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PROJECT TCP/SOM/8906 & 0104

FAO TECHNICAL CO-OPERATION PROGRAMME / SOMALI GOVERNMENT

V O L U M E ' 2 '

JUBBA HYDROMETRIC DATA (1980/81)

HYDROLOGICAL DATA COLLECTION AND UPGRADING OF THE NATIONAL
HYDROMETRIC NETWORK ON THE JUBBA AND SHEBELLI RIVERS, ALSO
THE IN-SERVICE TRAINING OF THE FIELD OPERATIONAL STAFF

By

BRIAN A.P. GEMMELL

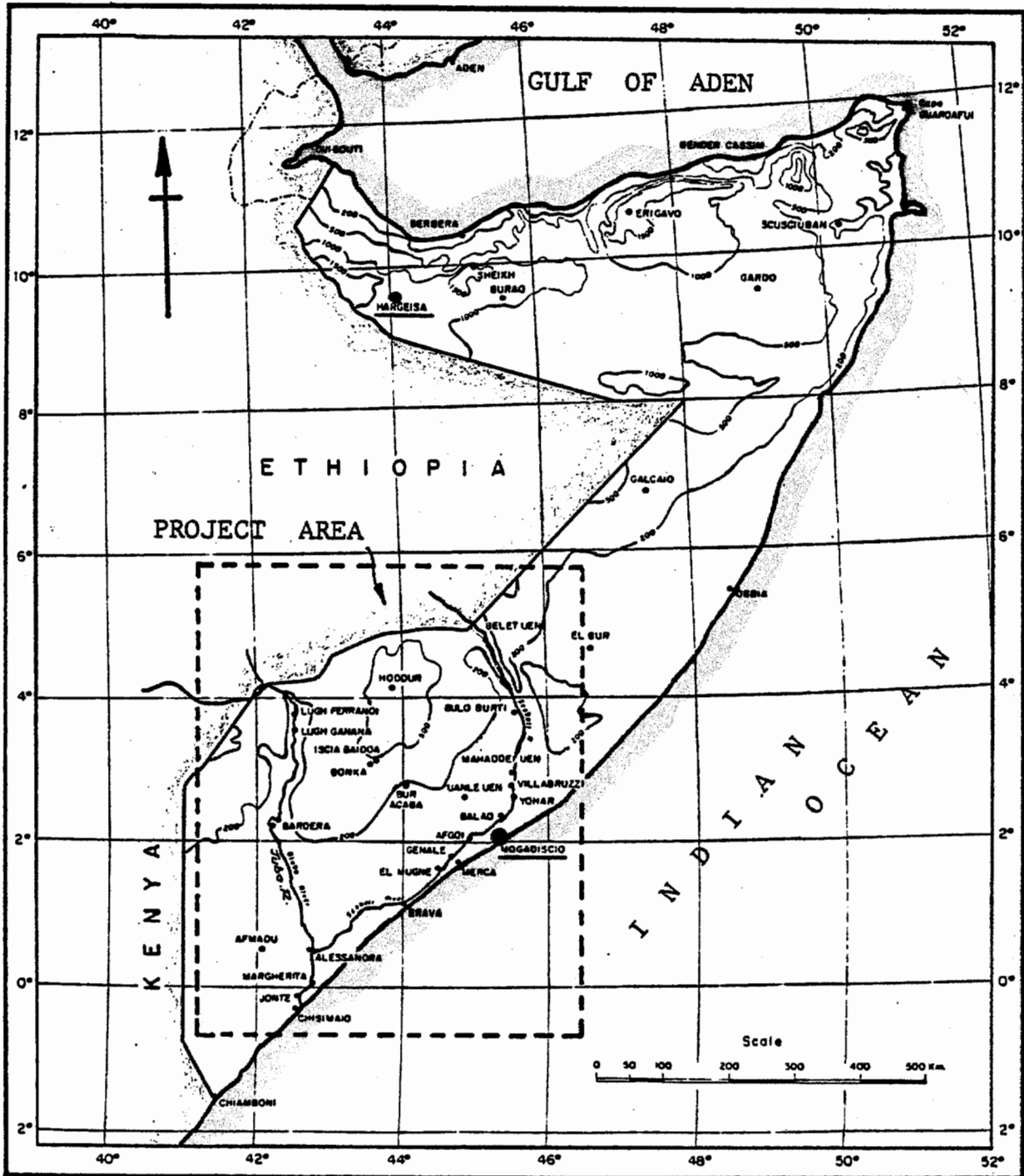
(FAO Consultant Hydrologist)

May 1982

Harrow, Middlesex, England.

TOPOGRAPHICAL MAP

SHOWING PROJECT AREA



F O R E W O R D

This Report has been prepared by the Consultant from data collected during the course of his four missions to Somalia between January 1980 and December 1981, while Managing the 'Water Hydrometry' Project TCP/SOM/8906 & 0104, in conjunction with the Director of the Land and Water Development Department of The Ministry of Agriculture, in Mogadishu.

The recommendations and conclusions appearing in this report are those that were considered appropriate at the time of preparation and maybe modified in the light of further knowledge obtained in the future.

The information and data available for the preparation of this report, was only obtained by close collaboration with personnel from the Ministry of Agriculture.

ABBREVIATIONS

mm	-	millimeters
cm	-	centimeters
m	-	meters
m ²	-	meters squared
m ³	-	meters cubed
mcm	-	million cubic meters
m ³ x 10 ⁶	-	" " "
m ³ x 10 ³	-	thousands of cubic meters
Km	-	Kilometer
Km ²	-	Kilometers square
m/sec	-	meters per second
m ³ /sec	-	meters cubed per second
W.L.	-	water level
R/B	-	right bank
L/B	-	left bank
S/A	-	slope area measurement
WP	-	wetted perimeter
R	-	hydraulic radius
S	-	slope
A	-	area
n	-	roughness factor
BM	-	benchmark
TBM	-	temporary benchmark
CTF	-	cease to flow
R.L.	-	relative level
A.D.	-	assumed datum
WERB	-	waters edge right bank
WELB	-	waters edge left bank
MSL	-	mean sea level
G.Z.	-	gauge zero
'MB'	-	measuring point (bridge)
'MP'	-	measuring point (recorder well)
G.H.	-	gauge height

P R E F A C E

The Hydrometry Project TCP/SOM/8906 was born after the visit to Somalia of the Hydrologist Jean C. Henry in 1979, to evaluate irrigation potential along the Jubba and shebelli rivers. During this study the Hydrometric data base was questioned as regards both its validity and representativity. The first steps taken to rectify the situation was the formulation of the Hydrometry Project and its implementation in January 1980.

The main objectives of the Hydrometry Project were to try and re-rate all the National Hydrometric stations on the Jubba and Shebelli rivers. Under the initial 'TCP' time schedule of one year, January to December 1980, the main objectives of the project could not have been achieved due to the level of the floods being below average. Under these circumstances only the lower levels of the rating curves were established. However, under the revised schedule of operating the project in three separate phases a period of eighteen months was covered instead of the original twelve, for no additional cost.

The re-phasing of the project duration was extremely beneficial to the outcome of the project in two major ways. The first benefit was that the extremely low river levels experienced, allowed missing gauge stands to be installed at most of the sites, and the wells and inlet pipes of recorder installations to be cleaned out of the past ten years silt deposits. With the cleaning of the stilling wells, and cannibalisation of spare parts from damaged recorders found in the Ministry stores, five recording stations were re-activated. Unfortunately two were vandalised soon after they were brought into operation. The long period of low water levels was ideally suited to the training programme especially with regard to the 'Stream Gauging' section. The

training began at the 'Grass roots level', so the trainee's would not have been ready had the extreme conditions been experienced soon after the start of the project.

The second major benefit was that two complete hydrological cycles were monitored. Probably the driest period on record Feb/March 1981, with both the Jubba and the Shebelli rivers drying up along their lower reaches. This extreme drought period was immediately followed by the wettest on record, with the highest levels on record being recorded on the upper and middle shebelli, and the lower Jubba.

These extreme conditions enabled discharge ratings at most stations to be achieved over the maximum range, a feat not accomplished since the original hydrological observations were started in Somalia between 1900/1939 during the Italian period of occupation.

In July 1981 the Government of Somalia requested the FAO to extend the project to the end of 1981 to ensure the continuity of the data collection programme, especially after the extreme flood events. This request was granted and a report was produced relating to the event (A History of the 'GU' Floods in Somalia on the Jubba and Shebelli rivers March to June 1981).

Throughout the project duration the Government and the United Nations Development Programme Representative, were constantly reminded of the absolute necessity to ensure that continuity with regard to the collection of reliable long term hydrological data, is paramount. It was hoped that the constant reminders would ensure the inclusion of the proposed 'Water Center Project', at the start of the 'IPF' funded five year development plan, scheduled to begin in 1982.

The importance of the Hydrological Studies was identified by the United Nations Multi-Agency Mission on Drought to East Africa, which visited Somalia in early October 1981.

