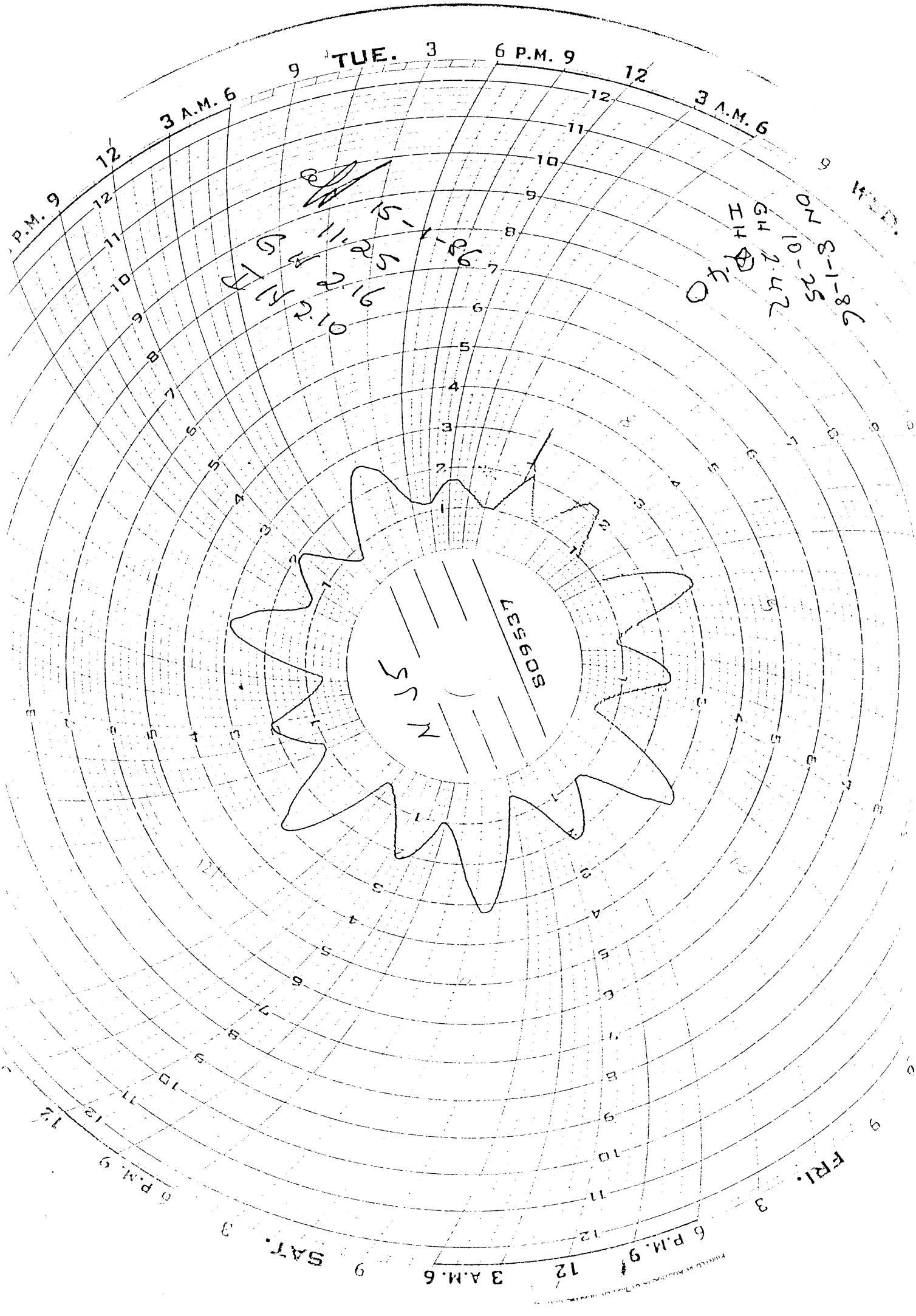
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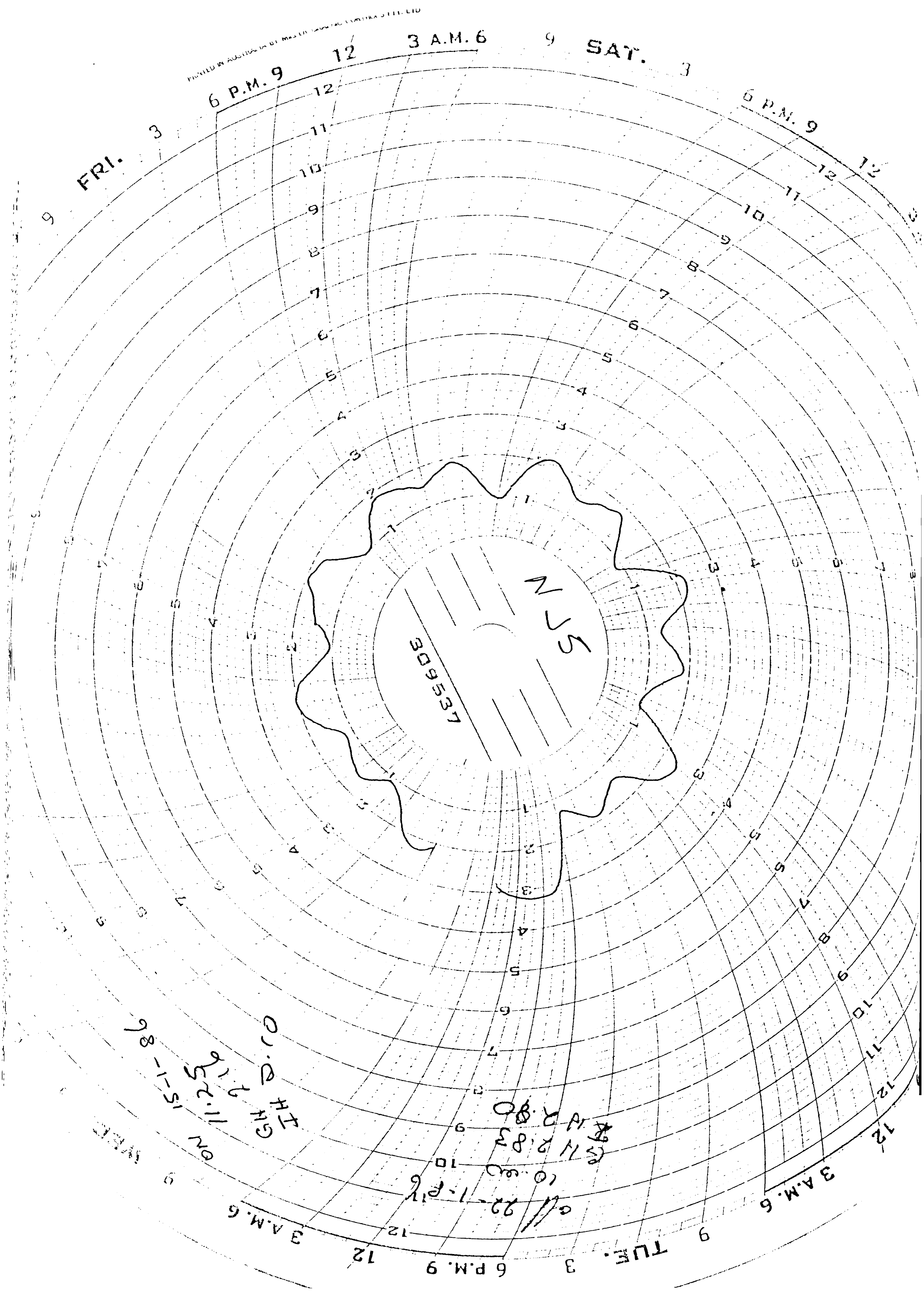

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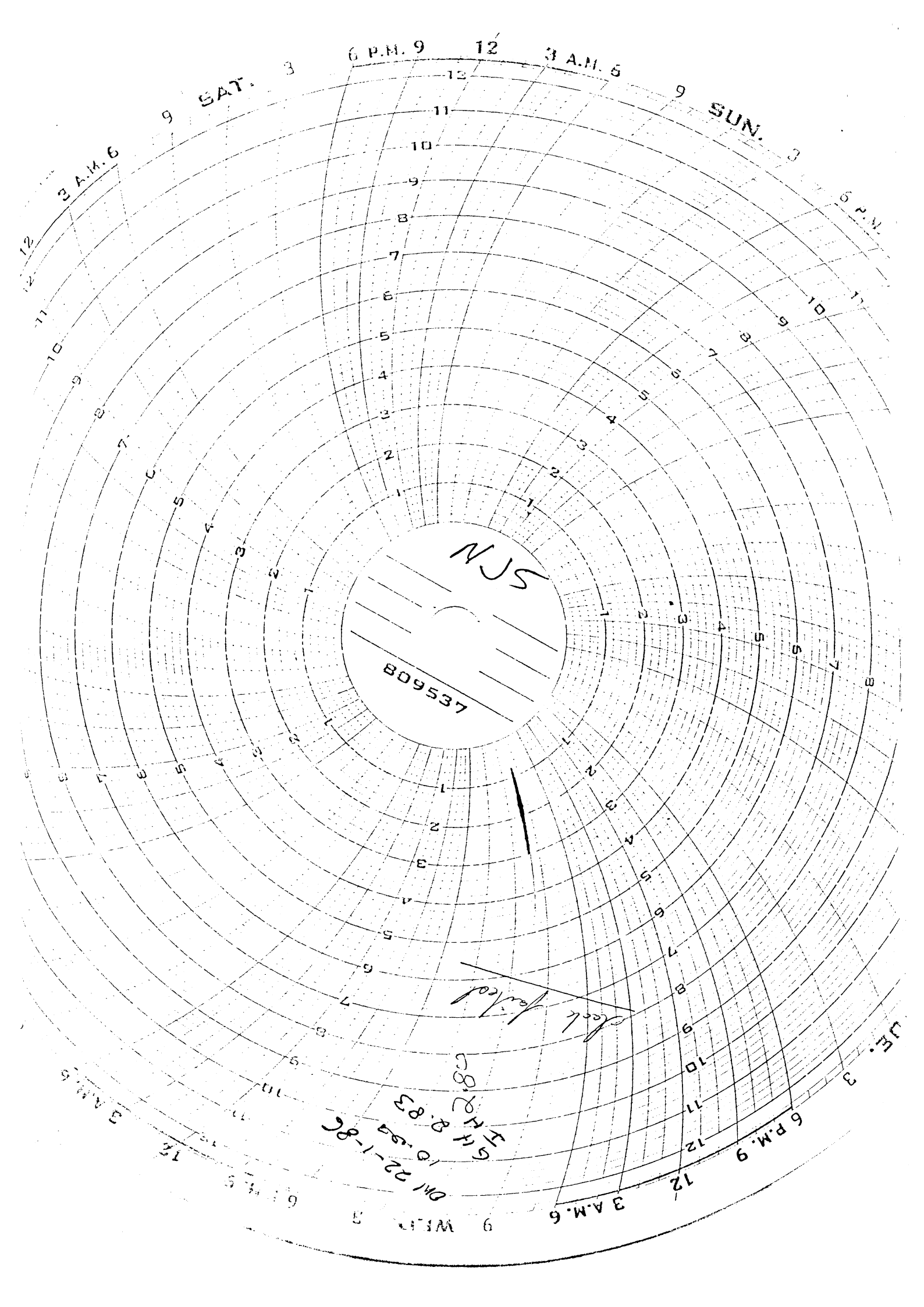
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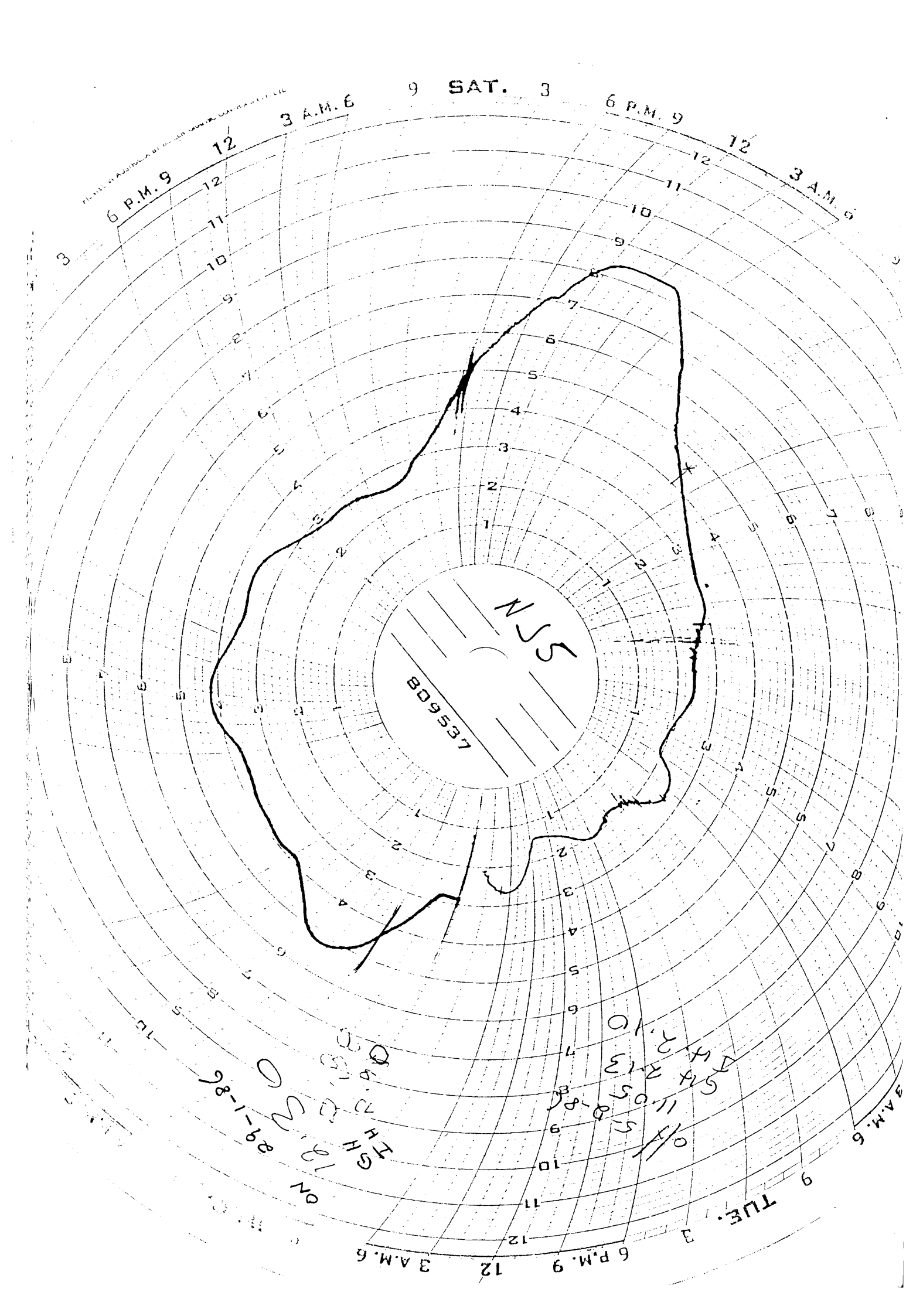
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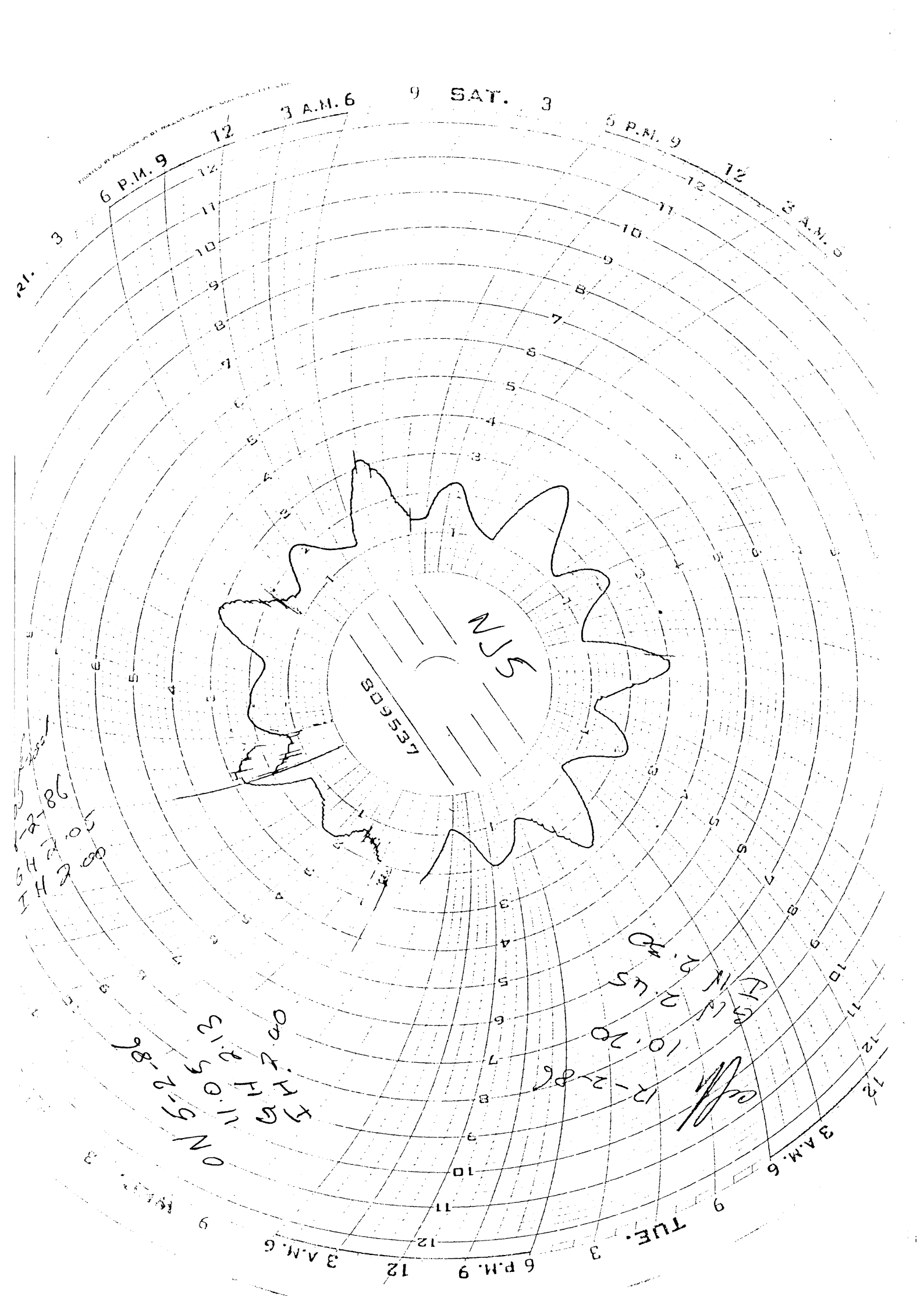
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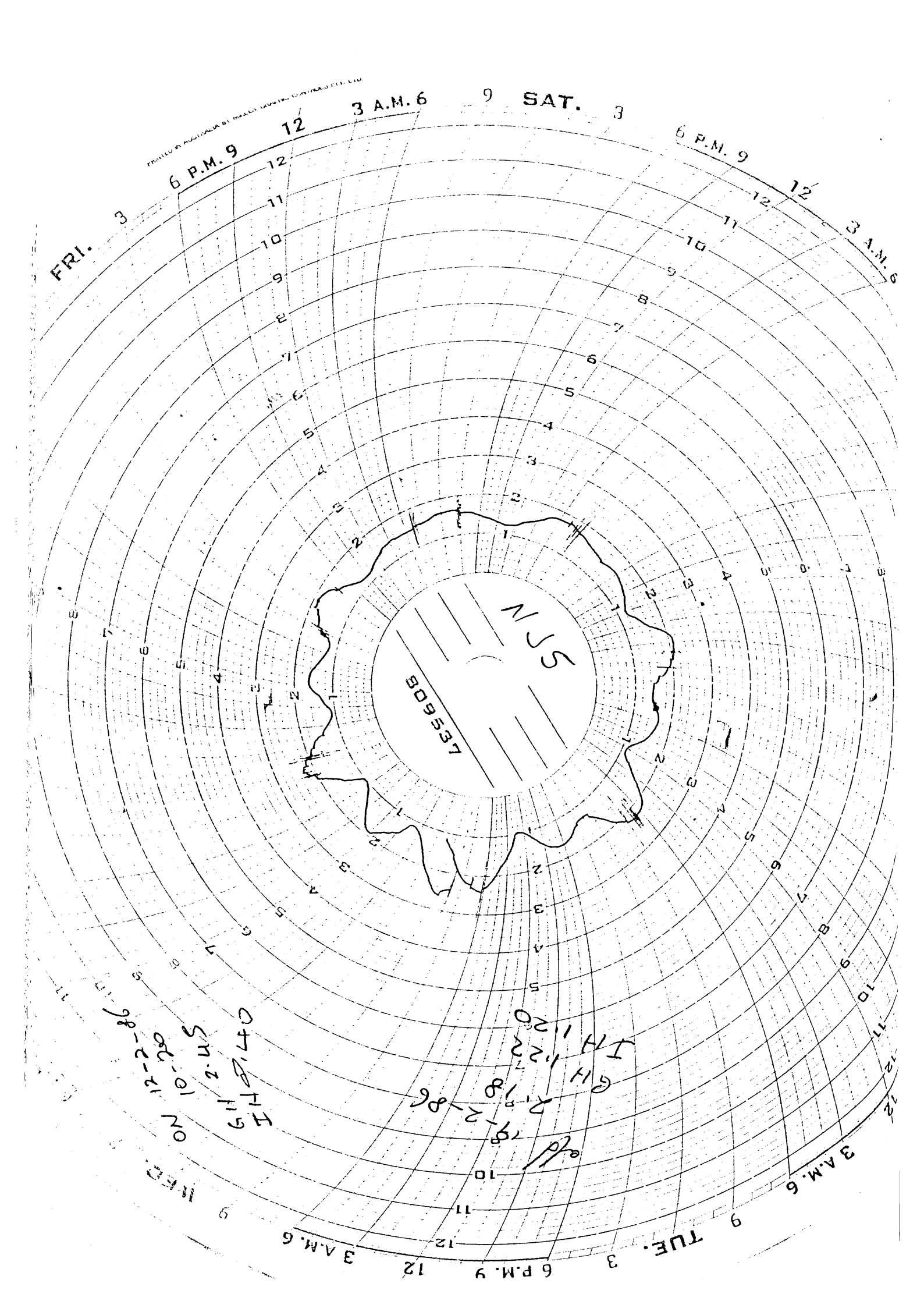
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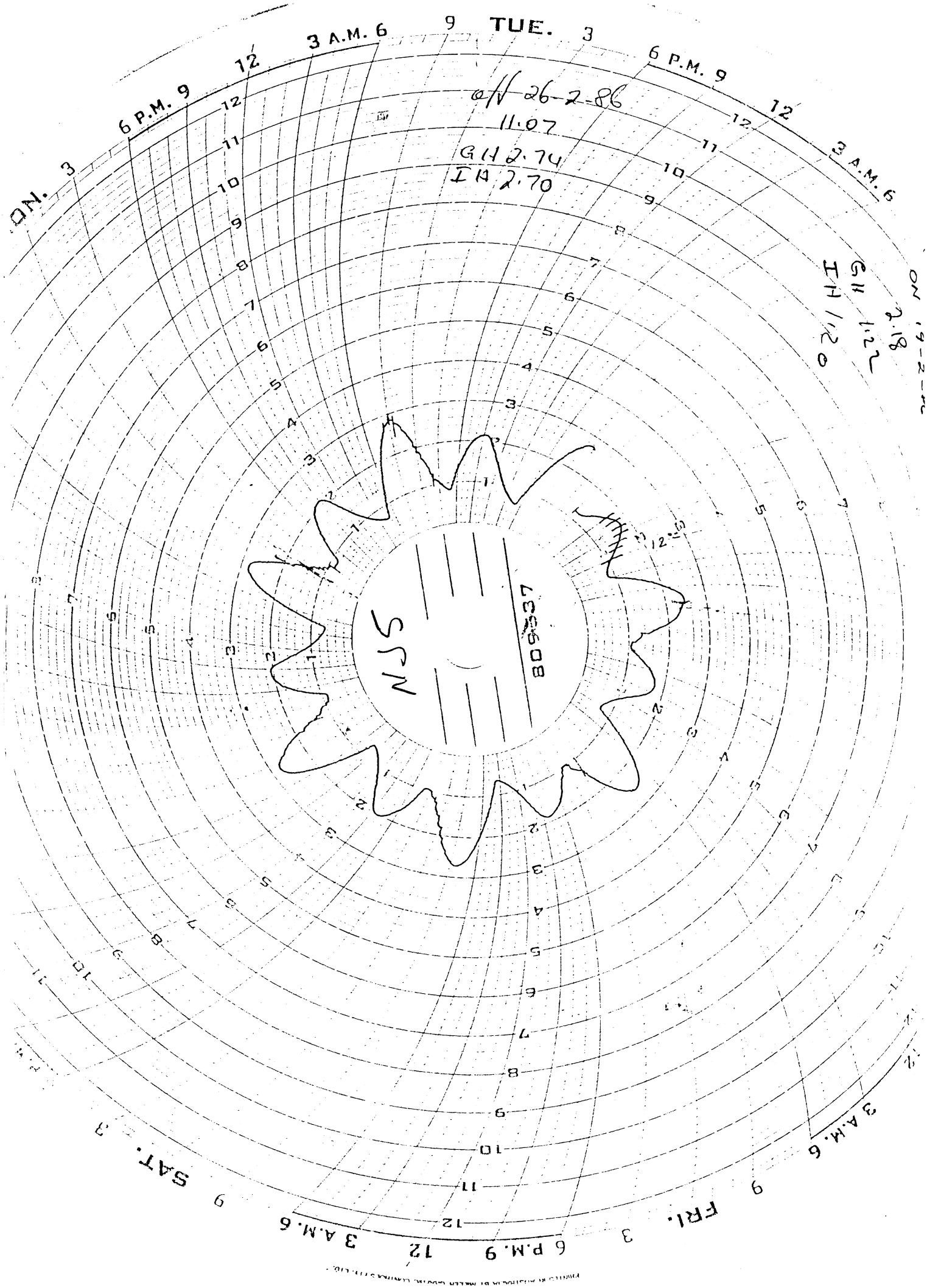