Throughout the Missions final report to the General Assembly in November 1981, it was continuously stressed that the Operational Hydrology Programme, as initiated by the FAO with the Hydrometry Project, must not be allowed to lapse due to the lack of funds, and thereby reverting to the same situation as found prior to the initiation of the Hydrometry Project in 1979.

The damage caused by the 'GU' floods and the insistence for continuity as expressed by the United Nations Mission on Drought, further convinced the Government that the Hydrometry Project had to continue, and so the Ministry of Agriculture once again requested the FAO to maintain the Hydrometry Project for the period leading upto the start of the 'Water Centre Project' in 1984/85.

It is hoped that the FAO will continue to support this most important requirement, especially in a country like Somalia so dependant on agriculture. If the FAO does not agree to finance this extension, the hydrological investigations will most likely be sidelined once again, and there remain for the next decade.

In addition to re-activating the Hydrological Network, the Gauging and In-service training programmes, the Government was advised to maintain a permanent and reliable body of Stream Gauge Observers who could maintain a complete station including a Recorder. At present the major problem is that some stations are left unmanned for months at a time, and this loss of streamflow data is what causes the main errors, when the data is analysed.

In-service training was mainly conducted with regard to the field operational requirements and on the basic computations directly relating to the discharge measurements and surveys carried out on site. This was done because the standard of personnel supplied to the project were more practically orientated, rather than academically inclined.

In addition to the In-service training, FAO fellowships were awarded. Three of the Trainee's were sent on three month Operational Hydrology Courses in Kenya. This was arranged through the FAO and WMO as an Inter-Agency exercise. The WMO arranged for the acceptance of the trainee's to attend the training programme with the 'Hydromet Surveys Project of Lakes Victoria, Kyoga and Mobutu Sese Seko', and were based in Kisumu.

Unfortunately the level of training recieved does not appear to have been satisfactory. However, the effect of the trip and the course on the overall attitude of the trainee's to the importance of thier work, and the added desire to remain within the said field, is in itself successful and beneficial to the future continuity of the hydrological activities in Somalia.

This report consists of the data collected by the Consultant and his team over the duration of the Hydrometry Project. All the basic data is included in Volumes '2,3, & 4 ', and is presented in a format usually used in the presentation of ' Hydrological Year Books'. With the training of the field staff and the rating of all the National Network stations, it can be said that the Project achieved it's main objectives. If the benifits from the work carried out by the Project are to be used in the future, the Hydrological investigations in Somalia must be expanded and not allowed to deteriorate to a derelict state, as has occured in the past.

C O N T E N T S

V O L U M E ' 2 '

HYDROLOGICAL DATA - JUBBA RIVER

SECTIONS :-

- A - JUBBA AT LUGH GANANA
- B - JUBBA AT BARDHEERE
- C - JUBBA AT JAMAMME
- D - WATER LEVEL CORRELATION GRAPHS
- E - STAGE AND DISCHARGE DATA SHEETS
- F - RIVER STAGE HYDROGRAPHS (1980/81)
- G - RIVER STAGE DATA QUALITY ' BAR CHARTS
- H - HISTORICAL INSTALLATION DATA SHEETS
- I - HISTORICAL DISCHARGE MEASUREMENTS AND RATING CURVES (JUBBA AT LUGH GANANA)

S E C T I O N (A)

JUBBA AT LUGH GANANA

- 1 - History sheets
- 2 - Site photographs
- 3 - Station Installation data
- 4 - Site sketch
- 5 - Recorder details (sketch)
- 6 - Site surveys
- 7 - List of Discharge Measurements
- 8 - Rating Curve (natural scale)
- 9 - Rating Curve (log/log scale)
- 10 - Rating Table
- 11 - Cross Sections
- 12 - Mean Daily Water Levels (Tabulated)

RIVER FLOW GAUGING STATIONHISTORY NOTESRIVER : JUBBAAT : LUGH GANANASTN. NO: JB.1.

DATE	TIME	REMARKS	SIGN																		
18.3.80	0900	<p><u>B.P.GEMMELL</u></p> <p>First visit to this site.</p> <p>Located the original Benchmark on the old Ferry cable anchor block. FAO reports indicate that this benchmark has an MSL. level of 149.917 meters.</p> <p>The Water level at 0900 hrs was 0.74 meters. Surveys were carried out including the Staff Gauges, Inlet pipes to the Recorder House, also the MP point on the top side of the Recorder House floor board.</p> <p>Surveyed cross section upstream of bridge through the Recorder site. Measured Recorder House dimensions and Inlet pipes (10 cm Dia.).</p> <p>Took Current Meter discharge measurement at a point 300 m upstream by wading. Water quality test at time 36.0°C (1100 micromos).</p>																			
19.3.80	0900	<p>Surveyed the overflow channel R/B for flood of 1977. Surveyed the slope of the water and measured depths in Recorder House:-</p> <p>All depths measured from MP point on the floor board of the Recorder House - R.L. 100.428 or Gauge Height 8.923 meters:</p> <table style="margin-left: 40px;"> <thead> <tr> <th></th> <th style="text-align: center;"><u>R.L.</u></th> <th style="text-align: center;"><u>G.H.</u></th> </tr> </thead> <tbody> <tr> <td>a). Depth to Well bottom</td> <td>8.26 m = 92.17 m,</td> <td>0.44m</td> </tr> <tr> <td>b). Depth to silt level</td> <td>7.87 m = 92.55 m,</td> <td>0.83m</td> </tr> <tr> <td>c). Depth to W.L. in Well</td> <td>7.55 m, = 92.87 m,</td> <td>1.16m</td> </tr> <tr> <td>d). Depth to ϕ low pipe</td> <td>7.53 m, = 92.89 m,</td> <td>1.18m</td> </tr> <tr> <td>e). Depth to ϕ Top pipe</td> <td>7.03 m, = 93.40 m,</td> <td>1.67m</td> </tr> </tbody> </table> <p>Took second Current Meter discharge by suspension from the D/S side of the bridge as initial training for the students in Winch suspension gauging methods.</p>		<u>R.L.</u>	<u>G.H.</u>	a). Depth to Well bottom	8.26 m = 92.17 m,	0.44m	b). Depth to silt level	7.87 m = 92.55 m,	0.83m	c). Depth to W.L. in Well	7.55 m, = 92.87 m,	1.16m	d). Depth to ϕ low pipe	7.53 m, = 92.89 m,	1.18m	e). Depth to ϕ Top pipe	7.03 m, = 93.40 m,	1.67m	
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20.3.80	0900	<p>Surveyed levels of possible flood marks and drew sketch of station location and site details. Removed the old SIAP Recorder and installed a reconditioned LEUPOLD & STEVENS (A-35) weight driven instrument. NO: 46750-67. Time scale = 2.4" per day with vertical scale of 1:10. - Chart duration over six months. Work disrupted by Air Raid warning.</p>																			
21.3.80	0800	<p>Started work on desilting the Recorder Well. Hired Military water tanker to raise the water level in the well to create pressure to blow the Inlet pipes clean. The pump supplied by the Ministry kept breaking down and could not do the job.</p>																			

Continued:.....

RIVER FLOW GAUGING STATIONHISTORY NOTESRIVER : JUBBAAT : LUGH GANANASTN. NO: JB.1.

DATE	TIME	R E M A R K S	SIGN
21.3.80	1200	<p><u>Continued:....</u></p> <p>The water pressure buildup in the well cleared the lower pipe but not the top one. The top pipe is bent downwards at the point where it emerges from the river bank, and needs replacing.</p> <p>Work was interrupted by 'AIR RAID' on the town. Went back to work at 1500 hrs - completed installation of the recorder and recorder house floor boards and a support arm for the 0-1 meter gauge stand. W.L. at 1600 hrs still 0.74 m.</p> <p>(See site sketch, photographs and surveys for detail information).</p>	B.P.G
1.5.80	0730	<p><u>B.P.GEMMELL & HYDRO TEAM</u></p> <p>Checked the station - W.L. at time 1.15 m (Staff gauge). Recorder reading at time = 1.18 m. The depth to the W.L. in the well = 7.52 m (1.18 m GH.). The lower pipe just in the water and probably silted.</p> <p><u>Notes from chart</u> - Flood arrived 2000 hrs and just entered the pipes 16/4/80. The main flood arrived on 23/4/80 at 1600 hrs (peak 1.46 GH), with 2nd peak of 1.38 m GH. on the 26/4/80.</p> <p>The recorder functioned well, but slightly slow on the time scale. Reset the instrument and took a CMM gauging at same Water level.</p>	B.P.G
2.5.80	0820	<p><u>HYDRO TEAM</u></p> <p>Took another discharge measurement at W.L. 1.12 m(GH) on flood recession.</p>	
3.5.80	0740	<p><u>HYDRO TEAM</u></p> <p>Took discharge measurement at W.L. 1.20 GH. Small rise in water levels. At 1700 hrs W.L. falling again 1.19 meters.</p>	
20.5.80	1730	<p><u>B.P.GEMMELL & HYDRO TEAM</u></p> <p>Arrived late at station site, read the gauge. W.L. at time 2.48 meters (GH).</p>	
21.5.80	0815	<p><u>Continued:...</u> - W.L. at time = 2.36 m (Staff gauge). Depth to W.L. from MP in Well= 6.55 m = 2.37 GH. (Note : if relating to the 0-2 m Gauges, a factor of 0.22 m must be added to make correction.</p>	B.P.G

Cont:.....

RIVER FLOW GAUGING STATIONHISTORY NOTESRIVER : JUBBAAT : LUGH GANANASTN. NO: JB. 1.

DATE	TIME	R E M A R K S	SIGN
21.5.80	1600	<p><u>Continued</u>:.... - At the start of the previous chart the recorder was set to a W.L. relating to the 0-2 m gauges. Present W.L. relates to 2-6 m gauge this is the reason for the 0.22 m correction due to the gauge overlaps.</p> <p>Took CMM gauging at W.L. 2.36 m GH. (Staff Gauge). Recorder set at 2.14 m(GH) relating to 0-2 m gauges. It appears that the inlet pipes are slightly silted thereby causing delayed reaction to the recorded W.L on the chart.</p> <p>Took water quality test and collected water samples for possible sediment analysis. Quality test = 0.56×10^3 at water temperature 29.1°C.</p>	B.P.G.
22.5.80	0615	<p><u>HYDRO TEAM</u></p> <p>Gauged the river at 2.34 m (GH). Recorder reading not checked. Water level in afternoon the same.</p>	
23.5.80	0630	<p><u>HYDRO TEAM</u></p> <p>Gauge height still 2.34 meters - no gauging. W.L. in the well 2.11 m + 0.22 correction = 2.33 m (GH).</p>	
4.6.80	0830	<p><u>HYDRO TEAM</u></p> <p>Discharge measurement at W.L. 1.68 m (GH). Recorder chart 1.74 m, delayed action due to siltation of the inlet pipes.</p>	
7.7.80	1225	<p><u>HYDRO TEAM</u></p> <p>Took discharge gauging from D/S side of bridge. W.L. at time 2.28 m. (GH). Depth to W.L. in well from MP was 6.71 meters, giving an inside W.L. of 1.995 m + 0.22 m correction = 2.215 meters (GH).</p>	
15.8.80	0830	<p><u>HYDRO TEAM</u></p> <p>Gauged the river at W.L. 2.26 m. Checked the inside W.L = 2.20 m. Also surveyed the slope of the water.</p>	A.S.H.
16.8.80	0720	<p><u>Continued</u>:... - Took another gauging at W.L. 2.40 m. Then checked the recorder and left for the lower Jubba at Barderra.</p>	A.S.H.
7.10.80	0200	<p><u>HYDRO TEAM</u></p> <p>Arrived Lugh early morning.</p>	
	0700	<p>Started discharge measurement at W.L. 2.62 m (GH). At end of measurement Air Raid warning suspended work for the day - not allowed back onto the bridge.</p>	
8.10.80	0745	<p><u>Continued</u>:... - Took second gauging at W.L. 2.50 m on</p>	

Continued:.....

RIVER FLOW GAUGING STATIONHISTORY NOTES

RIVER : JUBBA

AT : LUGH GANANA

STN. NO: JB. 1.

DATE	TIME	REMARKS	SIGN																											
8.10.80	0745	<u>Continued</u> : ... - the staff gauge. Depth to the W.L. inside the well = 6.38 meters = 2.55 m(GH) Chart reading at time 2.37 meters. Wound the clock, filled the pen. Chart still O.K. for duration. W.L. of the first gauging about the highest level for the flood.(?).	A.S.H.																											
27.10.80	1800	<u>B.P.GEMMELL & HYDRO TEAM</u> Water level on main 2-6 meter gauge = 2.14 m (GH). or 1.92 meters on the 0-2 m gauges. Chart reading at time = 2.06 m.																												
28.10.80	0645	<u>B.P.GEMMELL</u> Discharge measurement between 2.20 & 2.24 GH. Rising stage of flood.	B.P.G.																											
	1100	Depth to W.L. in well = 6.66 meters = 2.255(GH). <u>Surveyed Levels</u>																												
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	1410	Rechecked the W.L. in the well at time of resetting the recorder. Depth to W.L. = 6.61 m = 2.305 m (GH). Water level at time = 2.29 m (GH). Therefore reset the chart reading to 2.29 GH. Once the level falls below the 2.0 m level , a correction of 0.22 m must be made to the observers readings to agree with the chart readings. Note:- Depth to silt level = 7.95 meters = 0.975(GH) or 0.755(GH) on 0-1 meter gauge. Therefore both inlet pipes above the silt level.																												
	1600	W.L. = 2.31 m(GH), still rising.	B.P.G.																											
7.12.80	0935	<u>HYDRO TEAM</u> Took wading discharge measurement 500 m u/s, at a W.L. of 1.33 m(GH). Water level was steady through the whole measurement. Depth to W.L. in well = 7.14 m = 1.56 m (GH). The water is not flowing out of the well, therefore must be silted. (Or the depth to the water level in the well has been incorrectly measured. Note that the level to the water level on the 8/12 is less, inspite of the W.L. outside falling.																												

Continued:....

RIVER FLOW GAUGING STATIONHISTORY NOTESRIVER : JUBBAAT : LUGH GANANASTN. NO: JB.1.

DATE	TIME	REMARKS	SIGN
8.12.80	1030	Continued:.. - Took second gauging also by wading approximately 500 meters upstream. W.L. at time 1.30 meters gauge height. Depth to W.L. in well = 7.12 m = 1.80 - 0.22(1.58 GH)	A.S.H.
9.12.80	0850	Checked outside gauge = 1.33 m (GH). Depth to W.L. in the well = 7.14 m = 1.78 m - 0.22 (1.56 GH).	
10.12.80	0850	Took discharge measurement at W.L. = 1.29 m (GH). No reading from inside well.	
11.12,80	1710	W.L. outside gauge = 1.25 m (GH). Depth to W.L. in the well = 7.21 m = 1.71 m - 0.22 (1.49 GH).	
12.12.80	1700	W.L. outside gauge = 1.22 m (GH). Depth to W.L. in the well = 7.23 m = 1.69 m - 0.22 (1.47 GH).	
14.12.80	0700	<u>HYDRO TEAM</u> Took discharge measurement at W.L. of 1.18 m (GH). Depth to W.L. in well = 7.26 m = 1.66 m - 0.22 m = (1.44 GH.)	A.S.H.
22.02.81	0800	<u>HYDRO TEAM</u> Checked the station - W.L. at time = 0.56 m, reading on the lowest gauge post. Both the inlet pipes were out of the water. Depth to W.L. in well = 7.71 m = 1.21 m - 0.22 = (0.99 GH). Depth to silt level in well 7.87 m = 1.05 - 0.22 m = (0.83 GH). Cut the chart and reset the instrument, re-using the remainder of the chart. <u>Measurements taken of the well .</u> <u>GH</u> a. Depth to top pipe = 6.97 m = 1.95 m - 0.22m(1.72m) b. Depth to 2nd pipe = 7.47 m = 1.45 m - 0.22m(1.23m) c. Depth to cement = 8.18 m = 0.74 m - 0.22m(0.52m) d. WL below pipes by = 0.14 m. e. Dia. of inlet pipe = 0.10 m. Took Current Meter Discharge measurement at section opposite the Ministry Offices - upstream of bridge.	A.S.H.
22.03.81	0725	<u>B.P.GEMMELL & AHMED ALI</u> W.L. on outside gauge = 1.63 m. W.L. inside well was 1.67 m.	
	1400	Flushed out the recorder well by filling the well by tanker. Both inside and outside W.L. = 1.545 m. Surveyed floodmark = 3.08 m (Observer states 3.0 m.?) Floodmark surveyed at 3.81 m below the TBM under the bridge(L Iron in concrete)R.L. = 98.40 m. Minus 3.81m = R.L. 94.59 m. on main gauge = 3.085 GH. Gauged the river at a W.L. of 1.58 m GH.	B.P.G.

RIVER FLOW GAUGING STATIONHISTORY NOTESRIVER : JUBBAAT : LUGH GANANASTN. NO: JB.1.