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IA 2.70

GH 1.27
IH 1.20

ON 19-2-86
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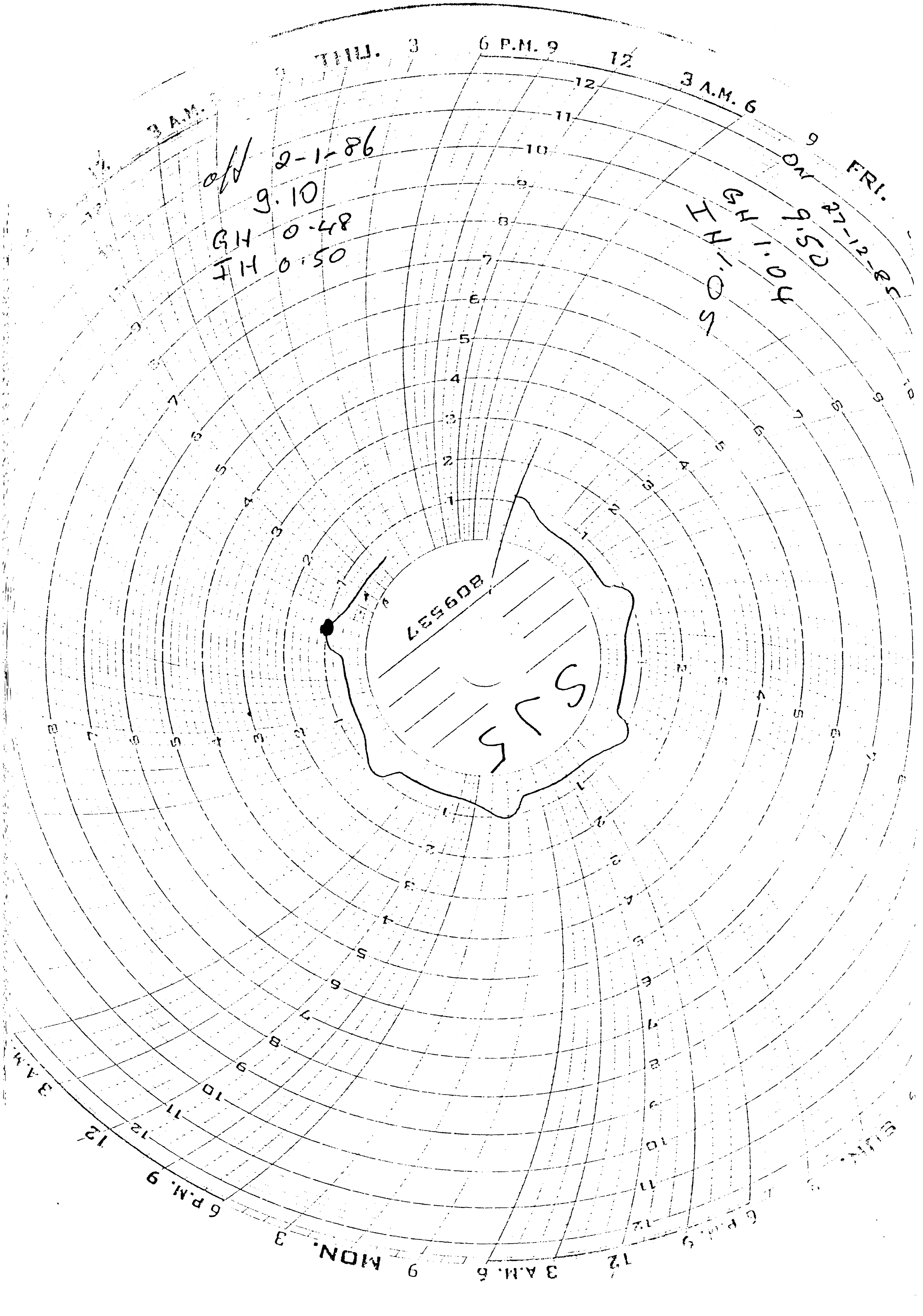
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FRI.
off 2-1-86
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IH 0.50
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IH 1.05
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12
3 A.M.
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3 A.M. 6
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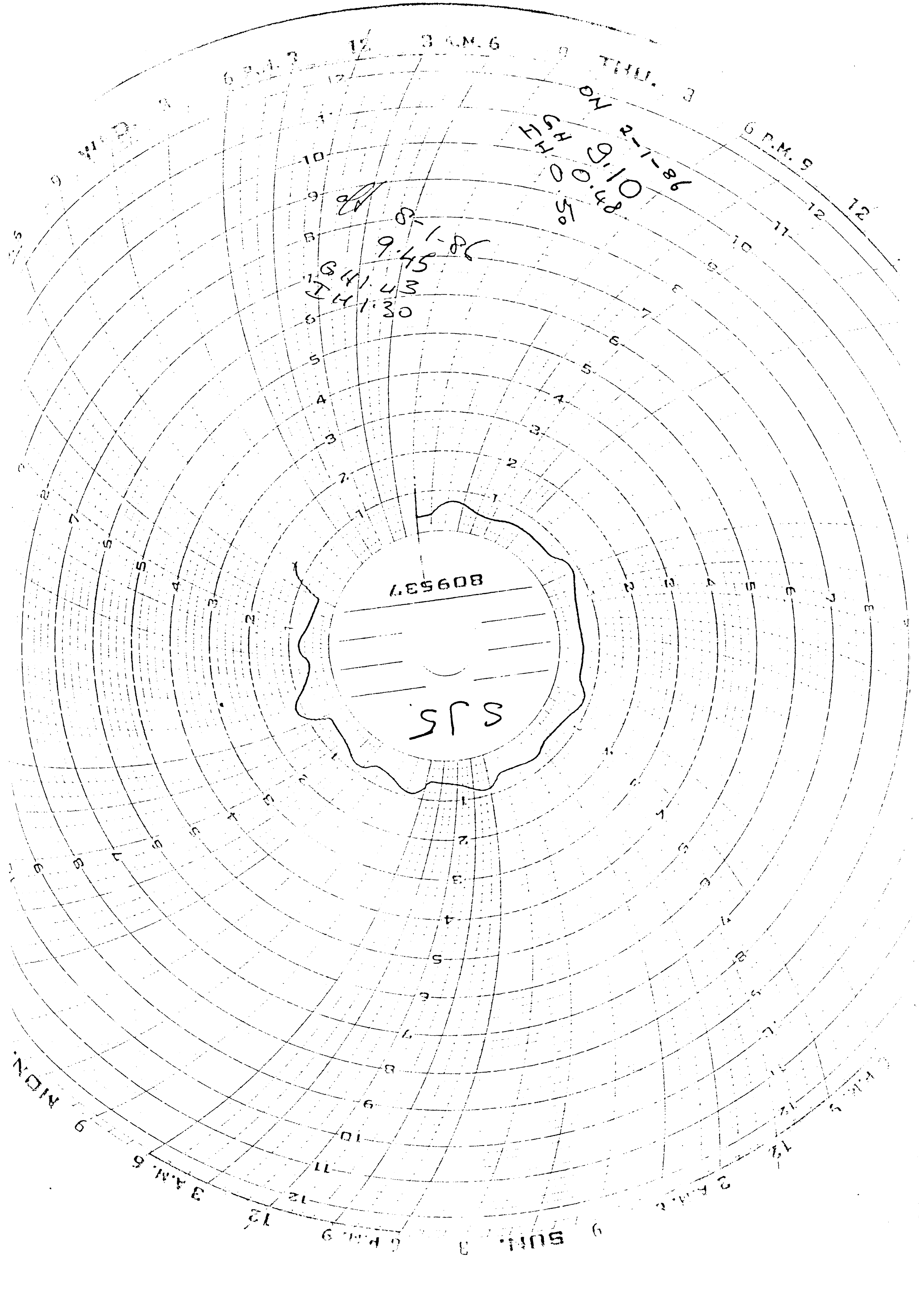
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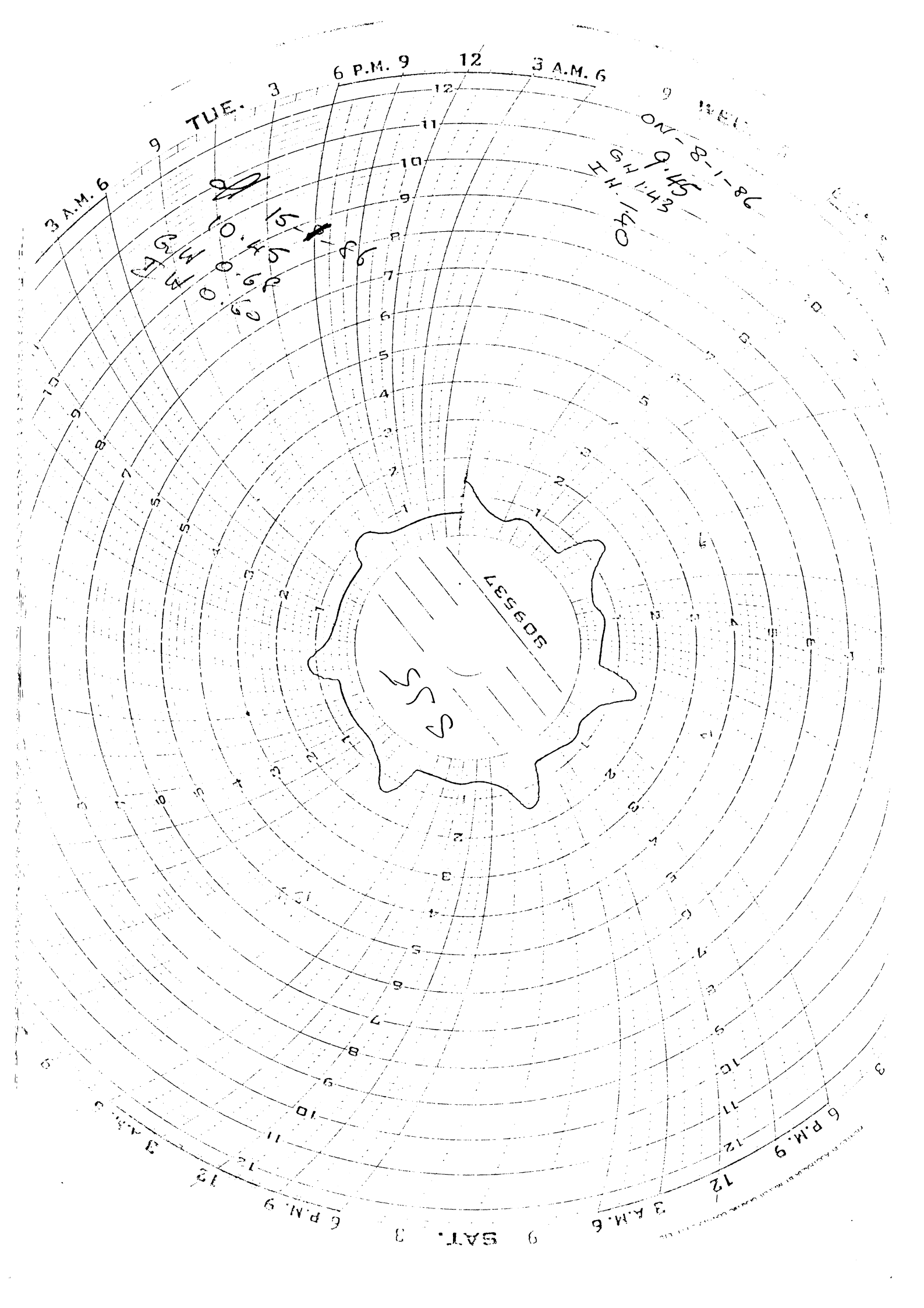
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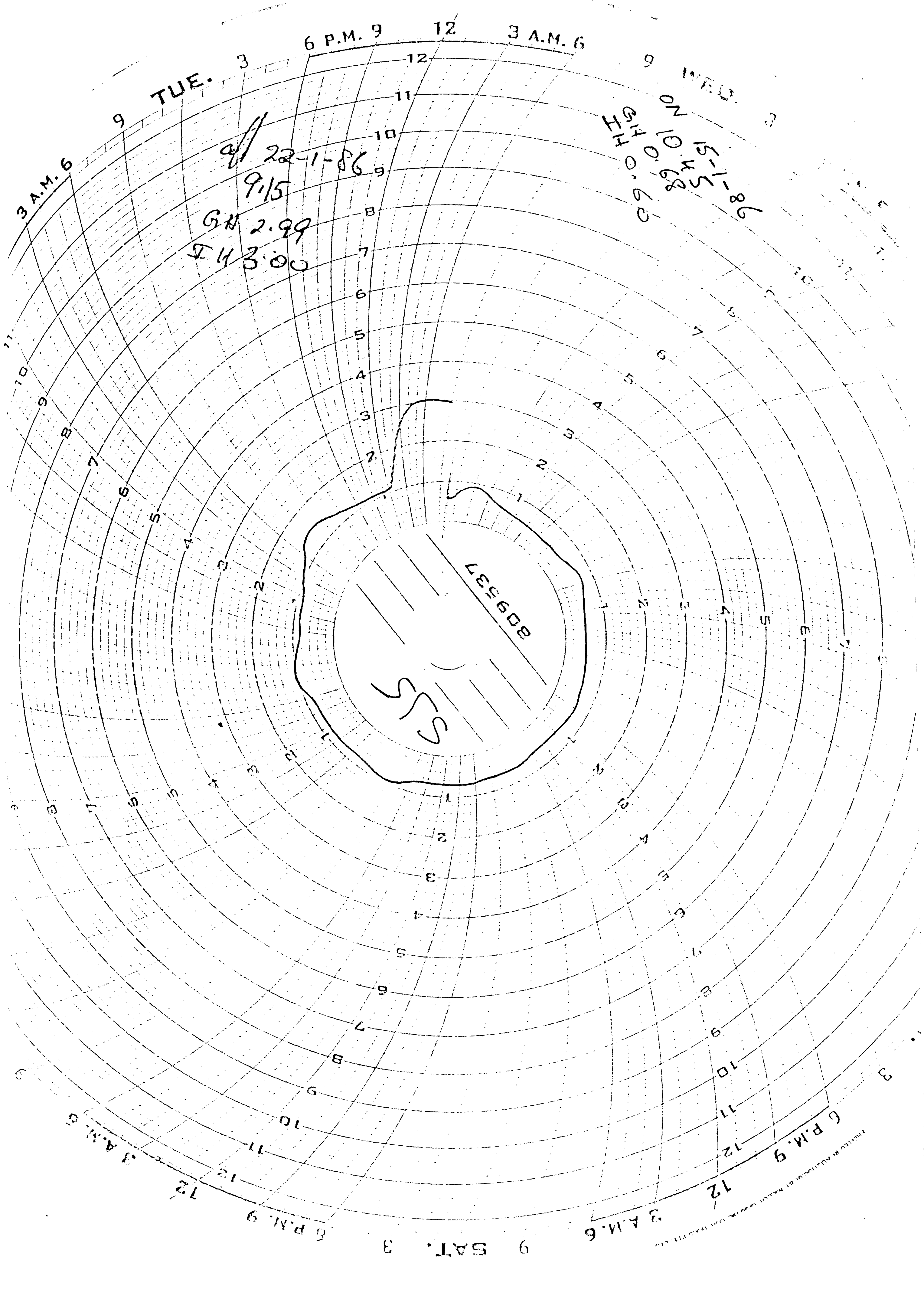
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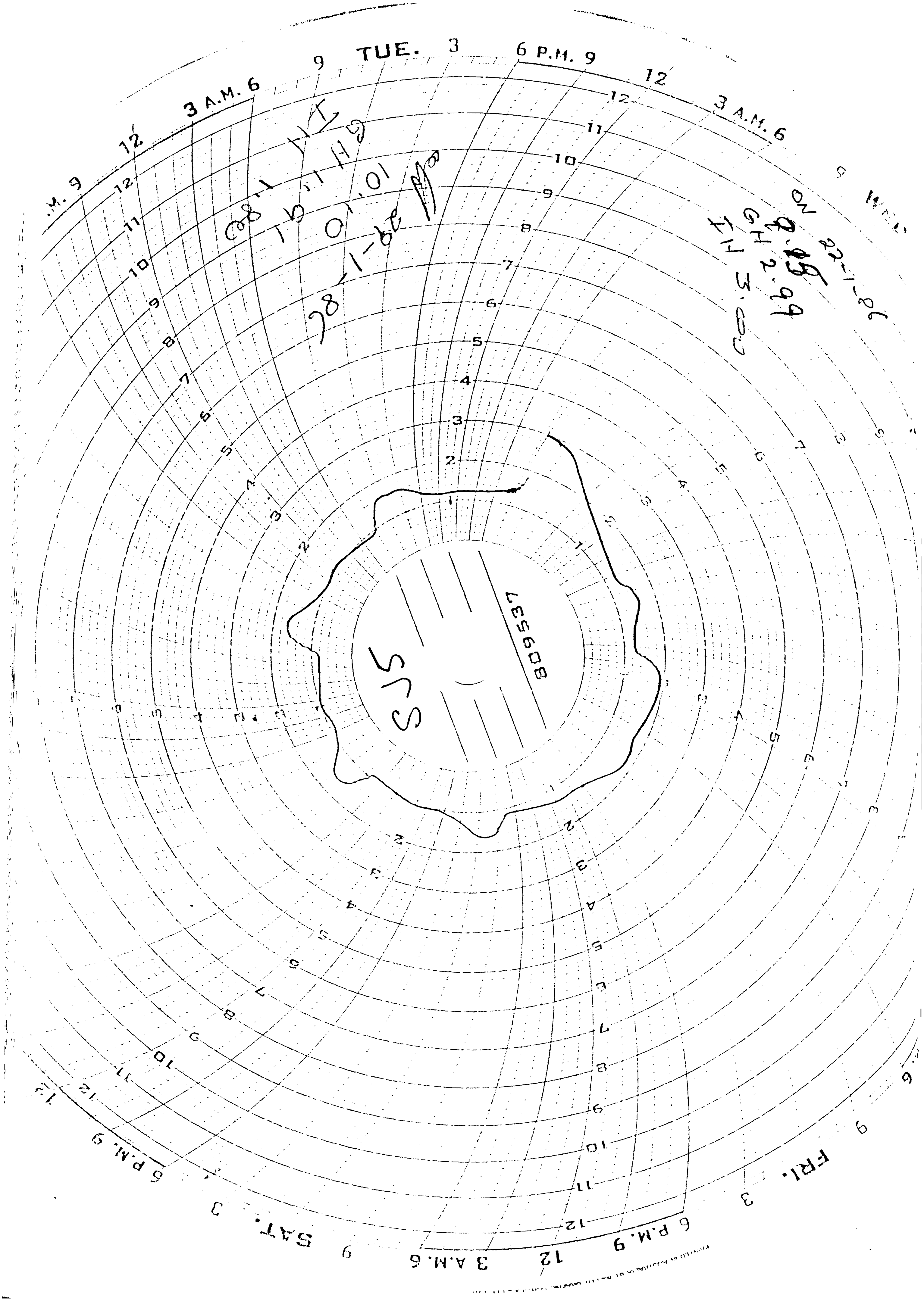
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FRI.
SAT.
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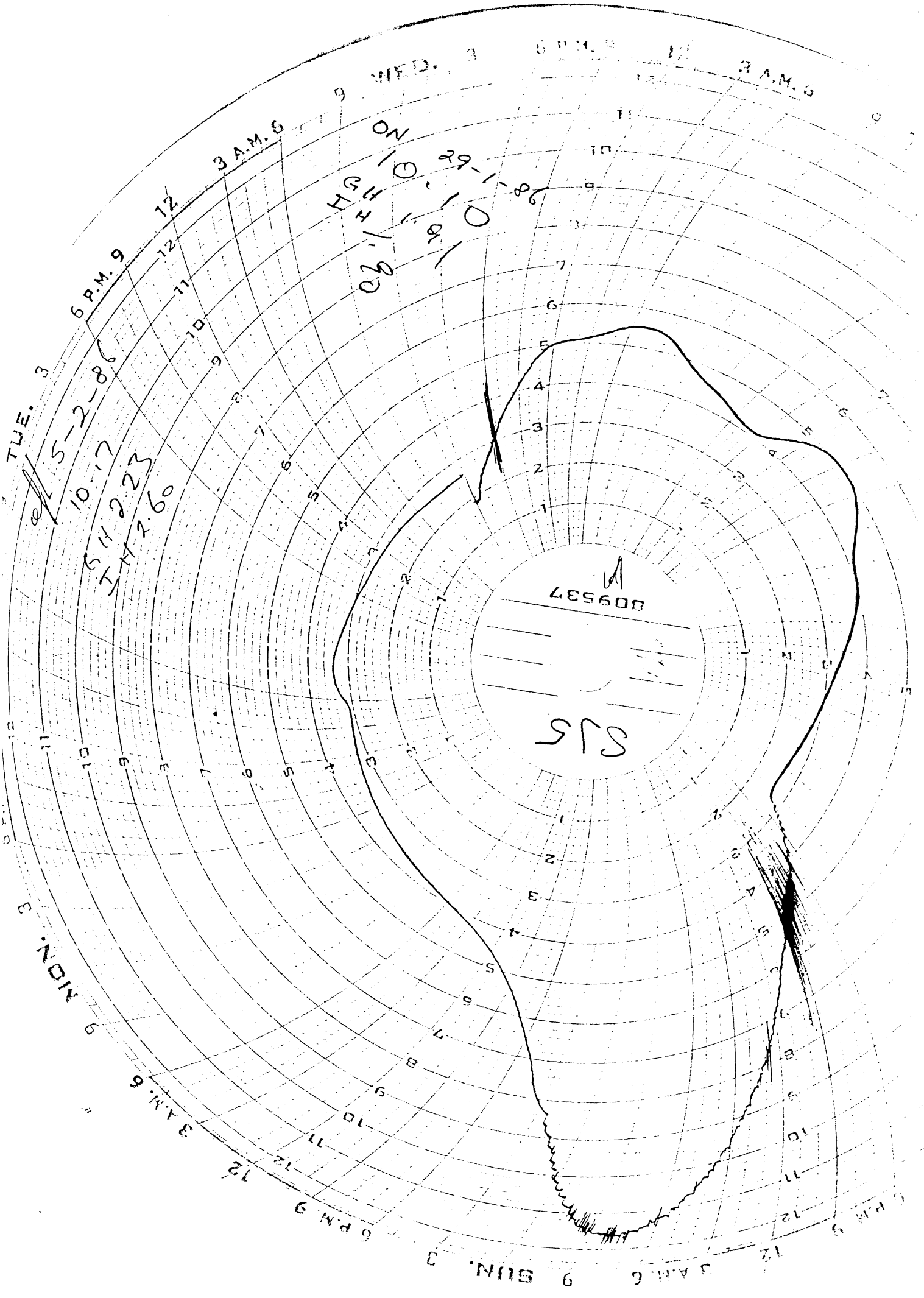
SJS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3 A.M. 6
6 P.M. 9
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TUE.
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LOW 28, 1-1-86
5-2-86
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T 7.60
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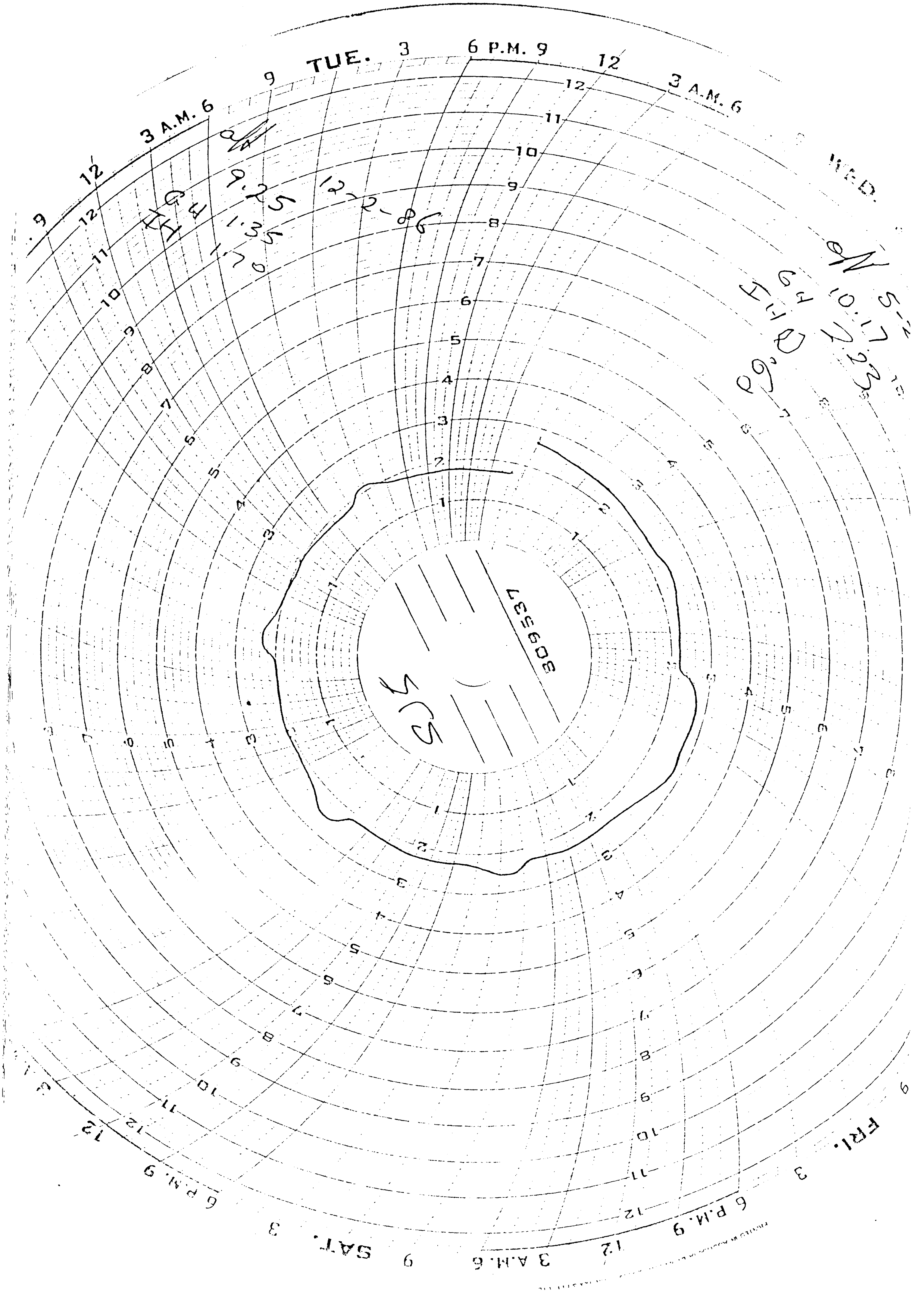
215