DATE	TIME	R E M A R K S	SIGN
24.03.81	0945	<u>B.P.GEMMELL & AHMED ALI</u> W.L. at time on transition level. On 0-2m = 2.0 m, and 2.22 m on the 2-6 meter gauge. Depth to the water level in the well = 6.69 meters = 2.23 m on the main gauge, therefore both the inside and outside levels are the same. Gauged the river twice at W.L. 1.97 & W.L. 2.42 GH.	
25.03.81	1200	<u>B.P.GEMMELL</u> W.L. = 2.38 m. Discharge measurement taken and set the recorder. Left the Hydro Team to continue gauging if the water level keeps rising.	B.P.G.
26.03.81	0800	<u>HYDRO TEAM</u> Flood rising, started gauging at GH. 3.60 m. Equipment broke down. Started gauging again at 1055 hrs at a W.L. of 4.00 m and finished at 1455 hrs (4.04 GH.).	
	1700	W.L. 4.10 m.	
27.03.81	0735	<u>HYDRO TEAM</u> Started gauging at time with W.L. of 3.94 m and then finished at 1030 hrs at a W.L. of 3.78 m. Falling flood. Recorder working O.K.	A.S.H.
21.04.81	1200	<u>B.P.GEMMELL</u> W.L. at time 5.38 m. Recorder reading 5.45 m. At end of gauging 2000 hrs. at W.L. 5.32 m. Water level started leveling out and will probably start to rise.	
22.04.81	0800	<u>B.P.GEMMELL & AHMED ALI</u> W.L. at time = 5.61 m (GH). Winch cable to short had to make extension cable from the hand cable. Started gauging at 1200 hrs (GH. 5.57 m). Then had to stop due to accident to the consultants hand, cable fell off pulley. Re-started measurement at 1425 hrs at a W.L. of 5.50 m, and completed at 1700 hrs at W.L. of 5.40 m (GH).	
23.04.81	0920	<u>B.P.GEMMELL & AHMED ALI</u> W.L. at time 5.42 m (GH). Gauged the river at mean W.L. of 5.43 m. Surveyed the floodmarks and water level slope (See survey sheets).	
	1100	Depth to W.L. in well = 3.82 m = 5.10 meters (GH). W.L. in well increased to 5.13 m (GH).	
	1435	Cut the Recorder chart and reset the instrument. Had a talk with the office staff to try and impress upon them the importance of reliable records. W.L. = 5.50 m.	B.P.G.

Continued:.....

RIVER FLOW GAUGING STATIONHISTORY NOTESRIVER : JUBBAAT : LUGH GANANASTN. NO: JB.1.

DATE	TIME	REMARKS	SIGN
1.05.81	1300	<p><u>B.P.GEMMELL</u></p> <p>Arrived at Lugh Ganana at 1300 hrs. Turned LandRover over 11 kilometers from Lugh, but continued the field trip and obtained the highest ever gaugings at the site.</p> <p>W.L. at time = 6.13 meters. Gauged river between 6.13 and 6.11 meters (Mean=6.12 m). - MSL = 147.54 m.</p> <p>Check survey levels:- <u>R.L.</u></p> <p>B.M. 100.000 Top of Iron 100.017 TBM (Under bridge). 98.405 Top of 3m gauge ... 94.505 Top of 2m gauge ... 93.725 MP (Recorder Well). 100 428</p> <p>At 1300 hrs the depth to W.L. in well = 3.03 meters = 5.89 m GH. Appears that there is a lag between the actual W.L. in the river and the level in the Recorder house.</p> <p>The depth to the W.L. from the MB on the bridge is 3.43 m.</p> <p>The flood peak on the 30/4 was 6.25 meters.</p>	
2.05.81	0605 0830 1230	<p><u>B.P.GEMMELL</u></p> <p>W.L. at time = 5.98 m (GH). Started gauging the river.</p> <p>W.L. = 5.98 m (GH).</p> <p>W.L. = 5.94 m (GH). Recorder = 5.90 m (GH).</p> <p>Check survey levels:-</p> <p>a)BM 100.000 b)Top of Iron 100.020 c)Floodmark..... 97.675 d)W.L. (5.97 m)..... 97.435 e)MB on bridge 101.065 f)Road surface 100.985 g)MP (Rec House) 100.430</p> <p>Left Lugh at 1230 hrs - raining at the time. Collected April gauge readings.</p>	
11.06.81	1600	<p><u>B.P.GEMMELL</u></p> <p>W.L. at 1530 hrs = 2.24 m on 2-6 m gauge, and 2.02 m on the 0-2 m gauge. Depth to the W.L. in the well = 5.74 meters = 3.18 meters (GH) - Pipes definitely silted. The instrument had been played with. Float cable moved from large pulley and drapped over the small one. The recorder was set to the outside W.L. of 2.24 meters. The recorder is blocked and will need desilting before any further data can be recorded.</p>	B.P.G.

Continued :.....

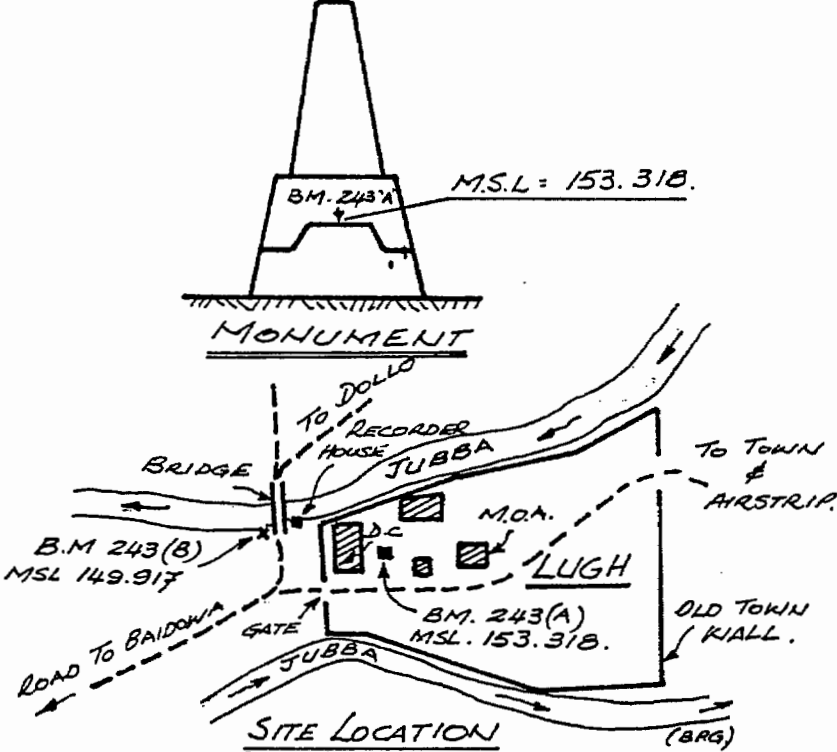
RIVER FLOW GAUGING STATION

HISTORY NOTES

RIVER : JUBBA

AT : LUGH GANANA

STN. NO: JB.1.

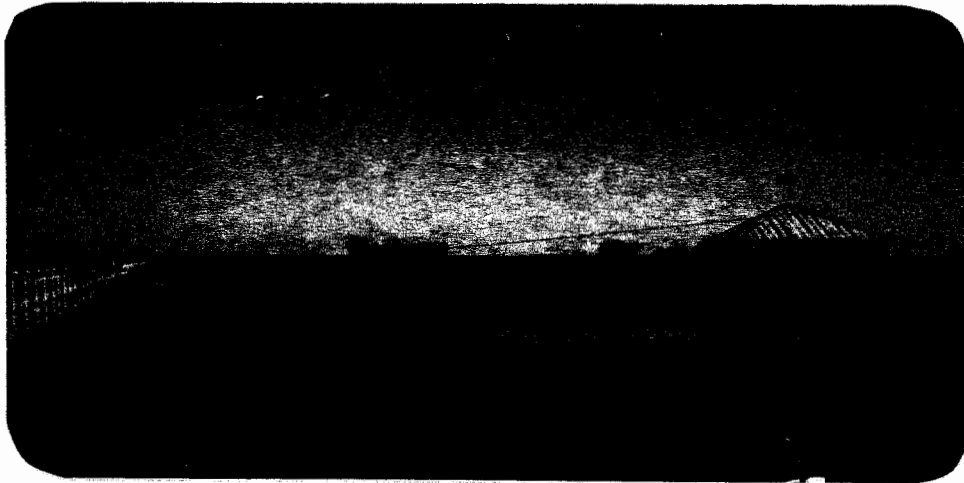
DATE	TIME	REMARKS	SIGN
11.06.81	1600	<p><u>B.P.GEMMELL</u> - Continued :-</p> <p>This visit was specifically made to establish the true levels of the two Benchmarks. 243(A) and 243(B) Benchmark 243(B) . See the survey details.</p> <p>Benchmark 243(b) = MSL. 149.917., GH = 8.497 m (GH) Benchmark 243(a) = MSL. 153.318., GH = 11.900 m (GH)</p> <p>These levels agree with the levels used by MMP and held at the Cartographic centre in Mogadishu.</p> <p>BM. 243(b) = X on the U/S corner of the concrete block situated just d/s of the bridge on the L/ B. (See photographs).</p> <p>BM. 243(a) = Top of top step on the face of the monument opposite the D.C!'s office facing the main road under the entrance arch into the town of Lugh. (See following drawing).</p> <p style="text-align: center;"><u>SKETCH OF BM 243(A).</u></p>  <p><u>Note:</u> See the survey details under the survey section.</p> <p>MMP - Have painted the Benchmark location on the monument, presumably when they carried out B.P.G. thier survey relating to the proposed 'HALBA' Refugee Irrigation Scheme.</p>	

RIVER FLOW GAUGING STATIONHISTORY NOTESRIVER : JUBBAAT : LUGH GANANASTN. NO:JB.1.

DATE	TIME	R E M A R K S	SIGN
16.08.81	0800	<p><u>Hydro Team</u></p> <p>Took discharge measurement at GH. 2.80/2.78 meters. River level falling slowly. Recorder chart reading 3.08 meters. Depth to WL in well 5.80 meters giving inside WL of 3.12 meters. WL on 15.08.81 at 1800 hrs was 2.86 meters indicating falling stage.</p>	M.A.M.
25.09.81	1215	<p><u>Hydro Team</u></p> <p>Took discharge gauging at WL of 3.86 meters. Depth to WL in well 5.265 meters = 3.66 m inside WL. Chart reading at time 3.285 meters. Something wrong with the recorder?</p>	
26.09.81	0740	<p><u>Hydro Team</u></p> <p>Took discharge measurement at 3.80 meters. WL in well 3.67 meters. With correction of 0.22m = 3.89 m? Made notations on recorder chart.</p>	A.H.S.
15.11.81	0800	<p><u>B.A.P.Gemmell</u></p> <p>Checked the station. WL at time 2.46 meters. Depth to WL in well = 5.84m = 3.08m GH. Levelled the outside WL to the 'MP' point which confirmed that the inside WL was 0.62 meters higher than the river level.</p> <p>The chart was cut and the instrument reset to the well water level. Appears to be some trouble with the reversal mechanism on the recorder. All the daily levels copied from June to 16th November.</p> <p>Depth to silt level in well 7.26 meters. The recorder pen was filled, the clock wound and the instrument wound. The observer appears to still be playing with the instrument. It will have to be locked in future. The river seems to be on the recession.</p>	B.P.G.

S I T E P H O T O G R A P H S

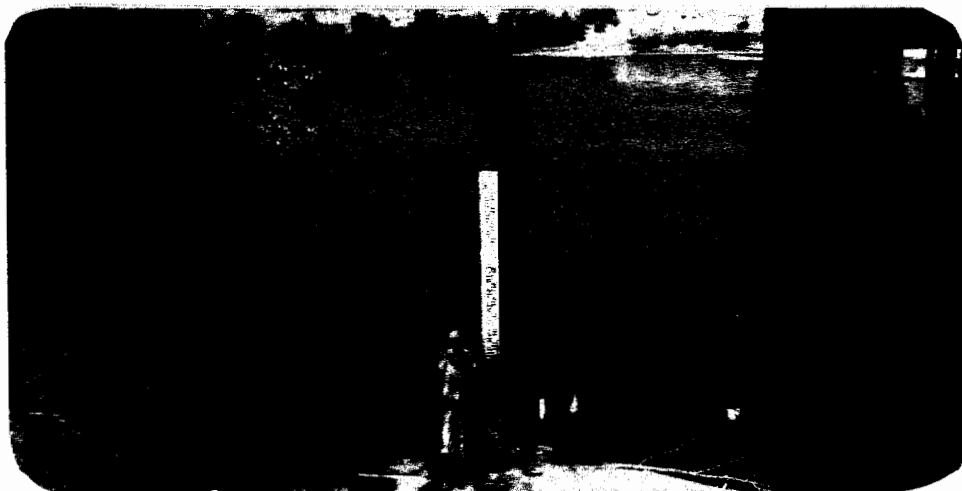
JUBBA AT LUGH GANANA



LUGH GANANA - (22.3.80) - Looking from left to right bank upstream side of bridge, into the Recorder House. 'MP' Point on floor boards in open doorway.



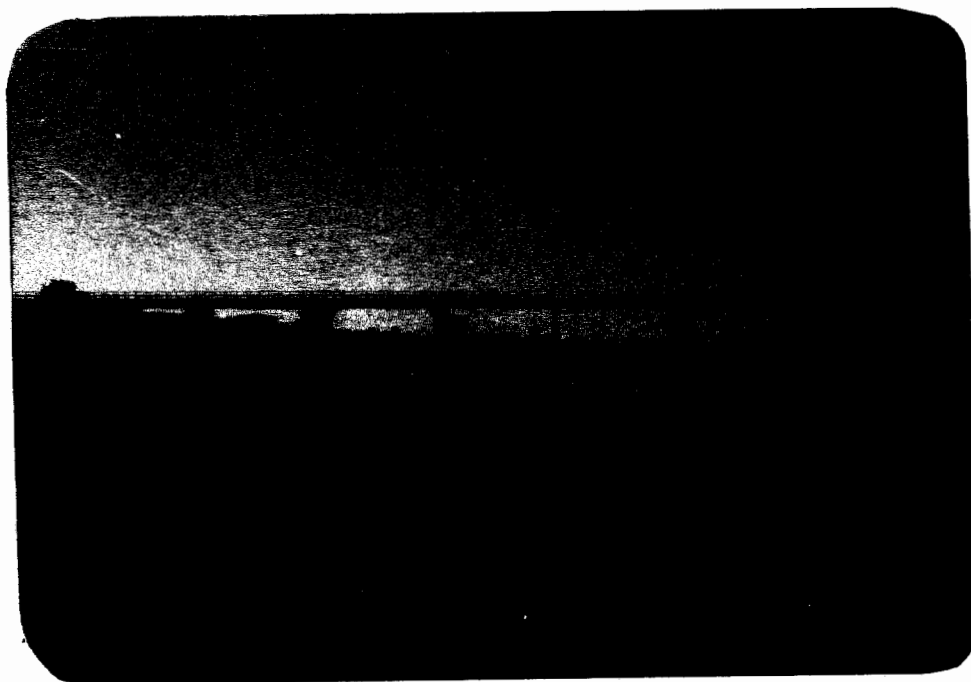
LUGH GANANA - (22.3.80) - Looking at 'BM' on concrete block 5 meters downstream of bridge on the left bank. (R.L. = 100.00 - MSL = 149.917 m)



LUGH GANANA - (22.3.80) - Looking at Staff Gauges on left bank 5.0 meters downstream of bridge. Three stands 0-1 , 1-2 & 2-6 meters. Overlap of 0.22 m. between the 0-2 and 2-6 ranges.

S I T E P H O T O G R A P H S

JUBBA AT LUGH GANANA



LUGH GANANA - (22.3.80) - Looking downstream at the upstream Bridge section. Gauges and the Recorder House situated on the left bank. Photograph taken at a Water Level of 0.75 meters. Low flow channel at present on the left bank near the gauges.



LUGH GANANA - (22.4.81) - Looking from left to right bank, Recorder House and staff Gauges on the left bank. Water level at time 5.50 meters. Note that the water begins to overspill at a gauge level between 5.30 and 5.50 meters.

STATION INSTALLATION RECORD

STREAM : JUBBA

LOCATION : LUGH GANANA

STN. NO : JB.1

LATITUDE : 03° 47' E

LONGITUDE : 42° 32' E

ALTITUDE : 150.0m

BENCHMARK DESCRIPTION :

- 1). BM. 243(B) - Hydrological BM. - A cross cut into the N.E. corner of old ferry concrete anchor block, situated d/s of the bridge on the L/B.
- 2). TBM - Angle iron protruding from concrete slab situated under bridge against left bank abutement on d/s side of bridge.
- 3). BM 243(B) = R.L. 100.000 = M.S.L. 149.917 m = G.H. 8.495 m.

STAFF GAUGE DESCRIPTION :

- 1). 0-1 m. gauge consists of single one meter enamel plate graduated in centimeters, fixed to wooden stand driven into river bank.
- 2). 1-2 m. gauge is enamelled one meter plate fixed to 4" I Beam stand & concreted into river bank and graduated in centimeters.
- 3). 2-6 m. gauges- 4 one meter plates (cast iron), Two centimeter divisions. Fixed to one stand (6" I Beam), embedded in large concrete foundation.

DATE OF INSTALLATION :

GAUGE ZERO :

Gauges Initially installed March 28th. 1963

0-2 m = R.L. 91.725 m

Present gauges installed post 1965.

0-2 m = MSL. 141.642 m

2-6 m = R.L. 91.505 m

RECORDER DESCRIPTION :

2-6 m = MSL 141.422 m

Leupold & Stevens strip chart recorder (A.35) - Weight driven, Instrument No: 46750-67. Time scale = 2.4"/day. Vertical scale 1:10. (One traverse of chart = 2.5 meters). Chart duration six months minimum. Instrument housed in structure set on stilling well constructed from concrete rings (1.0m dia). Two 10 cm. inlet pipes at bottom of well with stop cocks.

DATE OF INSTALLATION :

GAUGE ZERO : R.L. 92.17m

Built at same time gauges were installed (circa 1963). Well floor 8.26 m below 'MP' point = M.S.L. 142.09 m = G.H. 0.44 meters.

CONTROL DESCRIPTION :

Channel control with fairly stable left bank, but shifting bed conditions. The bed scours upto five meters between low flows and 6.25 meter flood level.