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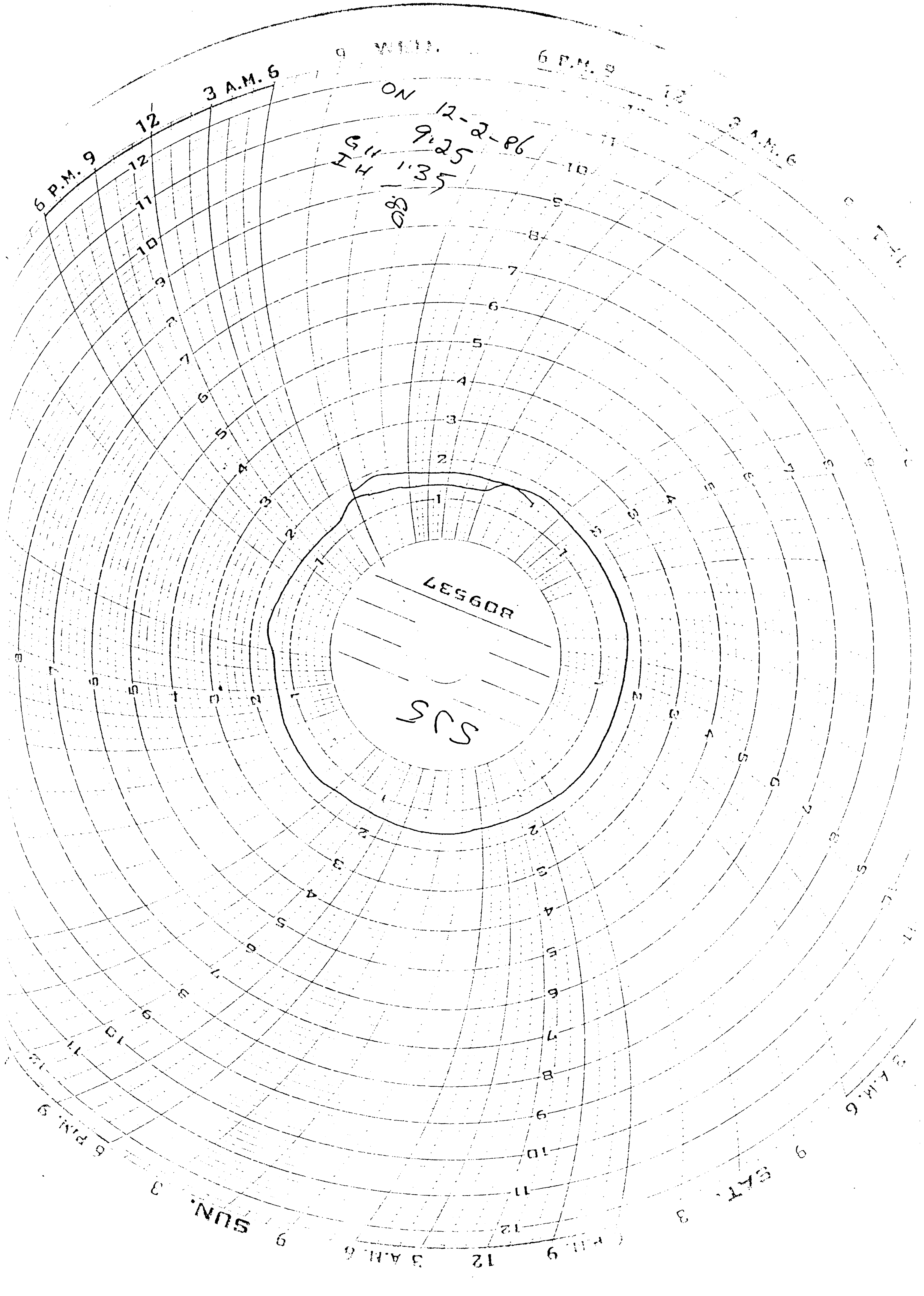
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ON 12-2-86
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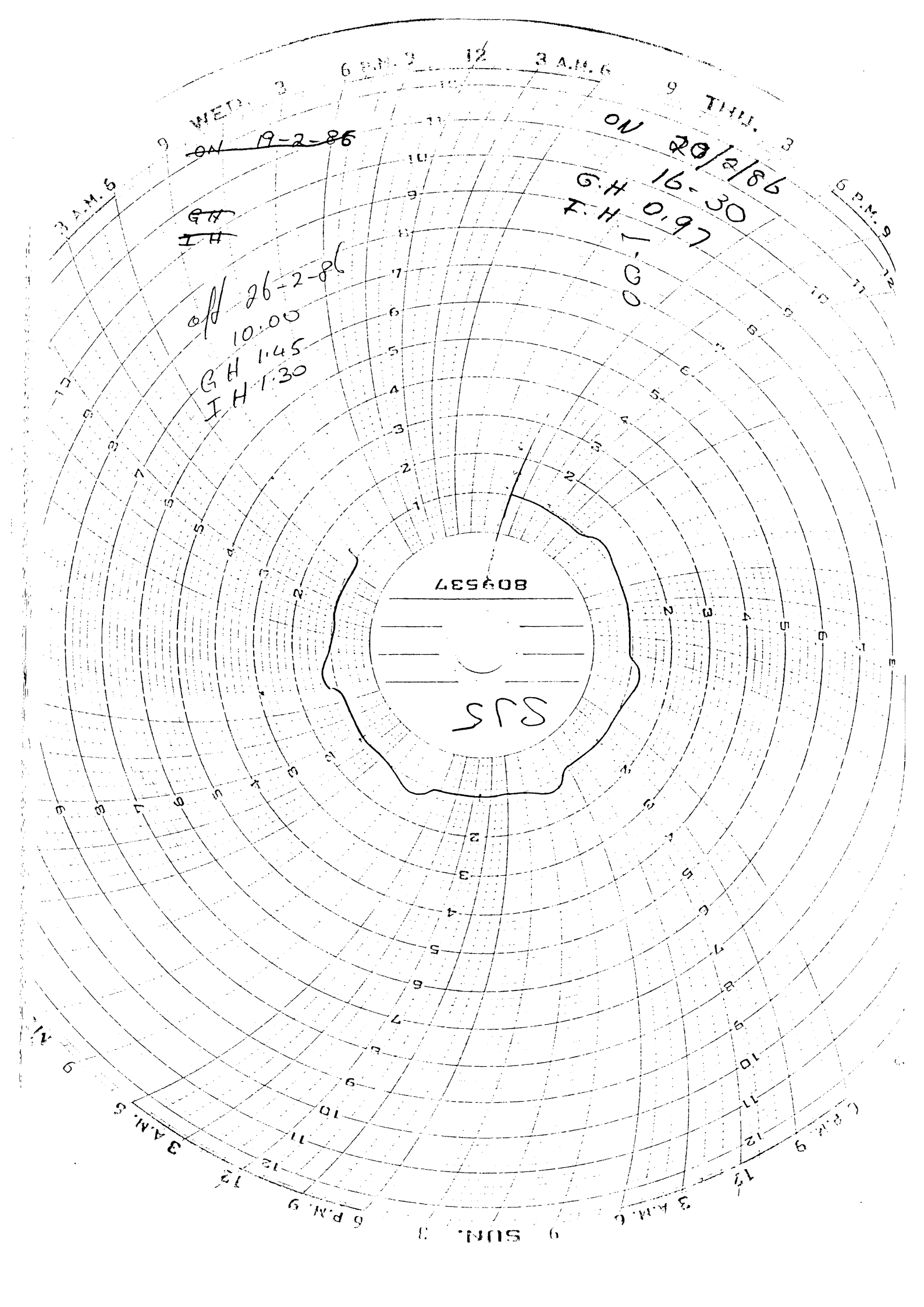
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12
3 A.M. 6
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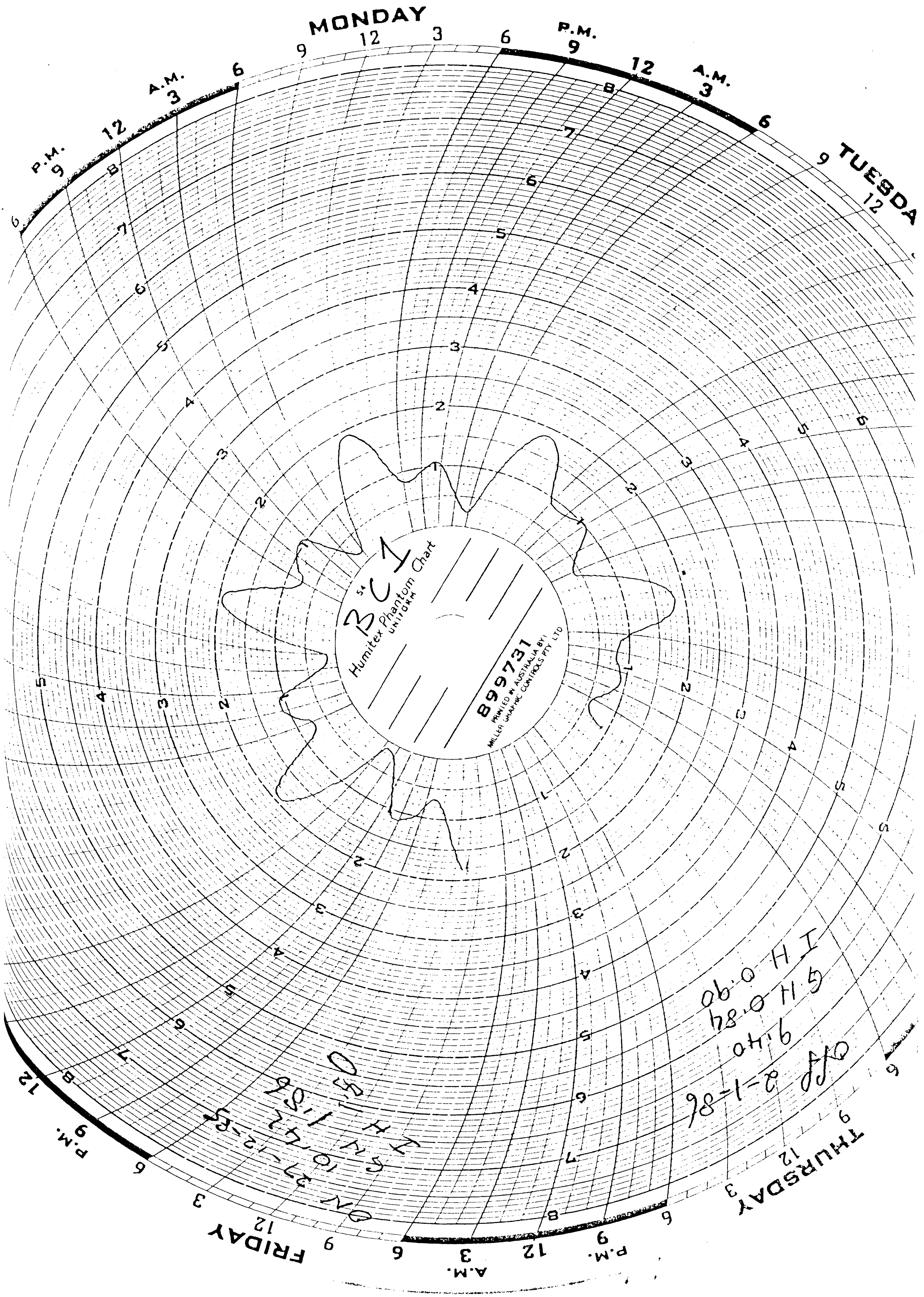