OTHER EQUIPMENT :

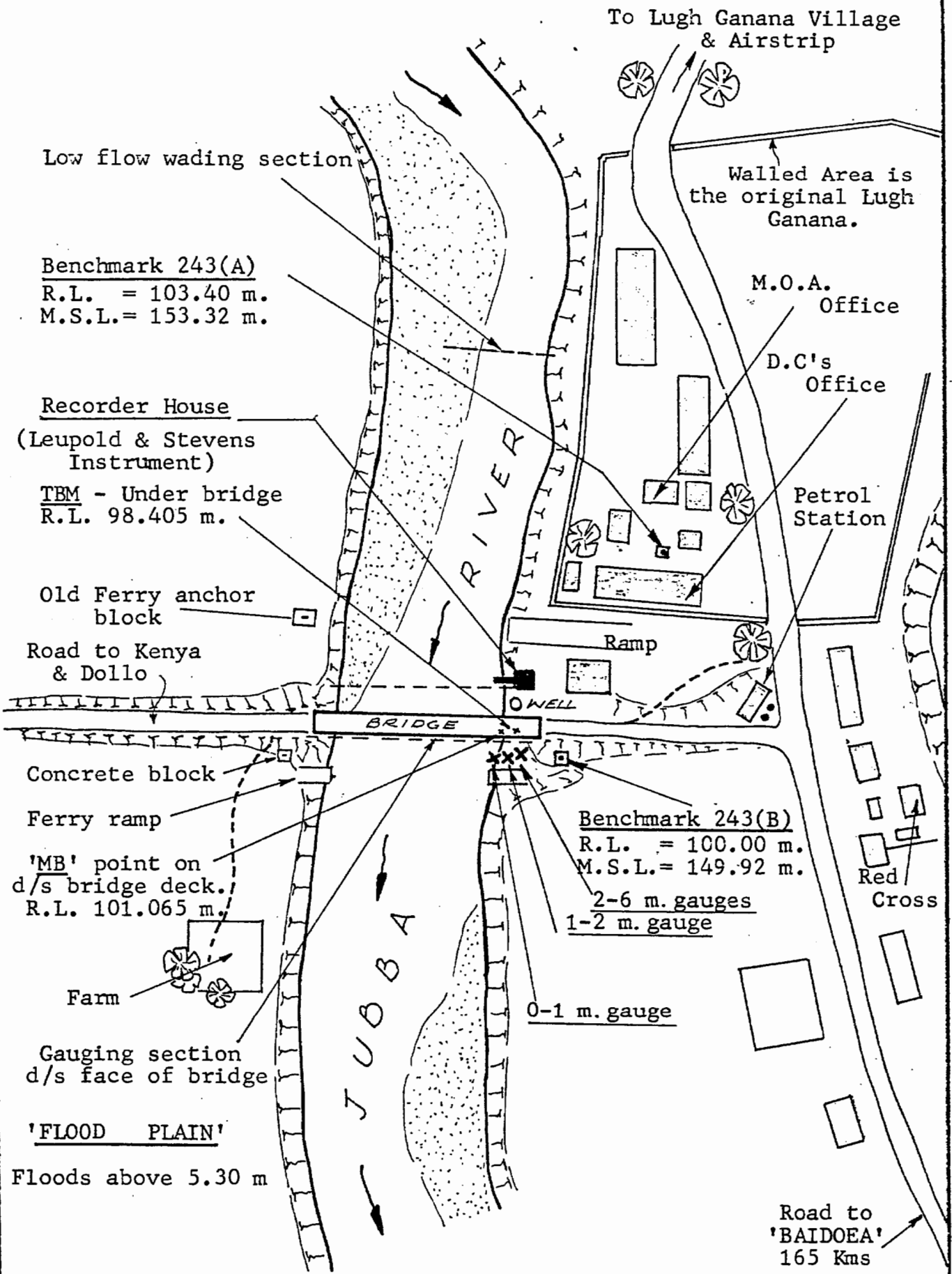
- 1). Discharge vertical points painted on d/s bridge deck, at intervals of 4.0 meters from left to right bank.
- 2). 'MB' - Point painted on bridge deck approx. at 16.0 m vertical point. Depth to water level observed from here when all gauges submerged. R.L. = 101.065 m = M.S.L. 150.982 m = G.H. 9.560 meters.
- 3). 'MP' - Point indicated on upper surface of floor boards from which depth to W.L. in well is measured to obtain Gauge Height. (RL 100.428 = M.S.L. 150.345 m = G.H. 8.923 meters.) Concrete ring RL. 100.375m.

NOTES :

- 1). A second Benchmark 243(A) is situated within the walled settlement on the step of a monument located between the DC's office and the Ministry of Agriculture Office. M.S.L. level of this Benchmark is 153.318 meters.
- 2). The Russians had different levels for these Benchmarks, obtained from an independant survey.
BM. 243(A) = M.S.L. (Not available)
BM. 243(B) = M.S.L. " "

S I T E S K E T C H

To Lugh Ganana Village & Airstrip



Low flow wading section

Benchmark 243(A)
R.L. = 103.40 m.
M.S.L. = 153.32 m.

Recorder House
(Leupold & Stevens Instrument)
TBM - Under bridge
R.L. 98.405 m.

Old Ferry anchor block

Road to Kenya & Dollo

Concrete block
Ferry ramp
'MB' point on d/s bridge deck.
R.L. 101.065 m.

Farm

Gauging section d/s face of bridge

'FLOOD PLAIN'
Floods above 5.30 m

Walled Area is the original Lugh Ganana.

M.O.A. Office

D.C.'s Office

Petrol Station

Ramp

OWELL

BRIDGE

Benchmark 243(B)
R.L. = 100.00 m.
M.S.L. = 149.92 m.

2-6 m. gauges
1-2 m. gauge

0-1 m. gauge

Red Cross

Road to 'BAIDOEAE' 165 Kms

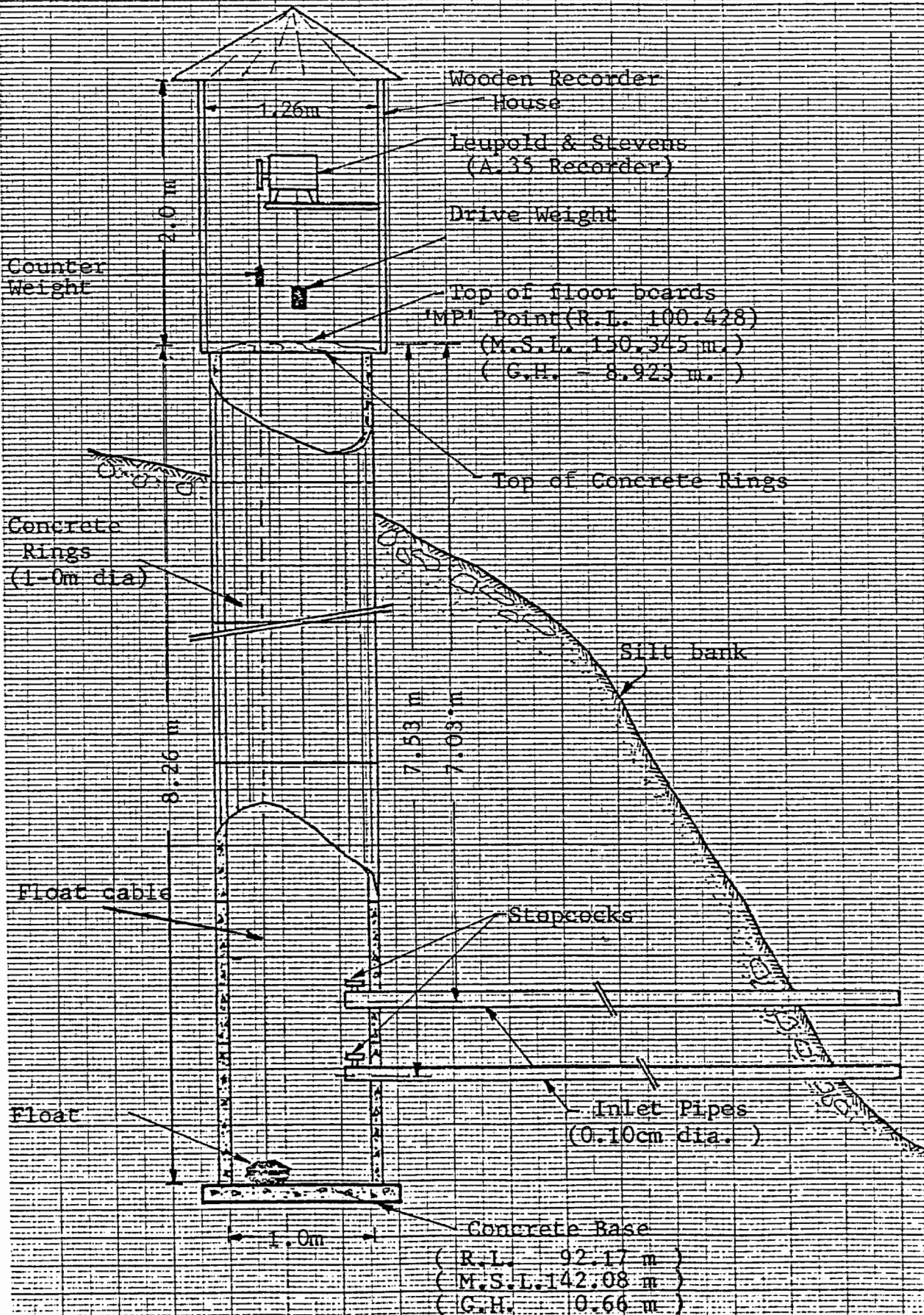
LUGH GANANA

NOT TO SCALE

BPG

RECORDER DETAILS

JUBBA RIVER AT LUCH CANANA

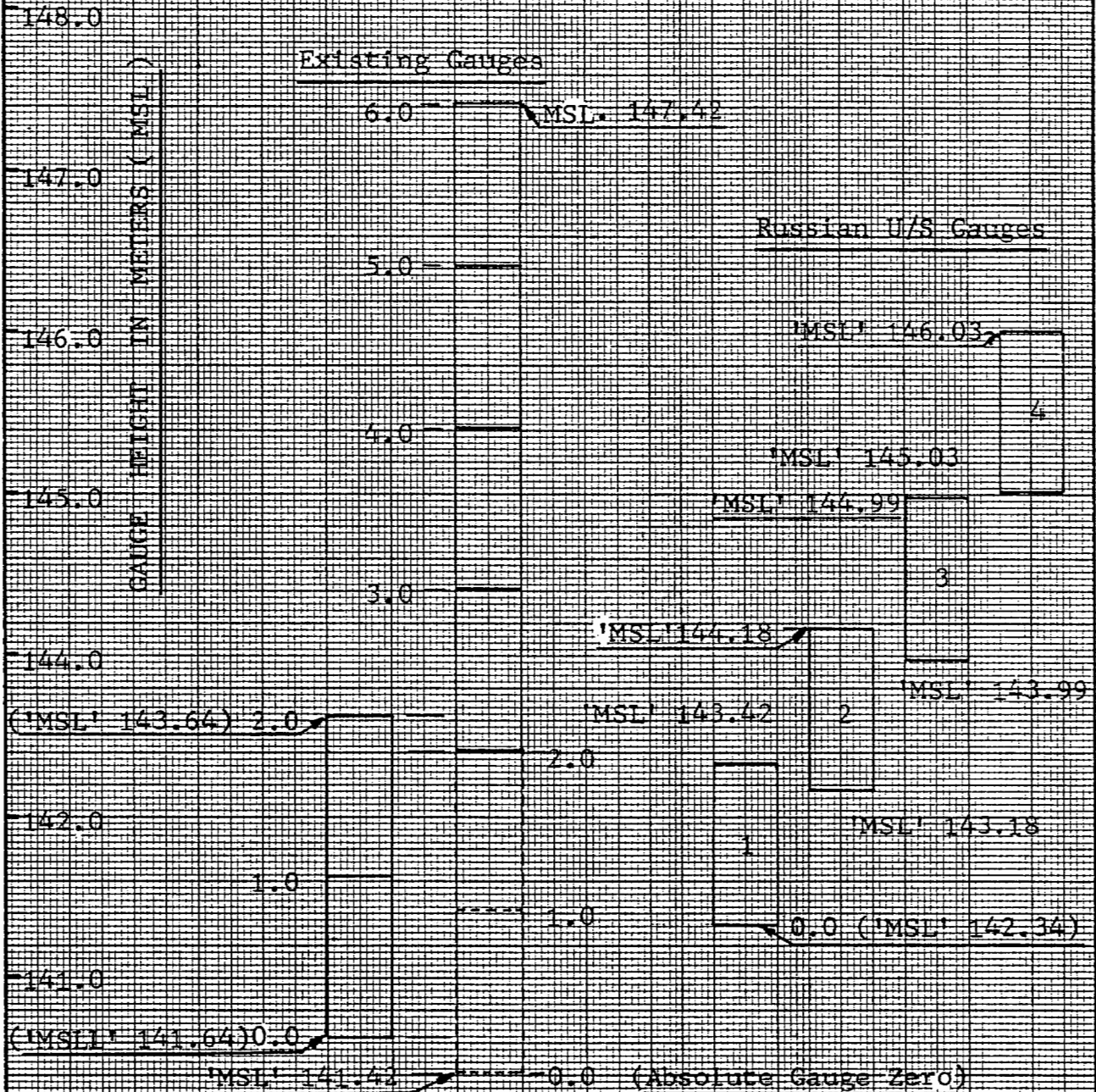


NOTE: G.H. Relate to Gauge Zero R.L. 91.505 m.

NOT TO SCALE

EXISTING & OLD STAFF GAUGE RELATIONSHIP

JUBBA RIVER AT LUGH GANANA



NOTES:

The existing gauges were installed during Lockwood/FAO Project in 1963. The 2-6 meter stand was the original range. The 0-2 meter stands installed at a later date (Unknown).

There is an overlap of 0.22 meters between the 1-2 m and 2-6 m. plates. All gauge readings between 0 & 2 meters must be adjusted by adding 0.22 meters to relate to the absolute gauge zero (MSL 141.42).

Date of Installation of Russian gauges unknown. Note gap of 0.04 meters between 3 & 4 plates, and overlaps between the others. Slope between Gauges = 0.05m over 175 meters.

ARG

SITE : JUBBA RIVER..... LOCATION : ... LUGH GANANA (JB.1.).....

DATE : ..18/3/80..... TIME : ..0800 HRS..... WATER LEVEL : 0.74 m.(GH)..

REMARKS : INITIAL SURVEY OF GAUGES, MP POINTS & SECTION AT RECORDER HOUSE.....

B.S	I.S	F.S	RISE	FALL	R.L.	M.S.L	DIST	REMARKS
0.385					100.000	149.92		BM. AD.100.00(MSL 149.92)
	0.368		0.017		100.017	149.93		TOP OF IRON GROOVE (TBM)
		1.645		1.277	98.740	148.66		CP, LOWER TBM
G.085					98.740	148.66		" " "
	0.420			0.335	98.405	148.32		TBM. ANGLE IRON (L/B)
		3.640		3.220	95.185	145.10		CP.
0.615					95.185	145.10		"
	1.295			0.680	94.505	144.42		TOP OF 3 meter Gauge
	2.295			1.000	93.505	143.42		Bottom 3 meter Gauge
	2.075		0.220		93.725	143.64		Top of 2 meter Gauge
	3.315			1.240	92.485	142.40		WL at 0930 Hrs.
	3.075		0.240		92.725	142.64		Top of 1 meter Gauge
	2.910		0.165		92.890	142.81		Top of Top Inlet pipe
		0.310	2.790		95.490	145.41		CP,
3.405					95.490	145.41		"
		0.482	2.923		98.413	148.33		TBM (Angle Iron)
1.405					98.413	148.33		CP,
		0.345	1.060		99.473	149.39		CP,
1.635					99.473	149.39		CP,
	0.680		0.955		100.428	150.35		MP(Recorder floor board)
								START OF SECTION AT THE
	0.600		0.080		100.508	150.43	0.0	RECORDER HOUSE (L/B).
	1.470			0.870	99.638	149.56	7.0	Instrument
	2.425			0.955	98.683	148.60	10.5	Next to the Recorder
		3.720		1.295	97.388	147.31	15.0	CP,
0.335					97.388	147.31	"	CP,
	1.550			1.215	96.173	146.10	18.5	Instrument
	3.490			1.940	94.233	144.16	22.5	Down the Bank
	5.250			1.760	92.473	142.40	26.5	WL & WE Left Bank
	4.890		0.360		92.833	142.76	"	Top inlet pipe
	5.030			0.140	92.693	142.62	"	Top of Bottom inlet pipe
	5.150			0.120	92.573	142.50	(28.5)	Depth at end of Pipes

SITE : .. JUBBA RIVER LOCATION : LUGH GANANA (JB.1.)

DATE : ...18/3/80..... TIME : ..0800 HRS..... WATER LEVEL : 0.74 m.(GH)..

REMARKS : INITIAL SURVEY OF GAUGES, MP POINTS & SECTION AT RECORDER HOUSE..

B.S	I.S	F.S	RISE	FALL	R.L.	M,S,L	DIST	REMARKS
			Survey continued from Sheet No: 1.					
	6.540			1.390	91.183	141.11	30.5	In water(deepest point)
	6.240		0.300		91.483	141.41	32.5	River Bed - sand.
	5.840		0.400		91.883	141.81	34.5	" " "
	5.810		0.030		91.913	141.84	42.5	" " "
	5.720		0.110		92.023	141.95	49.5	" " "
	5.650		0.070		92.093	142.02	54.5	" " "
	5.620		0.030		92.123	142.05	61.5	" " "
	6.030			0.410	91.713	141.64	65.5	" " "
	6.210			0.180	91.533	141.46	72.5	" " "
	6.160		0.050		91.583	141.51	77.5	" " "
	6.080		0.080		91.663	141.59	83.5	" " "
	5.950		0.130		91.793	141.72	85.5	" " "
	5.660		0.290		92.083	142.01	88.5	" " "
	5.500		0.160		92.243	142.17	95.5	" " "
	5.230		0.270		92.513	142.44	99.5	WE & WL Right Bank.
	5.050		0.180		92.693	142.62	117.5	River Bed - sand
	4.700		0.350		93.043	142.97	129.5	Starting up Right Bank
	4.820			0.120	92.923	142.85	144.5	Right Bank
	2.920		1.900		94.823	144.75	153.5	" "
	0.600		2.320		97.143	147.07	156.5	" "
	0.110		0.490		97.633	147.56	160.5	" "End of section
NOTE : Possible maximum flood level for 1977 flood approximately								
one meter above the level surveyed at the end of the section.								
Survey carried out by:								
B.A.P.Gemmell								
(FAO Consultant)								

SITE : JUBBA RIVER..... LOCATION : LUGH GANANA (JB.1.).....