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THURSDAY
FRIDAY
A.M.
P.M.
Humitex Phantom Chart
UNIFORM
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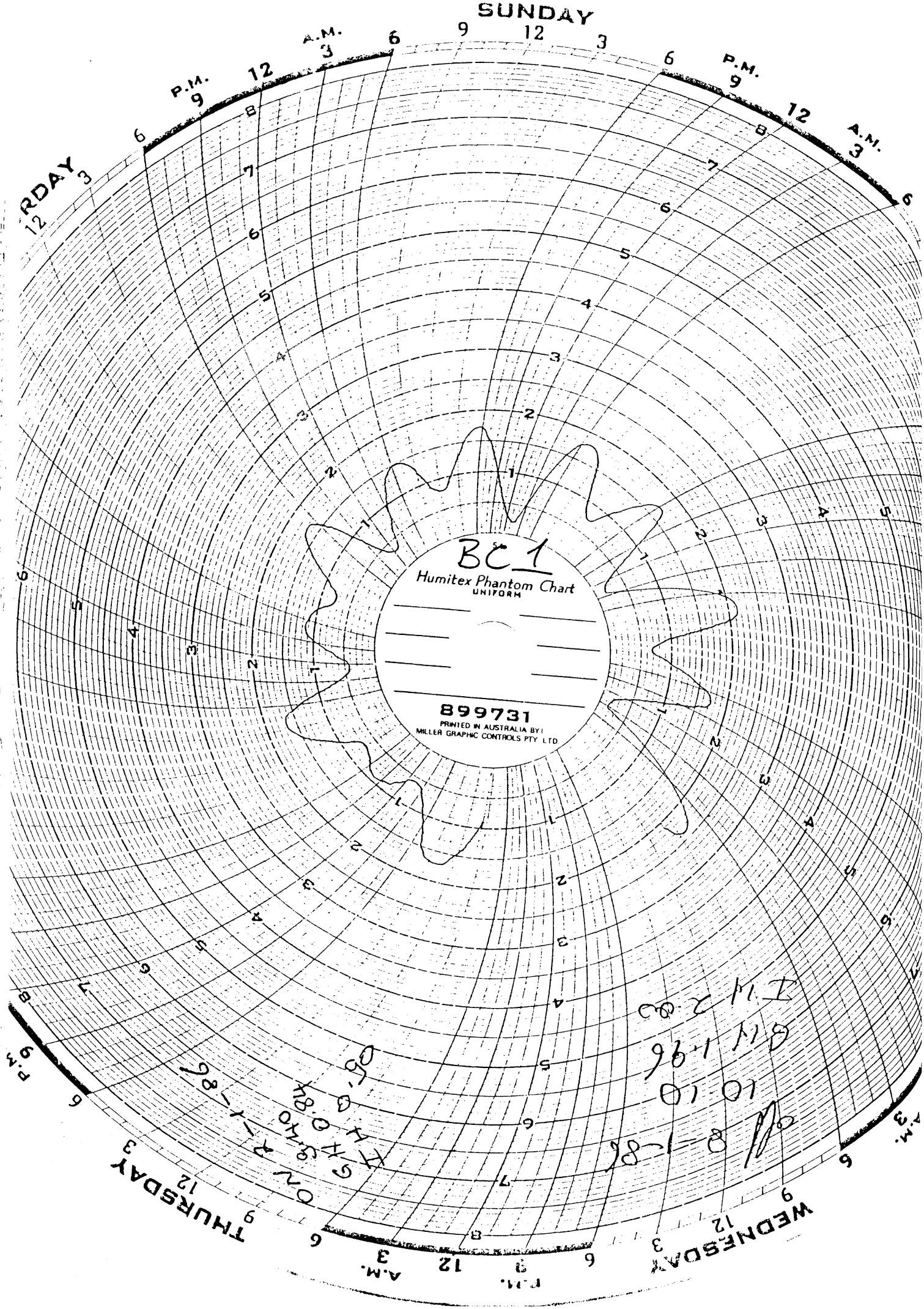
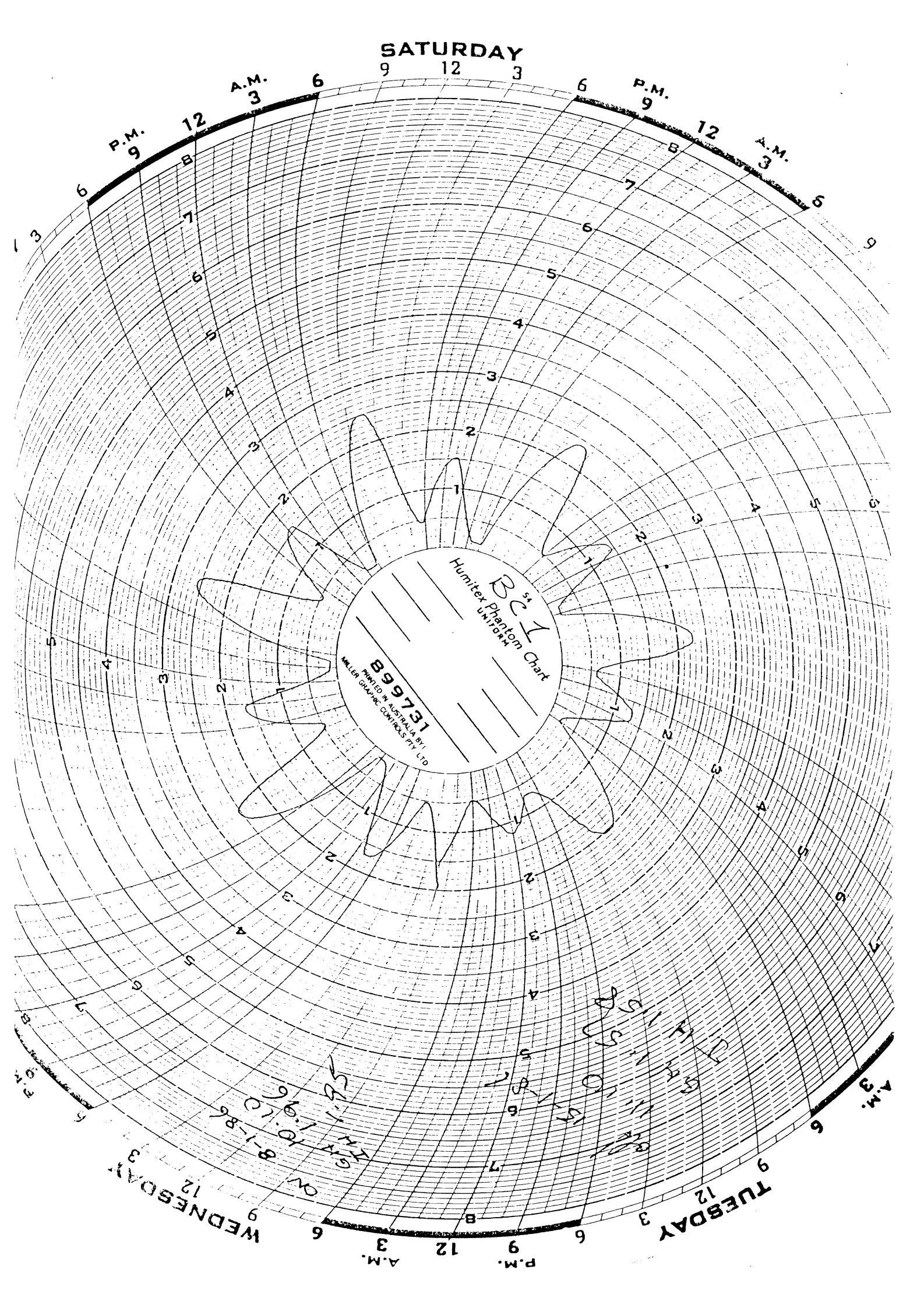
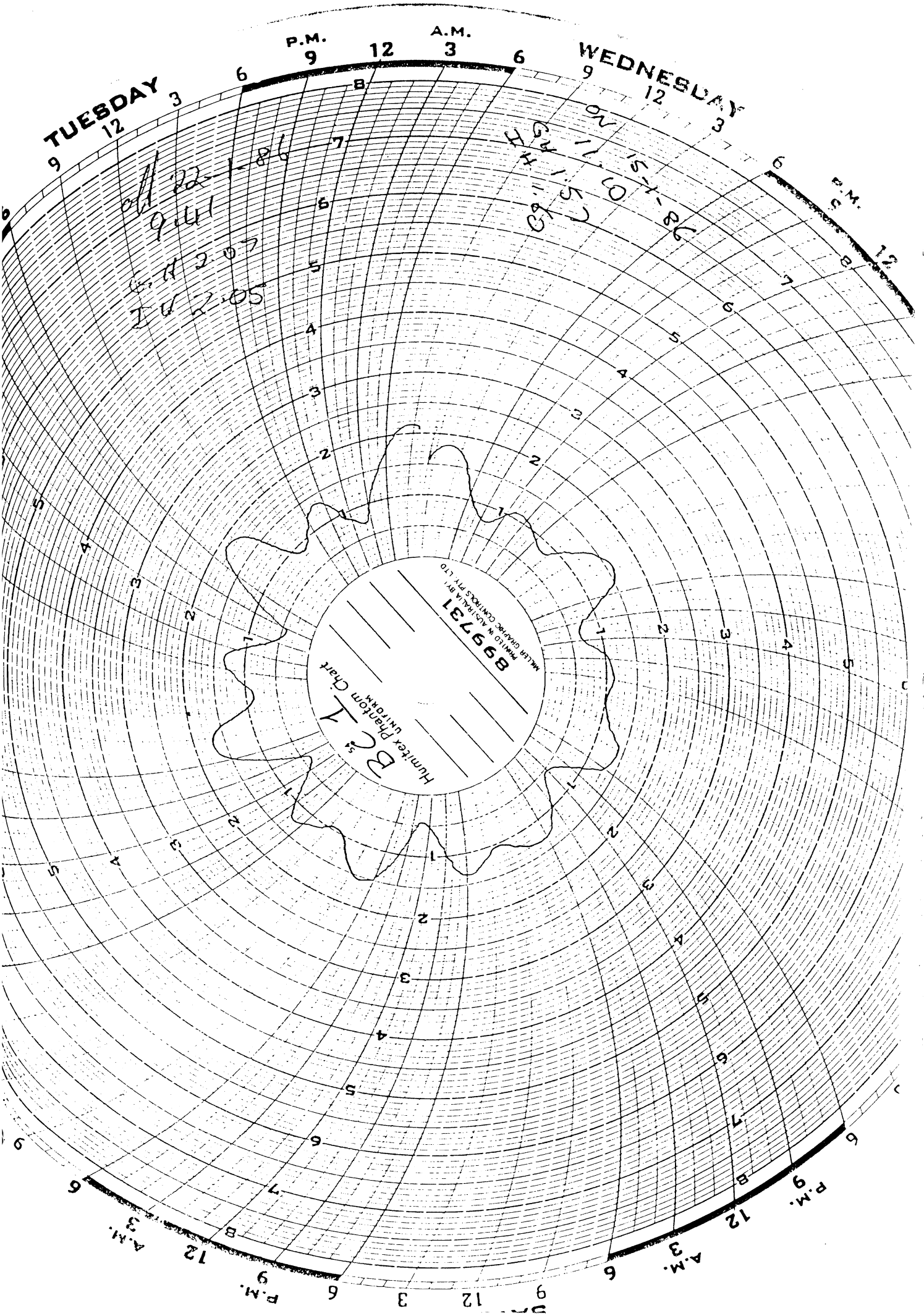

SUNDAY
A.M.
P.M.
BC 1
Humitex Phantom Chart
UNIFORM
899731
PRINTED IN AUSTRALIA BY
MILLER GRAPHIC CONTROLS PTY. LTD.
THURSDAY
WEDNESDAY


SATURDAY
A.M.
P.M.
TUESDAY
WEDNESDAY
Humitex Phantom Chart
UNIFORM
B99731
PRINTED IN AUSTRALIA BY
MILLER GRAPHIC CONTROLS PTY. LTD


TUESDAY
WEDNESDAY
A.M.
P.M.
12
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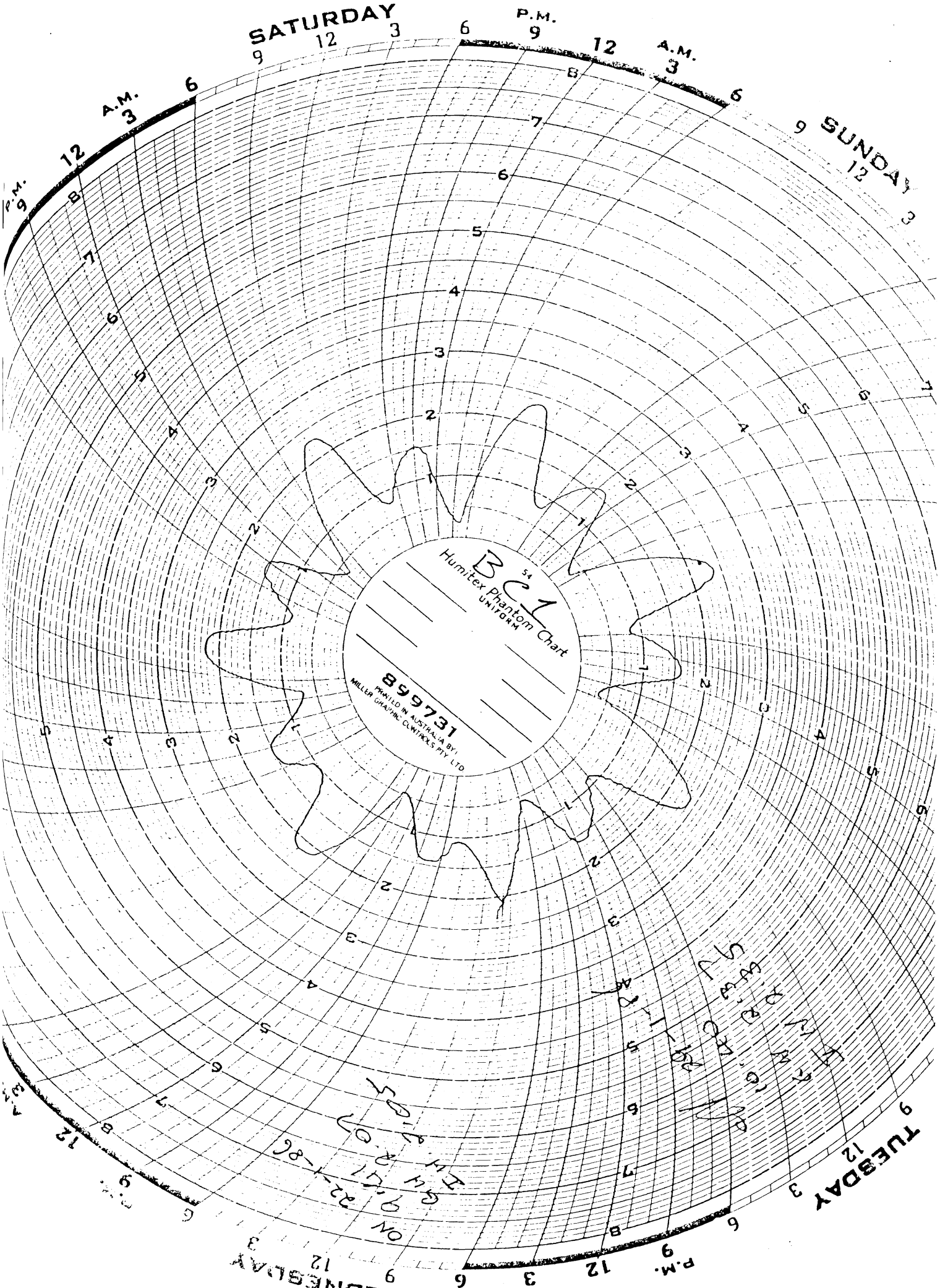
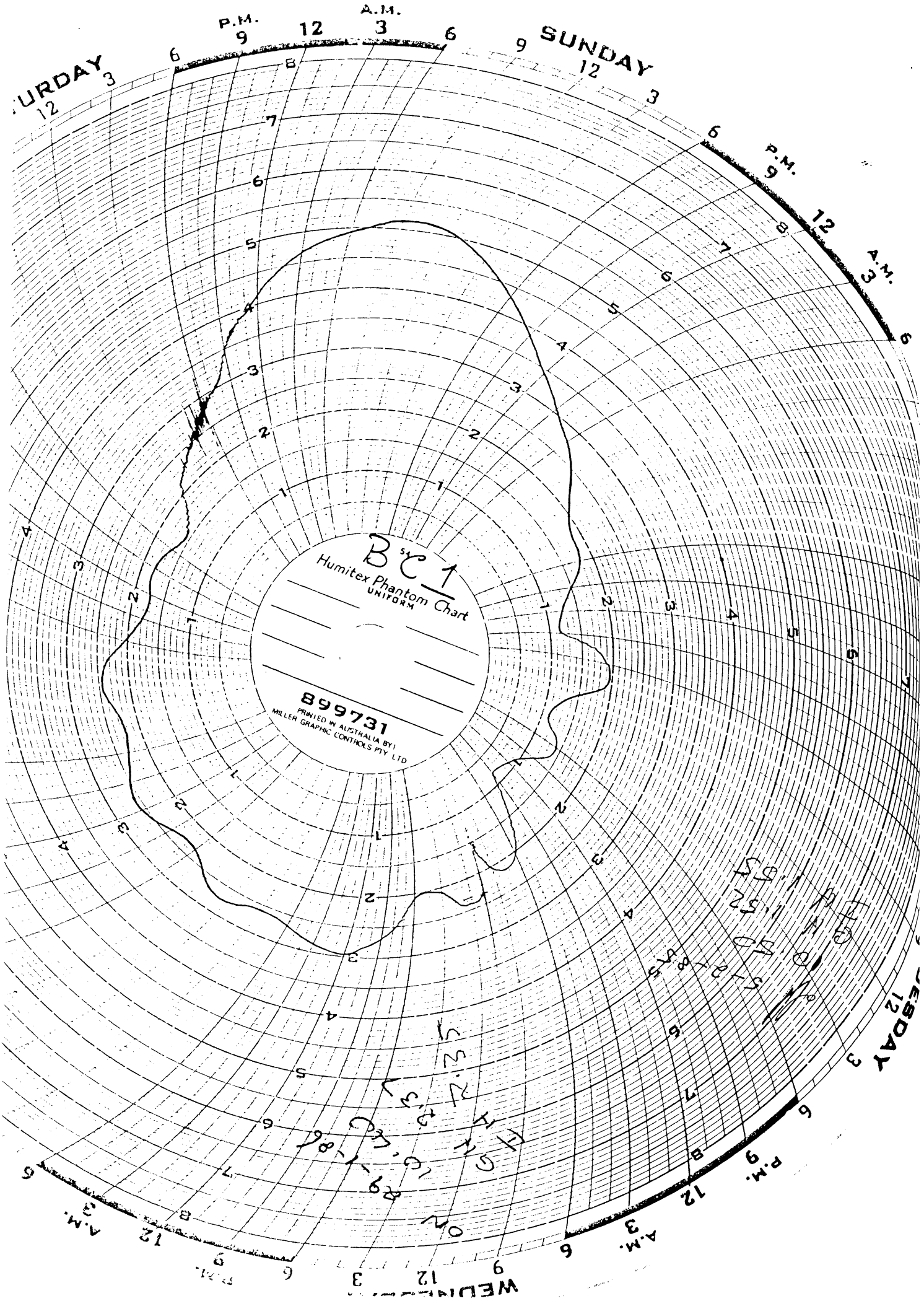
Humitex Phantom Chart
BC4
MADE IN AUSTRALIA BY
MILLER GRAPHIC CONTROLS PTY LTD
899731


SATURDAY
SUNDAY
MONDAY
TUESDAY
WEDNESDAY
A.M.
P.M.
Humitex Phantom Chart
UNIFORM
89731
PRINTED IN AUSTRALIA BY
MILLER GRAPHIC CONTROLS PTY LTD


A.M.
P.M.
12
3
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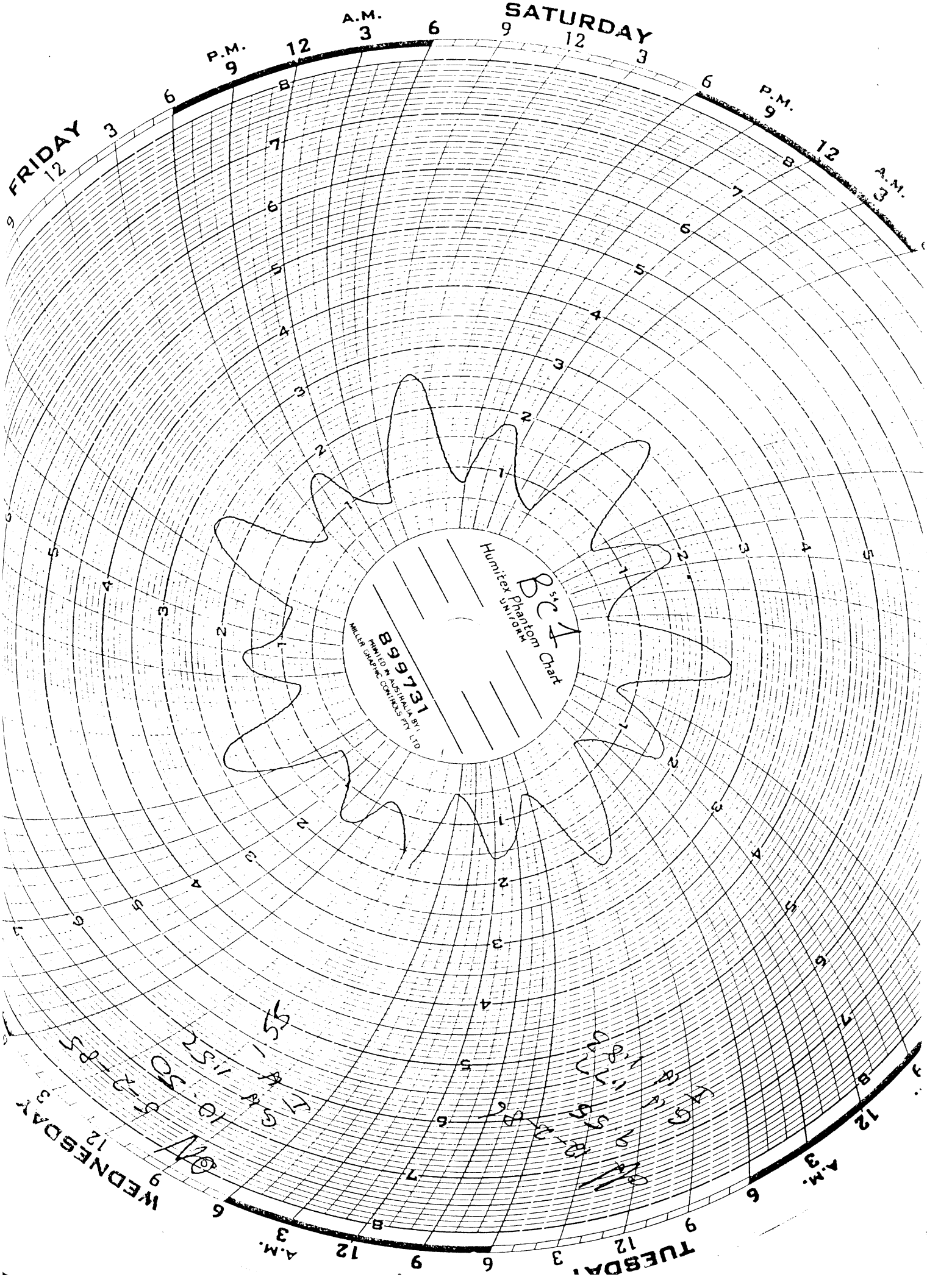
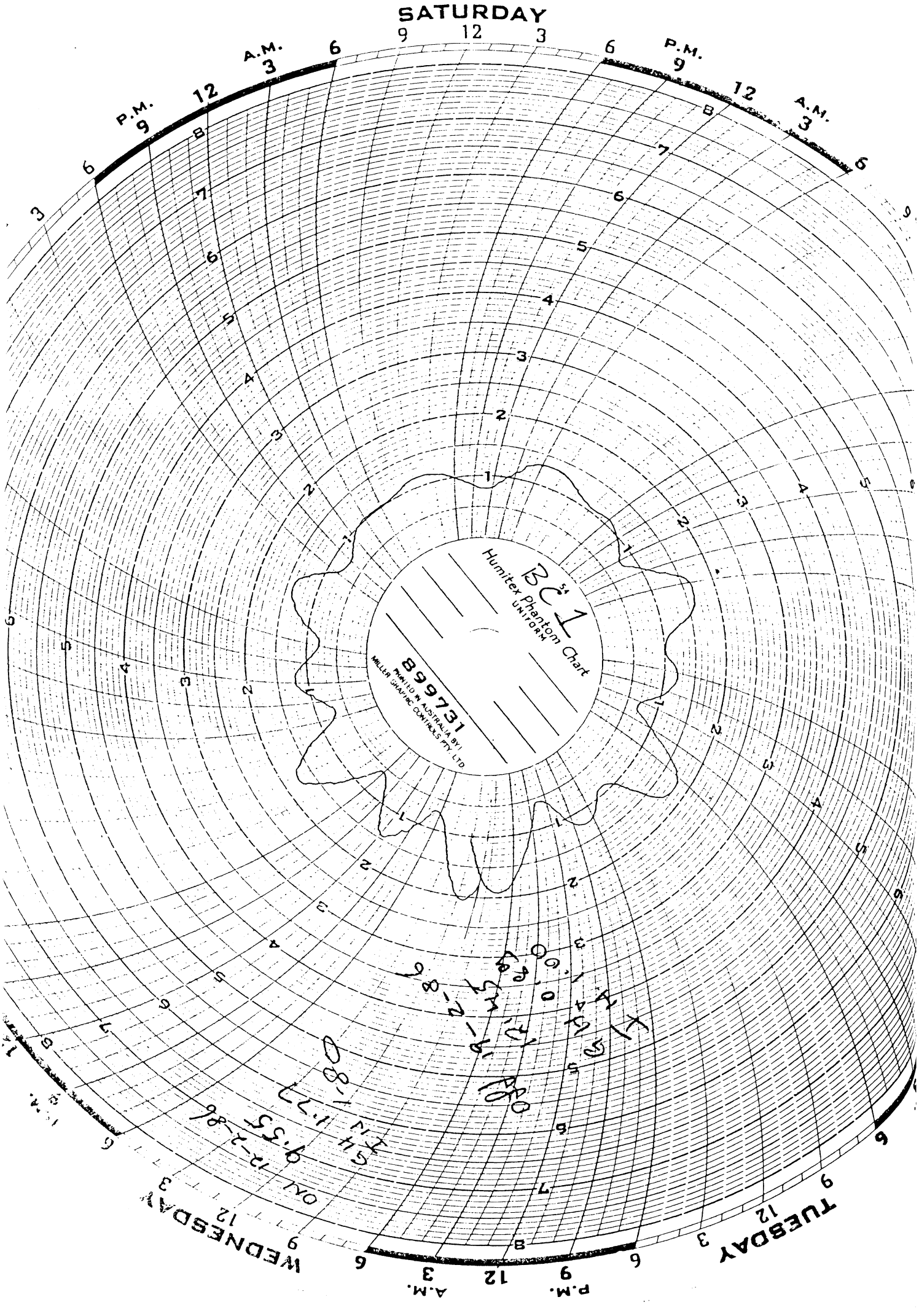
SUNDAY
MONDAY
TUESDAY
WEDNESDAY
BC1
Humitex Phantom Chart
UNIFORM
899731
PRINTED IN AUSTHALIA BY
MILLER GRAPHIC CONTROLS PTY LTD


SATURDAY
FRIDAY
A.M.
P.M.
Humitex Phantom Chart
UNIFORM
BC 1
89731
PRINTED IN AUSTRALIA BY
MILLER GRAPHIC CONTROLS PTY LTD


SATURDAY
9 12 3
A.M.
P.M.
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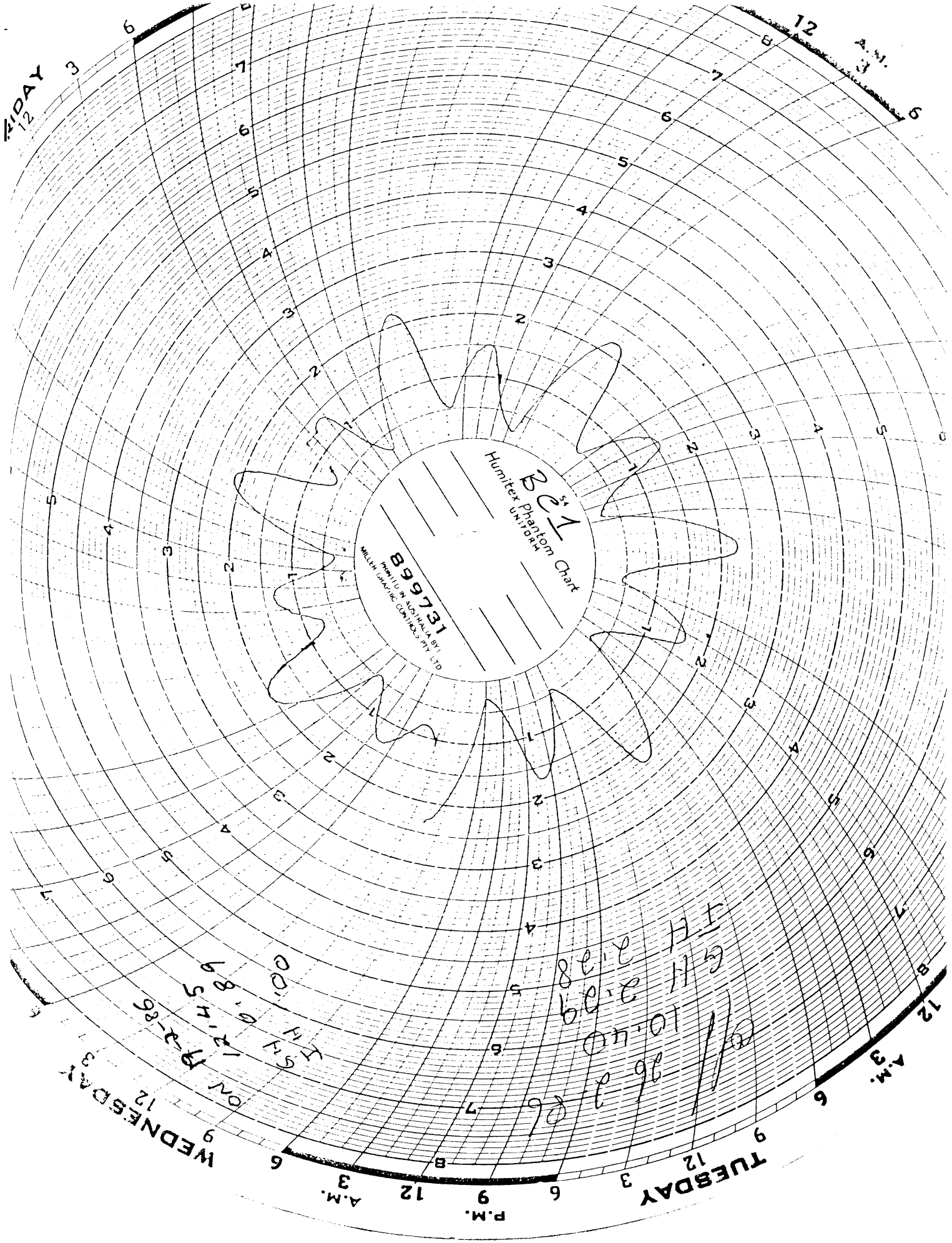
Humitex Phantom Chart
UNIFORM
899731
PRINTED IN AUSTRALIA BY
MILLER GRAPHIC CONTROLS PTY. LTD.
TUESDAY
WEDNESDAY


Humiter Phantom Chart
89731
MILLER GRAPHIC CONTROLS PTY LTD
TUESDAY
WEDNESDAY
FRIDAY
A.M.
P.M.

APPENDIX B

WATER QUALITY DATA FOR NORTH AND SOUTH JOHNSTONE RIVER

(Extracted from Queensland Water Resources Commission Publication)

SURFACE WATER RESOURCES BRANCH

WATER QUALITY DATA SYSTEM

SAMPLING STATION .. G.S. 112004

DRAINAGE BASIN 112

STREAM/STORAGE NTH JOHNSTONE R LOCALITY TUNG OIL PLANTATION A.M.T.D. 29.0 KM. LATITUDE 17 33 LONGITUDE 145 56

LYST	DATE SAMPLED	GAUGE HEIGHT	DISCHARGE	COND. @ 25C	PH	DISS. IONS	DISSOL SOLIDS	HARD	ALK.	NA	K	CA	MG	HCO3	CO3	CL	F	NO3	SO4	PO4	DOM	STK	IHR
1	22/09/71	0.85	8.892	65	6.8	57.1	0	21	22	11.0	0.0	5.0	2.0	27.0	N	12.0	0.10	0.0	T	0.0	1	P	1
1	06/02/72	1.06	26.111	48	7.3	44.1	0	11	18	9.0	0.0	1.0	2.0	22.0	N	10.0	0.05	U	U	0.0	1	P	1
1	08/08/72	0.97	0.203	50	7.1	40.1	0	13	16	6.0	0.0	2.0	2.0	20.0	N	10.0	0.05	0.0	T	0.0	1	P	1
1	13/10/72	0.87	10.677	56	7.1	47.1	0	16	22	7.0	0.0	3.0	2.0	27.0	N	8.0	0.05	0.0	T	0.0	1	P	1
1	23/01/73	0.83	7.108	60	7.1	58.1	0	12	24	13.0	0.0	3.0	1.0	29.0	N	12.0	0.05	0.0	T	0.0	1	P	1
1	06/12/73	1.05	27.725	82	8.1	47.1	57	14	20	5.2	1.0	2.5	2.0	24.0	0.1	12.0	0.14	U	U	0.0	1	P	1
1	24/01/74	1.78	111.581	41	7.0	32.4	36	9	12	3.5	0.5	1.4	1.4	15.0	U	9.0	U	U	U	0.0	3	P	1
1	15/03/74	0.93	15.604	55	7.3	45.0	47	13	20	5.0	0.8	2.5	1.7	24.0	0.0	11.0	U	U	U	0.0	3	P	1
1	10/10/74	0.85	9.827	60	7.5	44.3	53	13	20	5.0	1.0	2.5	1.7	24.0	0.0	10.0	0.14	U	U	0.0	3	P	1
1	22/01/75	0.88	11.723	110	8.1	95.5	77	50	50	4.5	1.2	17.0	1.8	61.0	0.0	10.0	U	U	U	0.0	3	P	1
1	14/11/75	0.95	17.925	55	7.5	34.2	39	14	18	4.7	0.7	2.7	1.8	22.0	0.0	2.0	0.31	U	U	0.0	3	P	1
1	19/08/76	0.96	18.300	51	6.3	35.6	40	13	13	4.7	0.7	2.5	1.7	16.0	0.0	10.0	0.00	0.0	0.0	0.0	1	P	1
1	25/11/76	0.83	12.400	52	7.3	41.9	41	14	18	5.7	1.3	3.0	1.7	22.0	0.0	8.0	0.20	0.0	0.0	0.0	1	P	1
1	14/01/77	0.83	1.770	60	7.3	45.6	45	16	23	5.1	1.1	3.3	1.8	28.0	0.0	6.0	0.30	0.0	0.0	0.0	1	P	1
1	18/01/78	1.16	33.439	52	6.8	25.5	32	14	10	5.0	0.9	2.5	1.9	12.0	0.0	3.0	0.00	0.2	0.0	0.0	1	P	1
1	24/07/80	1.12	28.820	50	7.0	30.5	36	12	11	4.2	0.6	2.0	1.6	13.0	U	6.0	0.10	U	1.0		1	P	1
1	09/12/81	0.93	13.000	53	7.3	37.0	40	15	15	5.5	1.1	2.7	2.0	18.0	U	6.0	0.20	0.5	1.0	0.0	1	P	1
1	17/08/83	1.17	47.269	45	7.6	34.5	28	10	11	10.0	0.8	1.7	1.4	13.5	U	7.0	0.10	T	T	0.0	1	P	1
1	17/11/83	0.95	9.777	57	7.4	41.8	43	14	19	4.6	1.0	2.5	2.0	23.0	U	5.7	0.10	0.5	2.4		1	P	1
1	09/04/84	1.22	33.000	49	7.6	30.2	34	12	13	4.0	0.6	2.0	1.6	16.0	J	6.0	T	T	T	0.0	1	P	1

SURFACE WATER RESOURCES BRANCH

WATER QUALITY DATA SYSTEM

SAMPLING STATION .. G.S. 112004

DRAINAGE BASIN 112

STREAM/STORAGE NTH JOHNSTONE R LOCALITY TUNG OIL PLANTATION A.M.T.D. 29.0 KM. LATITUDE 17 33 LONGITUDE 145 56

ANAL. NO.	ANALYST	DATE SAMPLED	GAUGE HEIGHT	DISCHARGE	COND. @ 25C	PH	DISS. IONS	DISSOL SOLIDS	HARD	ALK.	NA	K	CA	MG	HCO3	CO3	CL	F	NO3	SO4	PO4	DO %	SI K	IR R
[illegible]4966	1	07/06/84	1.31	43.300	49	7.2	30.5	34	12	13	4.3	0.7	2.1	1.6	16.0	U	5.8	T	T	T	0.0	1	P	1
[illegible]5928	1	06/09/84	1.01	14.200	51	7.2	40.6	43	12	17	4.6	0.7	2.2	1.7	20.5	U	8.0	T	T	2.9	0.0	1	P	1
[illegible]6265	1	12/12/84	0.93	8.914	57	6.7	42.1	45	13	16	5.2	1.2	2.3	1.8	19.5	U	5.8	T	T	6.3	0.0	1	P	1
[illegible]3600	1	07/02/85	3.43	393.000	31	7.2	17.8	21	5	6	2.4	1.2	1.0	0.7	6.9	U	4.0	T	1.0	T	0.0	1	P	1
[illegible]3594	1	08/02/85	2.52	228.900	40	7.5	25.0	27	8	10	3.4	1.0	1.5	1.1	12.0	U	5.1	T	0.9	T	0.0	1	P	1
[illegible]3797	1	13/05/85		39.900	47	7.1	29.9	33	10	13	4.3	0.6	1.8	1.4	16.0	U	5.8	T	T	T	0.0	1	P	1
[illegible]0861	1	08/08/85	1.10	18.100	53	7.3	31.4	[illegible]	11	13	4.4	0.8	2.0	1.4	16.0	U	4.2	0.10	0.5	2.0		1	P	1
[illegible]5846	1	17/06/86	1.47	57.113	48	7.2	31.2	35	10	11	4.0	0.7	1.8	1.3	13.5	U	6.0	0.10	1.8	2.0		1	P	1
[illegible]6823	1	03/07/86	1.02	16.764	58	7.4	35.2	39	13	12	4.8	1.0	2.4	1.6	15.0	U	6.5	0.10	1.8	2.0		1	P	1
[illegible]7317	1	24/11/86	0.87	7.318	66	7.0	42.7	44	14	21	5.3	1.0	2.8	1.8	25.5	U	6.3	T	T	T	0.0	1	P	1
[illegible]8519	1	11/02/87	0.97	13.278	49	7.1	33.5	37	9	13	5.0	1.3	2.0	1.0	16.0	U	6.0	T	T	2.2	0.0	1	P	1
[illegible]1773	1	27/07/87	1.24	36.396	48	7.4	28.3	34	10	11	4.3	0.6	1.9	1.3	14.0	U	6.2	T	T	T	0.0	1	P	1
[illegible]2283	1	26/10/87	0.90	10.251	59	7.1	40.0	42	15	16	5.7	1.0	2.7	2.0	19.5	U	6.4	0.10	0.5	2.0		1	P	1
[illegible]2759	1	02/02/88	0.90	8.929	59	7.2	35.4	39	16	15	5.0	0.9	3.0	2.0	18.5	U	6.0	T	T	T	0.0	1	P	1
[illegible]3526	1	28/04/88	1.39	50.957	49	6.7	31.3	35	11	13	5.0	0.8	2.0	1.5	16.0	U	6.0	T	T	T	0.0	1	P	1
[illegible]5703	1	12/07/88	1.20	32.688	49	6.5	31.3	34	12	13	4.3	0.8	2.2	1.5	16.0	U	6.5	T	T	T	0.0	1	P	1
127305	1	17/10/88	1.01	15.837	52	6.8	40.4	44	17	16	8.0	0.9	3.0	2.4	19.5	U	6.6	T	T	T	0.0	1	P	1
128446	1	22/01/89	1.52	73.941	47	7.2	27.4	32	9	11	3.7	0.7	1.8	1.2	14.0	U	6.0	T	T	T	0.0	1	P	1
130186	1	12/04/89	1.72	91.665	65	7.2	34.4	38	11	11	4.6	1.0	1.9	1.5	13.5	U	11.0	0.20	T	T	0.0	1	P	1

SURFACE WATER RESOURCES BRANCH

WATER QUALITY DATA SYSTEM

SAMPLING STATION .. G.S. 112101

DRAINAGE BASIN 112

STREAM/STORAGE STH JOHNSTONE R LOCALITY CENTRAL MILL A.M.T.D. 17.1 KM LATITUDE 17 36 LONGITUDE 145 59

ANAL. NO.	ANALYST	DATE SAMPLED	GAUGE HEIGHT	DISCHARGE	COND. @ 25C	PH	DISS. IONS	DISSOL SOLIDS	HARD	ALK.	NA	K	CA	MG	HCO3	CO3	CL	F	NO3	SO4	PO4	D O M	S T K	I R R
049978	1	29/09/71	0.81	5.013	77	6.9	60.1	0	20	28	10.0	0.0	3.0	3.0	34.0	N	10.0	0.10	0.0	T	0.0	1	P	1
049990	1	29/09/71	0.81	5.013	70	6.4	47.1	0	22	24	5.0	0.0	4.0	3.0	29.0	N	6.0	0.10	0.0	T	0.0	1	P	1
051494	1	28/01/72	0.99	7.738	65	6.9	63.1	0	16	28	13.0	0.0	3.0	2.0	34.0	N	11.0	0.10	U	U	0.0	1	P	1
052624	1	25/05/72	1.37	25.658	49	7.6	41.1	0	12	17	7.0	0.0	3.0	1.0	21.0	N	9.0	0.13	0.0	T	0.0	1	P	1
053660	1	08/08/72	1.00	0.985	66	6.4	48.1	0	14	22	8.0	0.0	4.0	1.0	27.0	N	8.0	0.05	0.0	T	0.0	1	P	1
055030	1	19/10/72	0.83	5.579	71	6.6	53.1	0	21	26	7.0	0.0	2.0	4.0	32.0	N	8.0	0.05	0.0	U	0.0	1	P	1
055689	1	23/01/73	0.94	5.069	62	6.7	66.1	0	14	26	15.0	0.0	4.0	1.0	32.0	N	14.0	0.05	0.0	T	0.0	1	P	1
057557	1	21/05/73	1.47	35.513	55	7.7	47.1	49	17	20	6.1	1.0	2.0	2.9	24.0	N	11.0	U	U	U	N	1	P	1
059579	1	03/12/73	0.00	0.000	58	6.7	56.9	57	16	28	5.4	2.1	3.2	2.0	34.0	U	10.0	0.10	U	U	0.0	1	P	1
061293	1	07/05/74	1.42	29.736	48	7.1	40.2	47	12	18	5.0	1.2	2.5	1.4	22.0	N	8.0	0.10	U	U	0.0	1	P	1
062934	1	14/08/74	1.02	8.666	66	7.7	53.5	59	15	24	6.0	3.7	3.0	1.8	29.0	0.0	10.0	U	U	U	0.0	3	P	1
063273	1	09/10/74	1.39	5.579	70	7.3	51.3	59	17	23	6.0	1.6	3.6	2.0	28.0	0.0	10.0	0.14	U	U	0.0	3	P	1
066059	1	06/08/75	1.38	15.639	54	7.1	39.6	46	12	20	4.5	0.9	2.5	1.5	24.0	0.0	5.0	U	U	1.2	0.0	3	P	1
067078	1	13/11/75	1.69	8.665	63	7.3	45.5	54	16	22	5.6	1.0	3.3	1.9	27.0	0.0	6.0	0.69	U	U	0.0	3	P	1
068273	1	10/03/76	2.33	37.200	50	6.9	37.9	45	13	18	4.7	0.9	2.5	1.6	22.0	0.0	6.0	0.20	0.0	0.0	0.0	1	P	1
070560	1	27/03/76	1.61	20.700	52	7.3	35.9	46	11	13	4.8	1.0	2.8	1.0	16.0	0.0	10.0	0.10	0.2	0.0	0.0	1	P	1
072511	1	03/08/76	1.39	11.200	60	7.4	44.7	53	15	19	5.5	1.1	3.4	1.7	23.0		10.0					1	P	1
074322	1	21/11/76	1.69	7.980	60	7.0	41.0	48	15	18	5.1	1.8	3.5	1.5	22.0	0.0	7.0	0.10	0.0	0.0	0.0	1	P	1
077125	1	07/03/77	6.33	622.870	68	7.3	53.4	56	17	28	6.1	1.4	4.0	1.7	34.0	0.0	6.0	0.20	0.0	0.0	0.0	1	P	1
077779	1	03/77	4.92	408.750	31	7.6	26.4	27	7	13	2.5	0.8	1.6	0.8	16.0	0.0	4.0	0.30	0.4	0.0	0.0	1	P	1

SURFACE WATER RESOURCES BRANCH

WATER QUALITY DATA SYSTEM

SAMPLING STATION .. G.S. 112101

DRAINAGE BASIN 112

STREAM/STORAGE STH JOHNSTONE R LOCALITY CENTRAL MILL A.M.T.D. 17.1 KM. LATITUDE 17 36 LONGITUDE 145 59

ANAL. NO.	ANALYST	DATE SAMPLED	GAUGE HEIGHT	DISCHARGE	COND. @ 25C	PH	DISS. IONS	DISSOL SOLIDS	HARD	ALK.	NA	K	CA	MG	HCO3	CO3	CL	F	NO3	SO4	PO4	D O M	S T K	I R R
071784	1	09/03/77	4.63	379.000	33	7.2	28.2	29	7	14	2.7	0.8	1.6	0.8	17.0	0.0	5.0	0.20	0.1	0.0	0.0	1	P	1
072477	1	27/04/77	2.30	63.100	48	6.9	32.3	40	12	15	4.4	0.9	2.5	1.4	18.0	0.0	5.0	0.00	0.1	0.0	0.0	1	P	1
073170	1	22/06/77	1.71	19.500	60	8.2	37.8	52	9	10	5.6	1.0	2.2	0.8	12.0	0.0	6.0	0.00	0.2	10.0	0.0	1	P	1
074241	1	05/10/77	1.40	7.803	64	7.2	46.6	57	16	20	6.0	1.4	3.3	1.8	24.0	0.0	10.0	0.10	0.0	0.0	0.0	1	P	1
075689	1	13/01/78	1.63	16.357	60	7.2	30.7	40	14	14	4.9	1.1	2.8	1.7	17.0	0.0	3.0	0.00	0.2	0.0	0.0	1	P	1
086848	1	24/08/80	1.53	12.020	57	6.9	37.1	46	13	17	4.9	0.9	2.5	1.7	21.0	U	5.0	0.10	U	1.0		1	P	1
080?6	1	26/01/82	1.54	12.300	56	8.2	43.6	54	12	15	4.2	1.3	2.4	1.5	18.0	0.1	5.0	0.10	1.0	10.0	0.0	1	P	1
097755	1	09/11/82	1.24	5.290	110	7.9	83.9	75	41	44	6.9	1.4	12.5	2.4	53.0	0.2	5.9	T	0.6	.0	0.0	1	P	1
098627	1	27/04/83	1.86	28.000	53	7.5	41.3	45	12	16	10.0	1.2	2.3	1.6	20.0	U	5.1	0.10	1.0	T	0.0	1	P	1
098624	1	02/06/83	1.84	28.700	51	7.4	40.0	45	13	18	8.0	1.0	2.4	1.7	22.0	U	4.9	T	T	T	0.0	1	P	1
102460	1	16/11/83	1.16	4.534	66	7.5	52.2	56	16	25	5.7	1.2	3.1	2.0	30.5	U	4.8	0.10	0.5	4.3		3	P	1
103254	1	12/01/84	1.60	14.800	65	7.5	45.0	49	17	18	6.9	1.3	3.1	2.2	22.0	U	5.6	T	1.4	2.5	0.0	1	P	1
103385	1	13/03/84	1.82	25.100	70	8.4	44.8	51	15	17	5.4	0.9	2.6	2.0	20.0	0.3	5.0	T	T	8.6	0.0	1	P	1
103387	1	21/03/84	1.75	21.000	51	8.2	36.1	39	13	16	4.3	1.0	2.4	1.6	19.0	0.2	5.0	0.10	0.5	2.0		1	P	1
105327	1	05/09/84	1.29	6.740	65	7.7	49.4	54	15	23	5.6	1.1	2.9	1.9	28.0	0.1	5.5	T	T	4.3	0.0	1	P	1
106362	1	10/12/84	1.12	4.548	66	6.7	59.6	61	17	29	6.2	1.5	3.4	2.1	35.5	U	4.8	T	T	6.1	0.0	1	P	1
107876	1	05/03/85	1.84	28.500	55	7.0	44.8	48	13	19	4.4	0.9	2.5	1.6	23.0	U	5.5	T	T	6.9	0.0	1	P	1
108599	1	02/05/85	1.74	22.000	52	7.2	36.6	43	12	18	4.8	0.9	2.3	1.4	22.0	U	5.2	T	T	T	0.0	1	P	1
109595	1	14/05/85	1.55	36.100	40	6.5	18.6	22	5	5	3.9	0.7	0.9	0.6	5.6	U	6.8	T	T	T	0.0	1	P	1
110365	1	01/08/85	1.37	9.110	66	7.2	39.1	45	12	21	5.2	1.1	2.6	1.4	25.5	U	2.7	0.10	0.5			1	P	1

*** E12 ***

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SURFACE WATER RESOURCES BRANCH

WATER QUALITY DATA SYSTEM

SAMPLING STATION .. G.S. 112101

DRAINAGE BASIN 112

STREAM/STORAGE STH JOHNSTONE R LOCALITY CENTRAL MILL A.M.T.D. 17.1 KM. LATITUDE 17 36 LONGITUDE 145 59

ANAL. NO.	ANALYST	DATE SAMPLED	GAUGE HEIGHT	DISCHARGE	COND. @ 25C	PH	DISS. IONS	DISSOL SOLIDS	HARD	ALK.	NA	K	CA	MG	HCO3	CO3	CL	F	NO3	SO4	PO4	DOM	STK	IRR
113546	1	07/11/85	1.53	14.996	54	7.7	34.2	37	12	16	4.3	1.2	2.4	1.4	19.5	U	5.4	T	T	T	0.0	1	P	1
113768	1	21/11/85	0.85	0.222	140	7.3	69.2	81	10	14	17.0	2.5	1.0	1.9	17.0	U	26.0	0.10	1.2	2.5	0.0	1	P	1
116850	1	24/06/86	1.79	21.118	55	7.3	34.5	42	11	13	4.8	0.9	2.5	1.2	16.0	U	5.0	0.10	2.0	2.0		1	P	1
116833	1	04/09/86	1.46	12.674	60	7.3	39.1	44	13	17	5.0	1.3	2.7	1.5	20.5	U	5.5	0.10	0.5	2.0		1	P	1
117318	1	25/11/86	1.04	4.408	76	7.5	47.4	54	17	24	6.2	1.6	3.7	1.9	29.0	0.1	4.9	T	T	T	0.0	1	P	1
118436	1	13/02/87	1.26	7.862	71	7.2	45.4	49	16	22	6.0	1.4	3.0	2.0	27.0	U	6.0	T	T	T	0.0	1	P	1
119647	1	30/04/87	2.50	29.119	48	7.1	29.2	35	10	12	4.2	1.0	2.2	1.2	14.5	U	5.5	T	0.6	T	0.0	1	P	1
122271	1	30/10/87	1.07	5.380	66	7.5	45.7	52	16	23	6.3	1.2	3.3	1.8	28.0	U	5.0	T	T	T	0.0	1	P	1
123362	1	03/02/88	1.01	4.837	66	7.4	43.2	48	14	22	6.0	1.1	3.0	1.6	26.5	U	5.0	T	T	T	0.0	1	P	1
124507	1	29/04/88	1.73	23.638	56	7.0	32.0	39	9	14	5.0	0.9	2.0	1.0	17.0	U	6.0	T	T	T	0.0	1	P	1
125317	1	13/07/88	1.29	10.693	57	6.5	41.3	47	13	21	5.1	1.0	2.8	1.4	25.0	U	6.0	T	T	T	0.0	1	P	1
127799	1	18/10/88		6.137	62	7.0	41.3	47	14	21	5.0	1.1	2.7	1.7	25.5	U	5.3	T	T	T	0.0	1	P	1
128317	1	23/01/89	1.88	31.191	53	7.0	33.3	42	10	14	5.0	1.0	2.2	1.2	17.0	U	6.8	T	T	T	0.0	1	P	1
130112	1	19/04/89	1.89	36.566	90	7.4	36.7	42	13	15	5.1	1.2	2.6	1.7	18.0	U	8.0	T	T	T	0.0	1	P	1

APPENDIX C

RESULTS OF THE FIELD DATA ANALYSIS FOR THE CROSS–SECTIONS:

NORTH JOHNSTONE RIVER

(Date of measurement: December 6 1990)

RESULTS OF THE COMPUTER CALCULATION BASED ON FIELD MEASUREMENTS
ON DECEMBER 6 1990.

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE: 830- 6-12-1990
STATION DEPTH: 2.20 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.26E+01 dynes/cm**2 U*= 0.16E+01 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.30	-35.00	0.00	-36.
0.80	-33.00	0.22	-35.
1.50	-25.00	0.44	-35.
		0.66	-34.
		0.88	-32.
		1.10	-30.
		1.32	-28.
		1.54	-27.
		1.76	-26.
		1.98	-23.
		2.20	0.

MEAN VELOCITY IN VERICAL = -29.5

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE: 830- 6-12-1990
STATION DEPTH: 2.20 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.30	31.60	0.00	31.65
0.80	31.50	0.22	31.61
1.50	31.30	0.44	31.57
		0.66	31.53
		0.88	31.48
		1.10	31.42
		1.32	31.35
		1.54	31.29
		1.76	31.23
		1.98	31.17
		2.20	31.10

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE: 830- 6-12-1990
STATION DEPTH: 2.20 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.30	0.95	0.00	1.78
0.80	0.95	0.22	1.17
1.50	9.27	0.44	0.56
		0.66	0.43
		0.88	1.54
		1.10	4.01
		1.32	7.02
		1.54	9.69
		1.76	11.69
		1.98	13.95
		2.20	17.59

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE: 830- 6-12-1990
STATION DEPTH: 2.20 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.30	-4.06	0.00	-3.46
0.80	-4.03	0.22	-3.90
1.50	2.21	0.44	-4.34
		0.66	-4.43
		0.88	-3.58
		1.10	-1.73
		1.32	0.52
		1.54	2.53
		1.76	4.03
		1.98	5.73
		2.20	8.45

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE: 845- 6-12-1990
STATION DEPTH: 3.20 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.18E+01 dynes/cm**2 U*= 0.13E+01 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	-51.00	0.00	-59.
2.00	-27.00	0.32	-54.
2.50	-20.00	0.64	-49.
		0.96	-43.
		1.28	-38.
		1.60	-33.
		1.92	-28.
		2.24	-24.
		2.56	-23.
		2.88	-20.
		3.20	0.

MEAN VELOCITY IN VERICAL = -34.6

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE: 845- 6-12-1990
STATION DEPTH: 3.20 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	31.40	0.00	31.36
2.00	31.40	0.32	31.39
2.50	31.30	0.64	31.41
		0.96	31.43
		1.28	31.45
		1.60	31.44
		1.92	31.41
		2.24	31.35
		2.56	31.29
		2.88	31.24
		3.20	31.16

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE: 845- 6-12-1990
STATION DEPTH: 3.20 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	6.39	0.00	5.41
2.00	9.36	0.32	6.04
2.50	10.40	0.64	6.66
		0.96	7.28
		1.28	7.91
		1.60	8.55
		1.92	9.20
		2.24	9.86
		2.56	10.52
		2.88	11.18
		3.20	11.85

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE: 845- 6-12-1990
STATION DEPTH: 3.20 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	0.04	0.00	0.00
2.00	2.25	0.32	0.00
2.50	3.05	0.64	0.24
		0.96	0.69
		1.28	1.15
		1.60	1.63
		1.92	2.12
		2.24	2.63
		2.56	3.14
		2.88	3.65
		3.20	4.17

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE: 940- 6-12-1990
STATION DEPTH: 2.60 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.52E+01 dynes/cm**2 U*= 0.23E+01 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	-36.00	0.00	-29.
1.00	-42.00	0.26	-32.
2.00	-38.00	0.52	-36.
		0.78	-40.
		1.04	-42.
		1.30	-43.
		1.56	-42.
		1.82	-40.
		2.08	-38.
		2.34	-34.
		2.60	0.

MEAN VELOCITY IN VERICAL = -36.9

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE: 940- 6-12-1990
STATION DEPTH: 2.60 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	31.40	0.00	31.39
1.00	31.40	0.26	31.40
2.00	31.30	0.52	31.40
		0.78	31.40
		1.04	31.40
		1.30	31.38
		1.56	31.35
		1.82	31.32
		2.08	31.29
		2.34	31.27
		2.60	31.24

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE: 940- 6-12-1990
STATION DEPTH: 2.60 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	1.73	0.00	1.98
1.00	1.78	0.26	1.85
2.00	4.90	0.52	1.72
		0.78	1.64
		1.04	1.84
		1.30	2.45
		1.56	3.33
		1.82	4.29
		2.08	5.14
		2.34	5.87
		2.60	6.78

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE: 940- 6-12-1990
STATION DEPTH: 2.60 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	-3.42	0.00	-3.23
1.00	-3.38	0.26	-3.32
2.00	-1.03	0.52	-3.42
		0.78	-3.48
		1.04	-3.34
		1.30	-2.88
		1.56	-2.21
		1.82	-1.49
		2.08	0.00
		2.34	-0.30
		2.60	0.38

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE: 950- 6-12-1990
STATION DEPTH: 3.60 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.34E+01 dynes/cm**2 U*= 0.18E+01 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	-45.00	0.00	-44.
1.50	-45.00	0.36	-45.
3.00	-27.00	0.72	-46.
		1.08	-46.
		1.44	-45.
		1.80	-43.
		2.16	-39.
		2.52	-34.
		2.88	-32.
		3.24	-29.
		3.60	0.

MEAN VELOCITY IN VERICAL = -38.5

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE: 950- 6-12-1990
STATION DEPTH: 3.60 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	31.30	0.00	31.31
1.50	31.30	0.36	31.30
3.00	31.40	0.72	31.30
		1.08	31.29
		1.44	31.30
		1.80	31.31
		2.16	31.34
		2.52	31.36
		2.88	31.39
		3.24	31.42
		3.60	31.44

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE: 950- 6-12-1990
STATION DEPTH: 3.60 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	12.18	0.00	11.85
1.50	12.76	0.36	12.09
3.00	13.14	0.72	12.32
		1.08	12.55
		1.44	12.73
		1.80	12.87
		2.16	12.97
		2.52	13.04
		2.88	13.11
		3.24	13.20
		3.60	13.29

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE: 950- 6-12-1990
STATION DEPTH: 3.60 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	4.37	0.00	4.12
1.50	4.80	0.36	4.30
3.00	5.04	0.72	4.47
		1.08	4.64
		1.44	4.78
		1.80	4.87
		2.16	4.94
		2.52	4.98
		2.88	5.03
		3.24	5.08
		3.60	5.14

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1115- 6-12-1990
STATION DEPTH: 3.30 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.58E+01 dynes/cm**2 U*= 0.24E+01 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	-38.00	0.00	-30.
1.00	-45.00	0.33	-35.
2.50	-42.00	0.66	-41.
		0.99	-45.
		1.32	-47.
		1.65	-47.
		1.98	-46.
		2.31	-44.
		2.64	-41.
		2.97	-37.
		3.30	0.

MEAN VELOCITY IN VERICAL = -40.4

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1115- 6-12-1990
STATION DEPTH: 3.30 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	31.30	0.00	31.41
1.00	31.20	0.33	31.34
2.50	31.20	0.66	31.26
		0.99	31.20
		1.32	31.17
		1.65	31.17
		1.98	31.18
		2.31	31.20
		2.64	31.20
		2.97	31.20
		3.30	31.20

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1115- 6-12-1990
STATION DEPTH: 3.30 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	18.77	0.00	18.57
1.00	18.93	0.33	18.70
2.50	18.51	0.66	18.84
		0.99	18.93
		1.32	18.93
		1.65	18.84
		1.98	18.71
		2.31	18.57
		2.64	18.47
		2.97	18.39
		3.30	18.28

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1115- 6-12-1990
STATION DEPTH: 3.30 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	9.25	0.00	9.06
1.00	9.40	0.33	9.18
2.50	9.09	0.66	9.31
		0.99	9.40
		1.32	9.41
		1.65	9.34
		1.98	9.24
		2.31	9.14
		2.64	9.06
		2.97	9.00
		3.30	8.92

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1130- 6-12-1990
STATION DEPTH: 4.30 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.43E+01 dynes/cm**2 U*= 0.21E+01 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	-49.00	0.00	-47.
2.00	-51.00	0.43	-49.
3.80	-30.00	0.86	-50.
		1.29	-52.
		1.72	-52.
		2.15	-50.
		2.58	-47.
		3.01	-41.
		3.44	-37.
		3.87	-33.
		4.30	0.

MEAN VELOCITY IN VERICAL = -43.9

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1130- 6-12-1990
STATION DEPTH: 4.30 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	31.10	0.00	31.15
2.00	31.00	0.43	31.11
3.80	31.10	0.86	31.07
		1.29	31.03
		1.72	31.01
		2.15	31.00
		2.58	31.02
		3.01	31.04
		3.44	31.08
		3.87	31.10
		4.30	31.13

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1130- 6-12-1990
STATION DEPTH: 4.30 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	19.58	0.00	19.53
2.00	19.68	0.43	19.57
3.80	19.46	0.86	19.62
		1.29	19.66
		1.72	19.69
		2.15	19.68
		2.58	19.64
		3.01	19.58
		3.44	19.51
		3.87	19.45
		4.30	19.40

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1130- 6-12-1990
STATION DEPTH: 4.30 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	9.92	0.00	9.86
2.00	10.03	0.43	9.91
3.80	9.83	0.86	9.96
		1.29	10.00
		1.72	10.03
		2.15	10.02
		2.58	9.99
		3.01	9.93
		3.44	9.87
		3.87	9.82
		4.30	9.77

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1236- 6-12-1990
STATION DEPTH: 4.00 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.44E+01 dynes/cm**2 U*= 0.21E+01 cm/s ZO= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	-36.00	0.00	-38.
1.80	-33.00	0.40	-36.
3.20	-39.00	0.80	-35.
		1.20	-34.
		1.60	-33.
		2.00	-33.
		2.40	-35.
		2.80	-37.
		3.20	-37.
		3.60	-33.
		4.00	0.

MEAN VELOCITY IN VERICAL = -33.6

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1236- 6-12-1990
STATION DEPTH: 4.00 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	31.40	0.00	31.49
1.80	31.20	0.40	31.42
3.20	31.10	0.80	31.35
		1.20	31.28
		1.60	31.22
		2.00	31.18
		2.40	31.15
		2.80	31.12
		3.20	31.10
		3.60	31.07
		4.00	31.04

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1236- 6-12-1990
STATION DEPTH: 4.00 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	21.55	0.00	20.84
1.80	23.06	0.40	21.41
3.20	23.30	0.80	21.98
		1.20	22.50
		1.60	22.92
		2.00	23.17
		2.40	23.26
		2.80	23.28
		3.20	23.30
		3.60	23.38
		4.00	23.43

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1236- 6-12-1990
STATION DEPTH: 4.00 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	11.27	0.00	10.71
1.80	12.47	0.40	11.16
3.20	12.67	0.80	11.61
		1.20	12.02
		1.60	12.35
		2.00	12.55
		2.40	12.63
		2.80	12.65
		3.20	12.67
		3.60	12.74
		4.00	12.79

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1250- 6-12-1990
STATION DEPTH: 5.00 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.44E+01 dynes/cm**2 U*= 0.21E+01 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	-30.00	0.00	-26.
1.50	-36.00	0.50	-30.
2.50	-30.00	1.00	-34.
4.00	-20.00	1.50	-36.
		2.00	-34.
		2.50	-30.
		3.00	-28.
		3.50	-25.
		4.00	-20.
		4.00	-20.
		5.00	0.

MEAN VELOCITY IN VERICAL = -27.0

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1250- 6-12-1990
STATION DEPTH: 5.00 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	31.10	0.00	31.15
1.50	31.00	0.50	31.10
2.50	30.90	1.00	31.05
4.00	30.90	1.50	31.00
		2.00	30.94
		2.50	30.90
		3.00	30.89
		3.50	30.89
		4.00	30.90
		4.00	30.90
		5.00	30.90

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1250- 6-12-1990
STATION DEPTH: 5.00 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	22.42	0.00	21.85
1.50	23.41	0.50	22.42
2.50	23.64	1.00	23.00
4.00	24.40	1.50	23.41
		2.00	23.57
		2.50	23.64
		3.00	23.84
		3.50	24.12
		4.00	24.40
		4.00	24.40
		5.00	24.91

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1250- 6-12-1990
STATION DEPTH: 5.00 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	12.03	0.00	11.58
1.50	12.79	0.50	12.03
2.50	13.00	1.00	12.47
4.00	13.56	1.50	12.79
		2.00	12.93
		2.50	13.00
		3.00	13.15
		3.50	13.35
		4.00	13.56
		4.00	13.56
		5.00	13.94

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1415- 6-12-1990
STATION DEPTH: 4.00 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.41E-01 dynes/cm**2 U*= 0.20E+00 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	6.00	0.00	6.
1.50	6.00	0.40	6.
3.30	3.00	0.80	6.
		1.20	6.
		1.60	6.
		2.00	5.
		2.40	5.
		2.80	4.
		3.20	4.
		3.60	3.
		4.00	0.

MEAN VELOCITY IN VERICAL = 4.9

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1415- 6-12-1990
STATION DEPTH: 4.00 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	31.60	0.00	31.83
1.50	31.20	0.40	31.65
3.30	31.00	0.80	31.46
		1.20	31.30
		1.60	31.17
		2.00	31.10
		2.40	31.06
		2.80	31.04
		3.20	31.01
		3.60	30.97
		4.00	30.92

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1415- 6-12-1990
STATION DEPTH: 4.00 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	22.38	0.00	20.52
1.50	25.70	0.40	22.01
3.30	27.79	0.80	23.50
		1.20	24.87
		1.60	25.93
		2.00	26.62
		2.40	27.05
		2.80	27.36
		3.20	27.69
		3.60	28.14
		4.00	28.60

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1415- 6-12-1990
STATION DEPTH: 4.00 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	11.82	0.00	10.36
1.50	14.42	0.40	11.53
3.30	16.04	0.80	12.70
		1.20	13.77
		1.60	14.60
		2.00	15.14
		2.40	15.48
		2.80	15.72
		3.20	15.97
		3.60	16.32
		4.00	16.67

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1423- 6-12-1990
STATION DEPTH: 5.00 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.41E-01 dynes/cm**2 U*= 0.20E+00 cm/s ZO= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	12.00	0.00	8.
1.50	18.00	0.50	12.
3.00	9.00	1.00	16.
4.40	-9.00	1.50	18.
		2.00	17.
		2.50	14.
		3.00	9.
		3.50	4.
		4.00	-3.
		4.00	-3.
		5.00	0.

MEAN VELOCITY IN VERICAL = 8.8

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1423- 6-12-1990
STATION DEPTH: 5.00 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	31.70	0.00	32.11
1.50	31.00	0.50	31.70
3.00	31.00	1.00	31.29
4.40	30.70	1.50	31.00
		2.00	30.92
		2.50	30.96
		3.00	31.00
		3.50	30.93
		4.00	30.80
		4.00	30.80
		5.00	30.57

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1423- 6-12-1990
STATION DEPTH: 5.00 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	22.16	0.00	20.28
1.50	25.62	0.50	22.16
3.00	27.72	1.00	24.03
4.40	28.41	1.50	25.62
		2.00	26.69
		2.50	27.33
		3.00	27.72
		3.50	28.00
		4.00	28.22
		4.00	28.22
		5.00	28.70

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1423- 6-12-1990
STATION DEPTH: 5.00 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	11.61	0.00	10.08
1.50	14.43	0.50	11.61
3.00	16.00	1.00	13.15
4.40	16.61	1.50	14.43
		2.00	15.25
		2.50	15.72
		3.00	16.00
		3.50	16.22
		4.00	16.44
		4.00	16.44
		5.00	16.88

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1520- 6-12-1990
STATION DEPTH: 3.90 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.47E+00 dynes/cm**2 U*= 0.68E+00 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	51.00	0.00	70.
1.50	18.00	0.39	55.
3.00	13.00	0.78	40.
		1.17	27.
		1.56	17.
		1.95	12.
		2.34	10.
		2.73	12.
		3.12	12.
		3.51	11.
		3.90	0.

MEAN VELOCITY IN VERICAL = 23.2

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1520- 6-12-1990
STATION DEPTH: 3.90 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	30.80	0.00	30.90
1.50	30.60	0.39	30.82
3.00	30.30	0.78	30.74
		1.17	30.67
		1.56	30.59
		1.95	30.51
		2.34	30.43
		2.73	30.35
		3.12	30.28
		3.51	30.20
		3.90	30.12

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1520- 6-12-1990
STATION DEPTH: 3.90 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	20.07	0.00	18.06
1.50	23.85	0.39	19.63
3.00	27.86	0.78	21.20
		1.17	22.70
		1.56	24.05
		1.95	25.19
		2.34	26.20
		2.73	27.17
		3.12	28.18
		3.51	29.24
		3.90	30.26

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1520- 6-12-1990
STATION DEPTH: 3.90 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	10.38	0.00	8.86
1.50	13.26	0.39	10.05
3.00	16.35	0.78	11.24
		1.17	12.38
		1.56	13.41
		1.95	14.29
		2.34	15.07
		2.73	15.81
		3.12	16.59
		3.51	17.41
		3.90	18.20

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1530- 6-12-1990
STATION DEPTH: 4.90 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.32E+00 dynes/cm**2 U*= 0.56E+00 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	54.00	0.00	69.
1.50	27.00	0.49	54.
3.50	13.00	0.98	40.
		1.47	28.
		1.96	20.
		2.45	17.
		2.94	15.
		3.43	13.
		3.92	10.
		4.41	9.
		4.90	0.

MEAN VELOCITY IN VERICAL = 24.2

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1530- 6-12-1990
STATION DEPTH: 4.90 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	30.80	0.00	31.08
1.50	30.30	0.49	30.81
3.50	30.00	0.98	30.54
		1.47	30.31
		1.96	30.17
		2.45	30.09
		2.94	30.05
		3.43	30.01
		3.92	29.94
		4.41	29.85
		4.90	29.79

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1530- 6-12-1990
STATION DEPTH: 4.90 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	19.39	0.00	17.75
1.50	22.60	0.49	19.36
3.50	27.90	0.98	20.97
		1.47	22.51
		1.96	23.92
		2.45	25.22
		2.94	26.47
		3.43	27.72
		3.92	29.01
		4.41	30.33
		4.90	31.61

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1530- 6-12-1990
STATION DEPTH: 4.90 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	9.88	0.00	8.57
1.50	12.44	0.49	9.86
3.50	16.48	0.98	11.14
		1.47	12.36
		1.96	13.46
		2.45	14.45
		2.94	15.40
		3.43	16.34
		3.92	17.33
		4.41	18.33
		4.90	19.31

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1640- 6-12-1990
STATION DEPTH: 3.50 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.35E+00 dynes/cm**2 U*= 0.59E+00 cm/s ZO= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	66.00	0.00	90.
1.50	24.00	0.35	73.
2.80	10.00	0.70	56.
		1.05	40.
		1.40	27.
		1.75	18.
		2.10	13.
		2.45	11.
		2.80	10.
		3.15	9.
		3.50	0.

MEAN VELOCITY IN VERICAL = 30.5

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1640- 6-12-1990
STATION DEPTH: 3.50 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	32.30	0.00	32.59
1.50	31.80	0.35	32.39
2.80	31.60	0.70	32.18
		1.05	31.99
		1.40	31.84
		1.75	31.73
		2.10	31.68
		2.45	31.64
		2.80	31.60
		3.15	31.54
		3.50	31.49

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1640- 6-12-1990
STATION DEPTH: 3.50 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	15.04	0.00	11.87
1.50	20.64	0.35	14.09
2.80	23.87	0.70	16.31
		1.05	18.42
		1.40	20.22
		1.75	21.52
		2.10	22.42
		2.45	23.13
		2.80	23.87
		3.15	24.79
		3.50	25.61

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1640- 6-12-1990
STATION DEPTH: 3.50 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	6.14	0.00	3.69
1.50	10.46	0.35	5.40
2.80	12.92	0.70	7.12
		1.05	8.75
		1.40	10.13
		1.75	11.13
		2.10	11.82
		2.45	12.36
		2.80	12.92
		3.15	13.62
		3.50	14.25

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1705- 6-12-1990
STATION DEPTH: 4.50 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.41E+00 dynes/cm**2 U*= 0.63E+00 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	72.00	0.00	92.
1.50	36.00	0.45	74.
2.50	18.00	0.90	56.
3.80	13.00	1.35	40.
		1.80	29.
		2.25	21.
		2.70	16.
		3.15	12.
		3.60	11.
		4.05	10.
		4.50	0.

MEAN VELOCITY IN VERICAL = 31.7

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1705- 6-12-1990
STATION DEPTH: 4.50 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	32.40	0.00	32.68
1.50	31.90	0.45	32.43
2.50	31.70	0.90	32.17
3.80	31.40	1.35	31.96
		1.80	31.82
		2.25	31.74
		2.70	31.66
		3.15	31.56
		3.60	31.45
		4.05	31.34
		4.50	31.24

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1705- 6-12-1990
STATION DEPTH: 4.50 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	14.09	0.00	12.29
1.50	17.95	0.45	13.91
2.50	22.40	0.90	15.53
3.80	25.22	1.35	17.30
		1.80	19.35
		2.25	21.43
		2.70	23.02
		3.15	24.03
		3.60	24.83
		4.05	25.78
		4.50	26.74

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1705- 6-12-1990
STATION DEPTH: 4.50 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	5.40	0.00	3.97
1.50	8.43	0.45	5.25
2.50	11.80	0.90	6.54
3.80	14.00	1.35	7.93
		1.80	9.50
		2.25	11.06
		2.70	12.27
		3.15	13.06
		3.60	13.69
		4.05	14.43
		4.50	15.18

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1800- 6-12-1990
STATION DEPTH: 3.20 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.16E+01 dynes/cm**2 U*= 0.12E+01 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	66.00	0.00	82.
1.50	36.00	0.32	72.
2.50	18.00	0.64	61.
		0.96	51.
		1.28	42.
		1.60	34.
		1.92	27.
		2.24	22.
		2.56	21.
		2.88	19.
		3.20	0.

MEAN VELOCITY IN VERICAL = 39.5

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1800- 6-12-1990
STATION DEPTH: 3.20 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	32.20	0.00	32.38
1.50	31.90	0.32	32.26
2.50	31.80	0.64	32.15
		0.96	32.04
		1.28	31.95
		1.60	31.88
		1.92	31.85
		2.24	31.82
		2.56	31.79
		2.88	31.76
		3.20	31.73

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1800- 6-12-1990
STATION DEPTH: 3.20 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	14.08	0.00	11.12
1.50	19.21	0.32	13.02
2.50	21.44	0.64	14.92
		0.96	16.74
		1.28	18.34
		1.60	19.53
		1.92	20.32
		2.56	20.92
		2.88	22.36
		3.20	23.00

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1800- 6-12-1990
STATION DEPTH: 3.20 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	5.47	0.00	3.21
1.50	9.36	0.32	4.65
2.50	11.05	0.64	6.10
		0.96	7.49
		1.28	8.70
		1.60	9.61
		1.92	10.20
		2.24	10.66
		2.56	11.15
		2.88	11.75
		3.20	12.23

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1810- 6-12-1990
STATION DEPTH: 4.10 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.98E+00 dynes/cm**2 U*= 0.98E+00 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	63.00	0.00	66.
1.60	54.00	0.41	63.
3.20	15.00	0.82	61.
		1.23	58.
		1.64	53.
		2.05	46.
		2.46	36.
		2.87	25.
		3.28	17.
		3.69	16.
		4.10	0.

MEAN VELOCITY IN VERICAL = 41.1

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1810- 6-12-1990
STATION DEPTH: 4.10 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	32.20	0.00	32.29
1.60	32.00	0.41	32.22
3.20	31.70	0.82	32.14
		1.23	32.07
		1.64	31.99
		2.05	31.92
		2.46	31.84
		2.87	31.76
		3.28	31.68
		3.69	31.61
		4.10	31.53

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1810- 6-12-1990
STATION DEPTH: 4.10 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	13.97	0.00	12.56
1.60	17.14	0.41	13.72
3.20	22.28	0.82	14.87
		1.23	16.04
		1.64	17.26
		2.05	18.54
		2.46	19.87
		2.87	21.21
		3.28	22.54
		3.69	23.85
		4.10	25.17

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1810- 6-12-1990
STATION DEPTH: 4.10 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	5.38	0.00	4.31
1.60	7.79	0.41	5.19
3.20	11.71	0.82	6.06
		1.23	6.96
		1.64	7.89
		2.05	8.86
		2.46	9.87
		2.87	10.89
		3.28	11.90
		3.69	12.90
		4.10	13.91

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1850- 6-12-1990
STATION DEPTH: 2.80 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.20E+01 dynes/cm**2 U*= 0.14E+01 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	54.00	0.00	51.
1.00	54.00	0.28	53.
2.00	15.00	0.56	54.
		0.84	55.
		1.12	52.
		1.40	43.
		1.68	31.
		1.96	25.
		2.24	23.
		2.52	21.
		2.80	0.

MEAN VELOCITY IN VERICAL = 38.7

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1850- 6-12-1990
STATION DEPTH: 2.80 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	32.10	0.00	32.09
1.00	32.10	0.28	32.10
2.00	32.00	0.56	32.10
		0.84	32.10
		1.12	32.09
		1.40	32.07
		1.68	32.04
		1.96	32.00
		2.24	31.98
		2.52	31.95
		2.80	31.92

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1850- 6-12-1990
STATION DEPTH: 2.80 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	13.71	0.00	12.98
1.00	14.69	0.28	13.39
2.00	19.29	0.56	13.80
		0.84	14.28
		1.12	15.10
		1.40	16.31
		1.68	17.71
		1.96	19.11
		2.24	20.33
		2.52	21.53
		2.80	22.97

STATION NUMBER: 1 PROFILE NUMBER:NJ DATE:1850- 6-12-1990
STATION DEPTH: 2.80 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	5.22	0.00	4.69
1.00	5.95	0.28	4.99
2.00	9.39	0.56	5.29
		0.84	5.65
		1.12	6.25
		1.40	7.15
		1.68	8.21
		1.96	9.25
		2.24	10.16
		2.52	11.06
		2.80	12.14

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1910- 6-12-1990
STATION DEPTH: 3.80 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.16E+00 dynes/cm**2 U*= 0.40E+00 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	60.00	0.00	72.
1.50	36.00	0.38	63.
3.00	3.00	0.76	54.
		1.14	44.
		1.52	36.
		1.90	27.
		2.28	19.
		2.66	10.
		3.04	7.
		3.42	6.
		3.80	0.

MEAN VELOCITY IN VERICAL = 30.3

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1910- 6-12-1990
STATION DEPTH: 3.80 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	32.10	0.00	32.15
1.50	32.00	0.38	32.11
3.00	31.90	0.76	32.07
		1.14	32.03
		1.52	32.00
		1.90	31.97
		2.28	31.94
		2.66	31.92
		3.04	31.90
		3.42	31.87
		3.80	31.85

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1910- 6-12-1990
STATION DEPTH: 3.80 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	12.73	0.00	10.25
1.50	17.14	0.38	12.13
3.00	19.93	0.76	14.02
		1.14	15.77
		1.52	17.20
		1.90	18.19
		2.28	18.86
		2.66	19.40
		3.04	20.01
		3.42	20.75
		3.80	21.43

STATION NUMBER: 2 PROFILE NUMBER:NJ DATE:1910- 6-12-1990
STATION DEPTH: 3.80 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	4.50	0.00	2.65
1.50	7.79	0.38	4.05
3.00	9.90	0.76	5.46
		1.14	6.77
		1.52	7.84
		1.90	8.58
		2.28	9.09
		2.66	9.50
		3.04	9.95
		3.42	10.51
		3.80	11.02

APPENDIX D

RESULTS OF THE FIELD DATA ANALYSIS FOR THE CROSS–SECTIONS:

SOUTH JOHNSTONE RIVER

(Date of measurement: December 6 1990)

RESULTS OF THE COMPUTER CALCULATION BASED ON FIELD MEASUREMENTS ON DECEMBER 6 1990

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE: 755- 6-12-1990
STATION DEPTH: 7.20 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.47E-02 dynes/cm**2 U*= 0.68E-01 cm/s ZO= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.30	7.00	0.00	8.
1.30	6.00	0.72	6.
2.80	15.00	1.44	7.
4.30	6.00	2.16	12.
5.90	2.00	2.88	15.
		3.60	11.
		4.32	6.
		5.04	3.
		5.76	2.
		6.48	1.
		7.20	0.

MEAN VELOCITY IN VERICAL = 6.7

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE: 755- 6-12-1990
STATION DEPTH: 7.20 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.30	31.60	0.00	31.65
1.30	31.50	0.72	31.53
2.80	31.80	1.44	31.51
4.30	31.80	2.16	31.66
5.90	31.80	2.88	31.81
		3.60	31.83
		4.32	31.80
		5.04	31.79
		5.76	31.80
		6.48	31.80
		7.20	31.80

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE: 755- 6-12-1990
STATION DEPTH: 7.20 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.30	2.27	0.00	0.59
1.30	7.73	0.72	4.61
2.80	13.67	1.44	8.45
4.30	15.49	2.16	11.71
5.90	19.79	2.88	13.84
		3.60	14.72
		4.32	15.52
		5.04	17.24
		5.76	19.39
		6.48	21.31
		7.20	23.29

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE: 755- 6-12-1990
STATION DEPTH: 7.20 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.30	-3.08	0.00	-4.34
1.30	1.01	0.72	-1.32
2.80	5.30	1.44	1.53
4.30	6.64	2.16	3.89
5.90	9.83	2.88	5.42
		3.60	6.06
		4.32	6.67
		5.04	7.94
		5.76	9.53
		6.48	10.95
		7.20	12.42

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE: 745- 6-12-1990
STATION DEPTH: 4.80 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.55E-01 dynes/cm**2 U*= 0.23E+00 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.30	16.00	0.00	17.
1.80	10.00	0.48	15.
3.20	6.00	0.96	13.
		1.44	11.
		1.92	10.
		2.40	8.
		2.88	7.
		3.36	6.
		3.84	4.
		4.32	4.
		4.80	0.

MEAN VELOCITY IN VERICAL = 8.7

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE: 745- 6-12-1990
STATION DEPTH: 4.80 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.30	31.70	0.00	31.71
1.80	31.70	0.48	31.69
3.20	31.90	0.96	31.68
		1.44	31.68
		1.92	31.71
		2.40	31.77
		2.88	31.85
		3.36	31.92
		3.84	31.99
		4.32	32.05
		4.80	32.13

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE: 745- 6-12-1990
STATION DEPTH: 4.80 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.30	2.16	0.00	0.73
1.80	8.64	0.48	3.02
3.20	12.38	0.96	5.27
		1.44	7.31
		1.92	9.03
		2.40	10.39
		2.88	11.58
		3.36	12.80
		3.84	14.15
		4.32	15.48
		4.80	16.65

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE: 745- 6-12-1990
STATION DEPTH: 4.80 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.30	-3.19	0.00	-4.26
1.80	1.61	0.48	-2.55
3.20	4.31	0.96	0.00
		1.44	0.63
		1.92	1.89
		2.40	2.88
		2.88	3.73
		3.36	4.61
		3.84	5.59
		4.32	6.55
		4.80	7.39

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE: 920- 6-12-1990
STATION DEPTH: 7.40 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.12E-01 dynes/cm**2 U*= 0.11E+00 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	-45.00	0.00	-57.
1.20	-30.00	0.74	-39.
2.70	-15.00	1.48	-26.
4.20	-2.00	2.22	-19.
6.00	-2.00	2.96	-13.
		3.70	-6.
		4.44	-1.
		5.18	0.
		5.92	-2.
		6.66	-2.
		7.40	0.

MEAN VELOCITY IN VERICAL = -13.5

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE: 920- 6-12-1990
STATION DEPTH: 7.40 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	31.30	0.00	31.30
1.20	31.30	0.74	31.30
2.70	31.30	1.48	31.30
4.20	31.30	2.22	31.30
6.00	31.30	2.96	31.30
		3.70	31.30
		4.44	31.30
		5.18	31.30
		5.92	31.30
		6.66	31.30
		7.40	31.30

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE: 920- 6-12-1990
STATION DEPTH: 7.40 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	8.76	0.00	7.64
1.20	10.29	0.74	9.31
2.70	12.35	1.48	10.81
4.20	14.22	2.22	11.89
6.00	22.52	2.96	12.53
		3.70	13.19
		4.44	15.01
		5.18	18.33
		5.92	22.13
		6.66	25.50
		7.40	28.97

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE: 920- 6-12-1990
STATION DEPTH: 7.40 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	1.84	0.00	1.00
1.20	2.96	0.74	2.24
2.70	4.49	1.48	3.35
4.20	5.88	2.22	4.15
6.00	12.03	2.96	4.62
		3.70	5.11
		4.44	6.46
		5.18	8.92
		5.92	11.74
		6.66	14.24
		7.40	16.81

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE: 910- 6-12-1990
STATION DEPTH: 5.00 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.12E-01 dynes/cm**2 U*= 0.11E+00 cm/s ZO= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	-36.00	0.00	-45.
1.00	-27.00	0.50	-36.
2.50	-9.00	1.00	-27.
4.20	-3.00	1.50	-19.
		2.00	-14.
		2.50	-9.
		3.00	-6.
		3.50	-4.
		4.00	-3.
		4.00	-3.
		5.00	0.

MEAN VELOCITY IN VERICAL = -14.3

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE: 910- 6-12-1990
STATION DEPTH: 5.00 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	31.20	0.00	31.10
1.00	31.30	0.50	31.20
2.50	31.30	1.00	31.30
4.20	31.40	1.50	31.33
		2.00	31.32
		2.50	31.30
		3.00	31.31
		3.50	31.35
		4.00	31.39
		4.00	31.39
		5.00	31.45

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE: 910- 6-12-1990
STATION DEPTH: 5.00 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	8.00	0.00	7.85
1.00	8.15	0.50	8.00
2.50	12.41	1.00	8.15
4.20	13.90	1.50	9.25
		2.00	10.90
		2.50	12.41
		3.00	13.24
		3.50	13.58
		4.00	13.78
		4.00	13.78
		5.00	14.60

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE: 910- 6-12-1990
STATION DEPTH: 5.00 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	1.30	0.00	1.23
1.00	1.38	0.50	1.30
2.50	4.54	1.00	1.38
4.20	5.61	1.50	2.18
		2.00	3.41
		2.50	4.54
		3.00	5.15
		3.50	5.38
		4.00	5.52
		4.00	5.52
		5.00	6.11

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1050- 6-12-1990
STATION DEPTH: 8.10 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.74E+00 dynes/cm**2 U*= 0.85E+00 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	-45.00	0.00	-46.
1.50	-42.00	0.81	-44.
3.00	-36.00	1.62	-42.
4.50	-30.00	2.43	-38.
6.00	-24.00	3.24	-35.
7.50	-12.00	4.05	-32.
		4.86	-29.
		5.67	-26.
		6.48	-21.
		7.29	-15.
		8.10	0.

MEAN VELOCITY IN VERICAL = -30.5

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1050- 6-12-1990
STATION DEPTH: 8.10 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	31.40	0.00	31.52
1.50	31.20	0.81	31.33
3.00	31.20	1.62	31.19
4.50	31.20	2.43	31.18
6.00	31.10	3.24	31.21
7.50	31.00	4.05	31.21
		4.86	31.18
		5.67	31.12
		6.48	31.07
		7.29	31.01
		8.10	30.96

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1050- 6-12-1990
STATION DEPTH: 8.10 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	15.14	0.00	14.62
1.50	16.09	0.81	15.46
3.00	16.81	1.62	16.18
4.50	17.36	2.43	16.60
6.00	17.69	3.24	16.90
7.50	18.16	4.05	17.21
		4.86	17.45
		5.67	17.62
		6.48	17.83
		7.29	18.09
		8.10	18.34

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1050- 6-12-1990
STATION DEPTH: 8.10 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	6.52	0.00	6.09
1.50	7.30	0.81	6.79
3.00	7.83	1.62	7.37
4.50	8.23	2.43	7.68
6.00	8.52	3.24	7.90
7.50	8.89	4.05	8.12
		4.86	8.31
		5.67	8.45
		6.48	8.63
		7.29	8.84
		8.10	9.04

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1015- 6-12-1990
STATION DEPTH: 5.40 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.58E+00 dynes/cm**2 U*= 0.76E+00 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	-27.00	0.00	-24.
1.50	-33.00	0.54	-27.
3.00	-33.00	1.08	-31.
4.50	-12.00	1.62	-34.
		2.16	-35.
		2.70	-35.
		3.24	-31.
		3.78	-24.
		4.32	-15.
		4.86	-13.
		5.40	0.

MEAN VELOCITY IN VERICAL = -25.7

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1015- 6-12-1990
STATION DEPTH: 5.40 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	31.40	0.00	31.52
1.50	31.20	0.54	31.39
3.00	31.20	1.08	31.27
4.50	31.10	1.62	31.19
		2.16	31.18
		2.70	31.20
		3.24	31.19
		3.78	31.16
		4.32	31.11
		4.86	31.08
		5.40	31.04

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1015- 6-12-1990
STATION DEPTH: 5.40 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	12.04	0.00	10.95
1.50	13.96	0.54	12.13
3.00	15.20	1.08	13.25
4.50	17.09	1.62	14.11
		2.16	14.61
		2.70	14.97
		3.24	15.44
		3.78	16.11
		4.32	16.85
		4.86	17.54
		5.40	18.22

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1015- 6-12-1990
STATION DEPTH: 5.40 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	4.23	0.00	3.38
1.50	5.72	0.54	4.30
3.00	6.64	1.08	5.17
4.50	8.07	1.62	5.84
		2.16	6.21
		2.70	6.46
		3.24	6.82
		3.78	7.33
		4.32	7.89
		4.86	8.41
		5.40	8.93

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1220- 6-12-1990
STATION DEPTH: 8.80 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.13E+01 dynes/cm**2 U*= 0.11E+01 cm/s ZO= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	-27.00	0.00	-29.
1.50	-24.00	0.88	-25.
3.00	-30.00	1.76	-24.
5.00	-33.00	2.64	-28.
7.00	-33.00	3.52	-31.
8.10	-15.00	4.40	-32.
		5.28	-34.
		6.16	-36.
		7.04	-33.
		7.92	-20.
		8.80	0.

MEAN VELOCITY IN VERICAL = -28.0

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1220- 6-12-1990
STATION DEPTH: 8.80 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	31.00	0.00	30.93
1.50	31.10	0.88	31.05
3.00	31.00	1.76	31.10
5.00	31.00	2.64	31.03
7.00	30.90	3.52	30.98
8.10	30.90	4.40	31.00
		5.28	30.99
		6.16	30.94
		7.04	30.90
		7.92	30.90
		8.80	30.90

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1220- 6-12-1990
STATION DEPTH: 8.80 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	20.36	0.00	20.21
1.50	20.69	0.88	20.47
3.00	21.35	1.76	20.80
5.00	21.85	2.64	21.21
7.00	22.64	3.52	21.50
8.10	22.83	4.40	21.69
		5.28	21.95
		6.16	22.33
		7.04	22.65
		7.92	22.80
		8.80	22.95

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1220- 6-12-1990
STATION DEPTH: 8.80 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	10.53	0.00	10.44
1.50	10.74	0.88	10.60
3.00	11.26	1.76	10.82
5.00	11.63	2.64	11.15
7.00	12.26	3.52	11.38
8.10	12.40	4.40	11.51
		5.28	11.71
		6.16	12.01
		7.04	12.26
		7.92	12.37
		8.80	12.48

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1200- 6-12-1990
STATION DEPTH: 6.30 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.22E+01 dynes/cm**2 U*= 0.15E+01 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	-30.00	0.00	-25.
1.50	-39.00	0.63	-31.
2.50	-42.00	1.26	-37.
4.00	-42.00	1.89	-41.
5.30	-27.00	2.52	-42.
		3.15	-43.
		3.78	-43.
		4.41	-39.
		5.04	-31.
		5.67	-25.
		6.30	0.

MEAN VELOCITY IN VERICAL = -34.6

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1200- 6-12-1990
STATION DEPTH: 6.30 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	30.70	0.00	30.45
1.50	31.10	0.63	30.77
2.50	31.10	1.26	31.04
4.00	31.10	1.89	31.13
5.30	31.20	2.52	31.10
		3.15	31.08
		3.78	31.09
		4.41	31.13
		5.04	31.18
		5.67	31.23
		6.30	31.28

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1200- 6-12-1990
STATION DEPTH: 6.30 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	19.19	0.00	18.56
1.50	20.32	0.63	19.35
2.50	20.87	1.26	20.08
4.00	20.75	1.89	20.62
5.30	20.77	2.52	20.88
		3.15	20.88
		3.78	20.78
		4.41	20.74
		5.04	20.76
		5.67	20.77
		6.30	20.79

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1200- 6-12-1990
STATION DEPTH: 6.30 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	9.76	0.00	9.39
1.50	10.46	0.63	9.86
2.50	10.88	1.26	10.31
4.00	10.78	1.89	10.68
5.30	10.76	2.52	10.88
		3.15	10.89
		3.78	10.81
		4.41	10.76
		5.04	10.76
		5.67	10.76
		6.30	10.75

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1400- 6-12-1990
STATION DEPTH: 9.00 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.75E-02 dynes/cm**2 U*= 0.86E-01 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	-1.00	0.00	0.
1.50	-3.00	0.90	-2.
3.00	-6.00	1.80	-3.
5.00	-12.00	2.70	-5.
7.00	-3.00	3.60	-8.
8.50	-1.00	4.50	-12.
		5.40	-11.
		6.30	-6.
		7.20	-2.
		8.10	-2.
		9.00	0.

MEAN VELOCITY IN VERICAL = -5.2

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1400- 6-12-1990
STATION DEPTH: 9.00 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	31.20	0.00	31.37
1.50	30.90	0.90	31.06
3.00	30.80	1.80	30.85
5.00	30.80	2.70	30.80
7.00	30.80	3.60	30.80
8.50	30.80	4.50	30.80
		5.40	30.80
		6.30	30.80
		7.20	30.80
		8.10	30.80
		9.00	30.80

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1400- 6-12-1990
STATION DEPTH: 9.00 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	25.07	0.00	23.11
1.50	28.42	0.90	26.64
3.00	28.61	1.80	28.84
5.00	28.74	2.70	28.77
7.00	28.80	3.60	28.48
8.50	28.74	4.50	28.62
		5.40	28.80
		6.30	28.83
		7.20	28.79
		8.10	28.76
		9.00	28.72

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1400- 6-12-1990
STATION DEPTH: 9.00 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	13.96	0.00	12.43
1.50	16.55	0.90	15.17
3.00	16.73	1.80	16.88
5.00	16.82	2.70	16.85
7.00	16.87	3.60	16.63
8.50	16.82	4.50	16.74
		5.40	16.87
		6.30	16.89
		7.20	16.87
		8.10	16.84
		9.00	16.81

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1345- 6-12-1990
STATION DEPTH: 6.60 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.96E+00 dynes/cm**2 U*= 0.97E+00 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	-9.00	0.00	-5.
1.50	-15.00	0.66	-10.
3.00	-9.00	1.32	-15.
4.50	-18.00	1.98	-14.
6.00	-18.00	2.64	-10.
		3.30	-10.
		3.96	-15.
		4.62	-18.
		5.28	-18.
		5.94	-17.
		6.60	0.

MEAN VELOCITY IN VERICAL = -12.9

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1345- 6-12-1990
STATION DEPTH: 6.60 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	31.00	0.00	30.99
1.50	31.00	0.66	31.00
3.00	30.90	1.32	31.00
4.50	30.80	1.98	30.98
6.00	30.90	2.64	30.93
		3.30	30.87
		3.96	30.82
		4.62	30.80
		5.28	30.84
		5.94	30.90
		6.60	30.94

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1345- 6-12-1990
STATION DEPTH: 6.60 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	25.68	0.00	24.27
1.50	28.04	0.66	26.13
3.00	28.36	1.32	27.75
4.50	28.74	1.98	28.44
6.00	28.55	2.64	28.41
		3.30	28.38
		3.96	28.59
		4.62	28.75
		5.28	28.69
		5.94	28.56
		6.60	28.48

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1345- 6-12-1990
STATION DEPTH: 6.60 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	14.48	0.00	13.43
1.50	16.24	0.66	14.81
3.00	16.51	1.32	16.01
4.50	16.82	1.98	16.53
6.00	16.65	2.64	16.53
		3.30	16.53
		3.96	16.71
		4.62	16.83
		5.28	16.78
		5.94	16.66
		6.60	16.58

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1500- 6-12-1990
STATION DEPTH: 9.00 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.31E-02 dynes/cm**2 U*= 0.55E-01 cm/s ZO= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	9.00	0.00	12.
2.00	3.00	0.90	7.
4.00	6.00	1.80	3.
6.00	3.00	2.70	3.
8.00	1.00	3.60	5.
		4.50	6.
		5.40	4.
		6.30	3.
		7.20	2.
		8.10	1.
		9.00	0.

MEAN VELOCITY IN VERICAL = 4.0

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1500- 6-12-1990
STATION DEPTH: 9.00 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	31.90	0.00	31.86
2.00	31.90	0.90	31.93
4.00	31.30	1.80	31.93
6.00	31.10	2.70	31.72
8.00	30.90	3.60	31.41
		4.50	31.21
		5.40	31.13
		6.30	31.08
		7.20	30.99
		8.10	30.89
		9.00	30.80

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1500- 6-12-1990
STATION DEPTH: 9.00 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	23.23	0.00	22.79
2.00	24.60	0.90	23.59
4.00	26.66	1.80	24.41
6.00	28.63	2.70	25.27
8.00	28.87	3.60	26.22
		4.50	27.24
		5.40	28.19
		6.30	28.75
		7.20	28.86
		8.10	28.88
		9.00	29.00

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1500- 6-12-1990
STATION DEPTH: 9.00 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	12.34	0.00	12.03
2.00	13.35	0.90	12.60
4.00	15.10	1.80	13.21
6.00	16.64	2.70	13.92
8.00	16.89	3.60	14.73
		4.50	15.57
		5.40	16.30
		6.30	16.74
		7.20	16.85
		8.10	16.90
		9.00	17.02

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1450- 6-12-1990
STATION DEPTH: 6.60 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.81E+00 dynes/cm**2 U*= 0.89E+00 cm/s Z0= 0.67E-01
cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	9.00	0.00	21.
1.00	1.00	0.66	5.
2.00	24.00	1.32	5.
4.00	12.00	1.98	24.
6.00	15.00	2.64	28.
		3.30	21.
		3.96	12.
		4.62	12.
		5.28	15.
		5.94	15.
		6.60	0.

MEAN VELOCITY IN VERICAL = 14.9

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1450- 6-12-1990
STATION DEPTH: 6.60 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	31.70	0.00	31.89
1.00	31.50	0.66	31.64
2.00	31.00	1.32	31.34
4.00	30.80	1.98	31.01
6.00	30.80	2.64	30.83
		3.30	30.78
		3.96	30.80
		4.62	30.81
		5.28	30.80
		5.94	30.80
		6.60	30.80

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1450- 6-12-1990
STATION DEPTH: 6.60 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	23.95	0.00	22.65
1.00	25.23	0.66	24.36
2.00	27.40	1.32	26.02
4.00	28.61	1.98	27.37
6.00	28.87	2.64	28.15
		3.30	28.49
		3.96	28.60
		4.62	28.68
		5.28	28.77
		5.94	28.86
		6.60	28.95

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1450- 6-12-1990
STATION DEPTH: 6.60 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	12.94	0.00	11.92
1.00	13.97	0.66	13.27
2.00	15.76	1.32	14.61
4.00	16.73	1.98	15.73
6.00	16.92	2.64	16.38
		3.30	16.65
		3.96	16.72
		4.62	16.78
		5.28	16.85
		5.94	16.91
		6.60	16.98

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1615- 6-12-1990
STATION DEPTH: 8.70 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.77E+00 dynes/cm**2 U*= 0.87E+00 cm/s ZO= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	39.00	0.00	40.
2.00	36.00	0.87	38.
4.00	33.00	1.74	36.
6.00	21.00	2.61	36.
8.00	15.00	3.48	35.
		4.35	31.
		5.22	26.
		6.09	21.
		6.96	18.
		7.83	16.
		8.70	0.

MEAN VELOCITY IN VERICAL = 27.6

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1615- 6-12-1990
STATION DEPTH: 8.70 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	32.30	0.00	32.26
2.00	32.30	0.87	32.33
4.00	31.70	1.74	32.33
6.00	31.50	2.61	32.15
8.00	31.40	3.48	31.86
		4.35	31.63
		5.22	31.53
		6.09	31.50
		6.96	31.46
		7.83	31.41
		8.70	31.36

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1615- 6-12-1990
STATION DEPTH: 8.70 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	20.62	0.00	20.42
2.00	21.65	0.87	20.76
4.00	25.32	1.74	21.35
6.00	27.00	2.61	22.64
8.00	27.18	3.48	24.38
		4.35	25.82
		5.22	26.65
		6.09	27.02
		6.96	27.14
		7.83	27.17
		8.70	27.24

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1615- 6-12-1990
STATION DEPTH: 8.70 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	10.26	0.00	10.13
2.00	11.03	0.87	10.36
4.00	13.96	1.74	10.79
6.00	15.28	2.61	11.82
8.00	15.45	3.48	13.21
		4.35	14.36
		5.22	15.01
		6.09	15.30
		6.96	15.40
		7.83	15.44
		8.70	15.51

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1600- 6-12-1990
STATION DEPTH: 6.30 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.41E+00 dynes/cm**2 U*= 0.64E+00 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	27.00	0.00	19.
1.00	33.00	0.63	29.
2.00	25.00	1.26	33.
3.50	18.00	1.89	26.
5.20	12.00	2.52	21.
		3.15	19.
		3.78	17.
		4.41	15.
		5.04	13.
		5.67	11.
		6.30	0.

MEAN VELOCITY IN VERICAL = 19.4

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1600- 6-12-1990
STATION DEPTH: 6.30 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	32.20	0.00	32.17
1.00	32.20	0.63	32.21
2.00	31.90	1.26	32.14
3.50	31.80	1.89	31.93
5.20	30.70	2.52	31.86
		3.15	31.86
		3.78	31.69
		4.41	31.29
		5.04	30.81
		5.67	30.40
		6.30	29.99

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1600- 6-12-1990
STATION DEPTH: 6.30 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	20.66	0.00	19.55
1.00	21.69	0.63	20.95
2.00	22.74	1.26	22.08
3.50	24.21	1.89	22.67
5.20	28.47	2.52	23.09
		3.15	23.69
		3.78	24.76
		4.41	26.33
		5.04	28.05
		5.67	29.64
		6.30	31.23

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1600- 6-12-1990
STATION DEPTH: 6.30 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	10.33	0.00	9.52
1.00	11.09	0.63	10.54
2.00	11.98	1.26	11.40
3.50	13.10	1.89	11.91
5.20	16.66	2.52	12.25
		3.15	12.69
		3.78	13.55
		4.41	14.86
		5.04	16.31
		5.67	17.63
		6.30	18.96

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1740- 6-12-1990
STATION DEPTH: 8.30 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.12E+01 dynes/cm**2 U*= 0.11E+01 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	39.00	0.00	42.
1.00	36.00	0.83	37.
2.00	27.00	1.66	30.
3.00	27.00	2.49	26.
5.00	24.00	3.32	27.
7.30	20.00	4.15	26.
		4.98	24.
		5.81	23.
		6.64	22.
		7.47	19.
		8.30	0.

MEAN VELOCITY IN VERICAL = 25.5

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1740- 6-12-1990
STATION DEPTH: 8.30 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	32.60	0.00	32.70
1.00	32.50	0.83	32.53
2.00	32.40	1.66	32.42
3.00	32.40	2.49	32.41
5.00	32.00	3.32	32.36
7.30	32.00	4.15	32.18
		4.98	32.00
		5.81	31.95
		6.64	31.98
		7.47	32.00
		8.30	32.00

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1740- 6-12-1990
STATION DEPTH: 8.30 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	17.41	0.00	16.58
1.00	18.15	0.83	17.95
2.00	18.54	1.66	18.35
3.00	20.64	2.49	19.40
5.00	23.56	3.32	21.34
7.30	24.55	4.15	22.70
		4.98	23.54
		5.81	24.02
		6.64	24.32
		7.47	24.62
		8.30	24.98

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1740- 6-12-1990
STATION DEPTH: 8.30 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	7.78	0.00	7.13
1.00	8.36	0.83	8.21
2.00	8.69	1.66	8.54
3.00	10.24	2.49	9.33
5.00	12.55	3.32	10.77
7.30	13.28	4.15	11.85
		4.98	12.54
		5.81	12.91
		6.64	13.12
		7.47	13.33
		8.30	13.60

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1730- 6-12-1990
STATION DEPTH: 5.90 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.26E+01 dynes/cm**2 U*= 0.16E+01 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	39.00	0.00	31.
1.00	45.00	0.59	40.
2.00	33.00	1.18	45.
3.50	27.00	1.77	37.
5.00	30.00	2.36	29.
		2.95	27.
		3.54	27.
		4.13	27.
		4.72	28.
		5.31	27.
		5.90	0.

MEAN VELOCITY IN VERICAL = 30.5

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1730- 6-12-1990
STATION DEPTH: 5.90 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	32.60	0.00	32.33
1.00	32.80	0.59	32.65
2.00	32.50	1.18	32.80
3.50	32.50	1.77	32.59
5.00	32.20	2.36	32.44
		2.95	32.47
		3.54	32.50
		4.13	32.41
		4.72	32.27
		5.31	32.14
		5.90	32.02

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1730- 6-12-1990
STATION DEPTH: 5.90 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	17.35	0.00	16.33
1.00	18.40	0.59	17.53
2.00	20.54	1.18	18.81
3.50	21.38	1.77	20.13
5.00	21.69	2.36	20.98
		2.95	21.30
		3.54	21.39
		4.13	21.49
		4.72	21.63
		5.31	21.75
		5.90	21.88

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1730- 6-12-1990
STATION DEPTH: 5.90 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	7.74	0.00	7.08
1.00	8.44	0.59	7.85
2.00	10.13	1.18	8.74
3.50	10.76	1.77	9.80
5.00	11.09	2.36	10.48
		2.95	10.70
		3.54	10.76
		4.13	10.87
		4.72	11.02
		5.31	11.16
		5.90	11.30

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1825- 6-12-1990
STATION DEPTH: 8.00 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.29E+00 dynes/cm**2 U*= 0.54E+00 cm/s ZO= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	48.00	0.00	51.
1.00	45.00	0.80	46.
2.00	33.00	1.60	38.
4.00	18.00	2.40	29.
6.20	12.00	3.20	22.
		4.00	18.
		4.80	15.
		5.60	13.
		6.40	11.
		7.20	9.
		8.00	0.

MEAN VELOCITY IN VERICAL = 22.9

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1825- 6-12-1990
STATION DEPTH: 8.00 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	32.50	0.00	32.26
1.00	32.70	0.80	32.65
2.00	32.40	1.60	32.57
4.00	32.40	2.40	32.32
6.20	31.80	3.20	32.34
		4.00	32.40
		4.80	32.27
		5.60	32.00
		6.40	31.74
		7.20	31.54
		8.00	31.31

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1825- 6-12-1990
STATION DEPTH: 8.00 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	16.21	0.00	14.88
1.00	17.43	0.80	17.00
2.00	18.07	1.60	17.99
4.00	19.74	2.40	18.20
6.20	23.96	3.20	18.75
		4.00	19.74
		4.80	21.13
		5.60	22.74
		6.40	24.35
		7.20	25.87
		8.00	27.42

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1825- 6-12-1990
STATION DEPTH: 8.00 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	6.93	0.00	6.04
1.00	7.76	0.80	7.46
2.00	8.34	1.60	8.22
4.00	9.57	2.40	8.46
6.20	12.92	3.20	8.87
		4.00	9.57
		4.80	10.65
		5.60	11.94
		6.40	13.23
		7.20	14.43
		8.00	15.66

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1835- 6-12-1990
STATION DEPTH: 5.60 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.17E+00 dynes/cm**2 U*= 0.40E+00 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	48.00	0.00	53.
1.50	39.00	0.56	47.
3.00	33.00	1.12	42.
4.50	9.00	1.68	38.
		2.24	37.
		2.80	35.
		3.36	29.
		3.92	19.
		4.48	9.
		5.04	7.
		5.60	0.

MEAN VELOCITY IN VERICAL = 29.0

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1835- 6-12-1990
STATION DEPTH: 5.60 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	32.30	0.00	32.03
1.50	32.70	0.56	32.33
3.00	32.40	1.12	32.60
4.50	32.50	1.68	32.71
		2.24	32.60
		2.80	32.44
		3.36	32.38
		3.92	32.43
		4.48	32.50
		5.04	32.53
		5.60	32.57

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1835- 6-12-1990
STATION DEPTH: 5.60 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	16.04	0.00	14.83
1.50	18.14	0.56	16.18
3.00	19.14	1.12	17.46
4.50	20.00	1.68	18.38
		2.24	18.83
		2.80	19.06
		3.36	19.31
		3.92	19.64
		4.48	19.99
		5.04	20.30
		5.60	20.63

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1835- 6-12-1990
STATION DEPTH: 5.60 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	6.87	0.00	6.08
1.50	8.28	0.56	6.97
3.00	9.13	1.12	7.81
4.50	9.73	1.68	8.46
		2.24	8.84
		2.80	9.06
		3.36	9.27
		3.92	9.49
		4.48	9.72
		5.04	9.95
		5.60	10.17

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1945- 6-12-1990
STATION DEPTH: 7.70 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.12E+00 dynes/cm**2 U*= 0.34E+00 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	39.00	0.00	40.
1.50	36.00	0.77	38.
3.00	24.00	1.54	36.
5.00	10.00	2.31	30.
6.90	6.00	3.08	23.
		3.85	17.
		4.62	12.
		5.39	9.
		6.16	7.
		6.93	6.
		7.70	0.

MEAN VELOCITY IN VERICAL = 19.8

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1945- 6-12-1990
STATION DEPTH: 7.70 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	32.30	0.00	32.29
1.50	32.30	0.77	32.30
3.00	32.20	1.54	32.30
5.00	32.20	2.31	32.24
6.90	32.00	3.08	32.20
		3.85	32.20
		4.62	32.21
		5.39	32.17
		6.16	32.09
		6.93	32.00
		7.70	31.92

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1945- 6-12-1990
STATION DEPTH: 7.70 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	12.39	0.00	12.10
1.50	12.85	0.77	12.55
3.00	14.78	1.54	12.86
5.00	26.93	2.31	13.12
6.90	27.42	3.08	15.14
		3.85	19.92
		4.62	25.12
		5.39	27.88
		6.16	27.91
		6.93	27.42
		7.70	27.62

STATION NUMBER: 1 PROFILE NUMBER:SJ DATE:1945- 6-12-1990
STATION DEPTH: 7.70 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	4.18	0.00	3.96
1.50	4.52	0.77	4.30
3.00	5.98	1.54	4.52
5.00	14.98	2.31	4.73
6.90	15.41	3.08	6.24
		3.85	9.79
		4.62	13.64
		5.39	15.69
		6.16	15.74
		6.93	15.42
		7.70	15.60

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1930- 6-12-1990
STATION DEPTH: 5.30 m
VELOCITY DATA (cm/s); POSITIVE VALUES DENOTE EBB FLOW
AND NEGATIVE VALUES FLOOD FLOW
COMPUTED PARAMETERS:
STRESS= 0.57E-01 dynes/cm**2 U*= 0.24E+00 cm/s Z0= 0.67E-01 cm

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	VELOCITY	DEPTH(m)	VELOCITY
0.50	39.00	0.00	42.
2.00	33.00	0.53	39.
3.00	30.00	1.06	36.
4.40	2.00	1.59	34.
		2.12	33.
		2.65	32.
		3.18	28.
		3.71	18.
		4.24	6.
		4.77	4.
		5.30	0.

MEAN VELOCITY IN VERICAL = 25.1

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1930- 6-12-1990
STATION DEPTH: 5.30 m
TEMPERATURE DATA (C)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	TEMPERATURE	DEPTH(m)	TEMPERATURE
0.50	32.20	0.00	32.29
2.00	32.00	0.53	32.19
3.00	32.00	1.06	32.10
4.40	31.90	1.59	32.03
		2.12	32.00
		2.65	32.00
		3.18	31.99
		3.71	31.96
		4.24	31.91
		4.77	31.88
		5.30	31.84

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1930- 6-12-1990
STATION DEPTH: 5.30 m
SALINITY DATA (PPT)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SALINITY	DEPTH(m)	SALINITY
0.50	13.05	0.00	12.56
2.00	14.14	0.53	13.08
3.00	14.72	1.06	13.57
4.40	19.21	1.59	13.97
		2.12	14.16
		2.65	14.32
		3.18	15.10
		3.71	16.73
		4.24	18.66
		4.77	20.36
		5.30	22.09

STATION NUMBER: 2 PROFILE NUMBER:SJ DATE:1930- 6-12-1990
STATION DEPTH: 5.30 m
DENSITY DATA (SIGMA-T UNITS)

MEASUREMENTS		COMPUTED PROFILE	
DEPTH(m)	SIGMA-T	DEPTH(m)	SIGMA-T
0.50	4.70	0.00	4.31
2.00	5.58	0.53	4.72
3.00	6.01	1.06	5.12
4.40	9.36	1.59	5.44
		2.12	5.60
		2.65	5.71
		3.18	6.29
		3.71	7.51
		4.24	8.95
		4.77	10.22
		5.30	11.52