DATE : 18/3/80..... TIME : 1200 Hrs..... WATER LEVEL : 0.74 m (GH).....

REMARKS : SURVEY OF 1977 FLOOD OVERSPILL ON THE R/B AT BRIDGE SECTION.....

B.S	I.S	F.S	RISE	FALL	R.L.	M.S.L	DIST	REMARKS
2.455					100.000	149.92		BM AD.100.0(msl 149.92)
	2.220		0.235		100.235	150.15		Possible Flood Mark
	1.570		0.650		100.885	150.80	0.0	STN '1' Instrument
	1.570		0.000	0.000	100.885	150.80	3.0	Start of Bridge Deck LB
		1.750		0.180	100.705	150.62	161.0	End of Bridge deck RB
0.220					100.705			CP.
							229.0	STN. 2.
		2.820		2.600	98.105	148.02	321.0	CP,
1.510					98.105	148.02		CP,
							435.0	STN. 3.
		1.470	0.040		98.145	148.06	598.0	CP,
1.670					98.145	148.06		CP,
							700.0	STN. 4.
	2.730			1.060	97.085	147.00		U/S side of Culvert
	2.690		0.040		97.125	147.04		D/S side of Culvert
		1.470	1.220		98.345	148.26	803.0	CP,
2.020					98.345	148.26		CP,
							900.0	STN. 5.
		1.150	0.870		99.215	149.13	997.0	CP,
2.280					99.215	149.13		CP,
							1,097	STN. 6.
	2.940			0.660	98.555	148.47		D/S side of road bund
		0.760	2.180		100.735	150.65	1,224	CP,
2.770					100.735	150.65		CP,
	3.330			0.560	101.295	150.09		D/S side of road bund
		1.620	1.710		103.005	151.80	1,337	Instrument, End of sect
NOTE: a) Levels surveyed as far as the Refugee camp on the right bank.								
b) All distances measured in meters.								
Surveyed By :								
B.A.P.Gemmell								
(FAO Consultant)								

SITE : JUBBA RIVER..... LOCATION : LUGH..GANANA...(JB..1.).....

DATE : 21/5/80..... TIME : 1200 Hrs..... WATER LEVEL : 2.36 m (GH).....

REMARKS : Survey of flood peak & Water slope for CMM. also WL slope 20/3/80

B.S	I.S	F.S	RISE	FALL	R.L.	DIST	ANG	REMARKS
C.620					98.405			TBM L Iron Under Bridge
		4.260		3.640	94.765			CP, Metal peg
1.400					94.765			CP, " "
	1.820			0.420	94.345			FM at section L/B
	2.290			0.470	93.875			WL at Gauge (2.36 m)
	2.280		0.010		93.885		0°	WL at section R/B.
	1.860		0.420		94.305	147.0		FM at R/B sect (+2.5m)
	1.780		0.080		94.385		45°	FM R/B Upstream
	2.220			0.440	93.945	185.0		WL " "
	1.720		0.500		94.445		15°	FM R/B Upstream
	2.180			0.460	93.985	296.0		WL " "
	1.880		0.300		94.285			FM L/B Downstream
	2.300			0.420	93.865	336.0		WL L/B " "
		1.400	0.900		94.765			TBM. Metal Peg.
NOTE : Flood Peak Water Level = RL 94.305 = 2.80m GH. (MSL = 144.222 m)								
a) Water slope at time = 0.12 m fall over distance of 632m = 0.00019								
b) Flood slope = 0.16 m fall over distance of 632m = 0.00025								
c) Water level = RL 93.865 = 2.36 m GH. = MSL 143.782 m.								
<u>SLOPE SURVEY 20/3/80</u>								
1.085					93.725			Top 0-2 m gauge post.
	2.350			1.265	92.460	130.0		WL D/S
	2.345		0.005		92.465	151.0		WL U/S
	2.355			0.010	92.455	101.0		WL D/S
	2.340		0.010		92.465	107.0		W/L U/S
		1.085	1.255		93.720			Top 0-2 m gauge post.
NOTE : Total Slope = $\frac{0.02}{281} = 0.00007$ (GH = 0.74 meters - MSL 142.38 m)								
Surveyed By:								B.A.P.Gemmell.

SITE : JUBBA RIVER LOCATION : LUGH GANANA (JB.1.)

DATE : 23/4/81 TIME : 1200 Hrs. WATER LEVEL : 5.40 m. (GH).

REMARKS : FLOOD PEAK AND WATER LEVEL SLOPES AT TIME OF VISIT.

B.S	I.S	F.S	RISE	FALL	R.L.	DIST	ANG	REMARKS
1.690					100.000			BM=AD.100.0(MSL 149.917)
	1.670		0.020		100.020			TBM=Top of Iron.
	0.625		1.045		101.065			MP on the Bridge deck
		2.975		2.350	98.715			CP,
0.935			0.000	0.000	98.715			CP,
	1.255			0.320	98.395			TBM, under bridge.
	2.650			1.405	96.990	224.0		FM D/S
	2.815			0.165	96.835			WL D/S
	2.760		0.055		96.890	156.0		FM D/S
	2.790			0.030	96.860			WL D/S
	2.660		0.130		96.990	83.0		FM D/S
	2.760			0.100	96.890			WL D/S
	2.520		0.240		97.130	0.0		FM at section
	2.755			0.235	96.895			WL at section
	2.520		0.235		97.130	46.0		FM U/S
	2.750			0.230	96.900			WL U/S
		0.935	1.815		98.715			CP, TBM.
NOTE : WL Slope at 5.40 GH = $\frac{0.065}{270 \text{ m}}$ = 0.00024. (RL 96.905, & MSL 146.82)								
Flood slope at 5.63 GH = $\frac{0.14}{270 \text{ m}}$ = 0.00052. (RL 97.135 & MSL 147.05)								
(MP) on Bridge deck 4.17 meters above W.L. at GH 5.40 m.								
Hand rail on bridge one meter above the MP point at bridge deck level. (MSL 102.07).								
Surveyed By:								
								B.A.P.Gemmell.

DISCHARGE MEASUREMENTS

SHEET NO: 1. (1980)

STREAM : JUBBA RIVER AT : LUGH GANANA STATION NO : JB.1.

NO	DATE	OBSERVER	GH m	WIDTH m	AREA m	V _m m/sec	Q m ³ /sec	M.S.L	METH	R E M A R K S
1	18.3.80	B.P.Gemmel	0.75	46.0	30.04	0.19	5.81	142.39	.2/.8	Base flow 100 m U/S of Bridge (Wading)
2	19.3.80	" "	0.75	100.5	75.50	0.07	5.35	"	"	" Suspension from Bridge
3	19.3.80	" "	"	"	"	"	"	S/A	S/A	Survey of 1977 peak flood.
4	1.5.80	" "	1.15	117.5	106.40	0.34	35.70	142.79	.2/.8	Steady stage - Suspension, D/S of bridge
5	2.5.80	HYDRO TEAM	1.12	117.0	104.20	0.33	33.98	142.76	.2/.8	Slow recession
6	3.5.80	" "	1.20	117.0	115.60	0.36	41.26	142.84	.2/.8	Steady Stage. Suspension from bridge.
7	21.5.80	B.P.Gemmel	2.37	124.0	241.10	0.70	168.03	143.79	.2/.8	Falling stage. " " "
8	21.5.80	" "	2.80	"	"	"	"	144.22	S/A	Survey of Peak flood.
9	22.5.80	Hydro Team	2.34	124.0	236.00	0.70	164.70	143.76	.2/.8	Steady Stage. CMM suspension gauging.
10	4.6.80	" "	1.68	120.5	157.80	0.57	90.40	143.32	V.V.C.	Stage falling slowly. Suspension gauging
11	7.7.80	" "	2.28	137.0	215.02	0.60	129.60	143.70	V.V.C.	Falling Stage. " " "
12	15.8.80	" "	2.27	124.0	206.01	0.72	148.20	143.69	.2/.8	Rising Stage. Suspension Gauging.
13	16.8.80	" "	2.40	127.0	224.31	0.74	165.30	143.82	.2/.8	Steady Water Level.
14	8.10.80	B.P.Gemmel	2.59	131.0	285.17	0.75	213.70	144.01	V.V.C	Stage Steady/Falling.
15	9.10.80	" "	2.49	129.0	254.78	0.77	195.96	143.91	.2/.8	Falling stage.
16	28.10.80	" "	2.22	121.5	201.50	0.70	141.30	143.64	.2/.8	Rising stage (WL on 0-2m plate = 2.0m)
17	7.12.80	Hydro Team	1.33	152.0	99.20	0.42	41.35	142.97	.2/.8	Steady Stage.(Wading gauging U/S bridge)
18	8.12.80	" "	1.30	153.0	97.47	0.40	41.34	142.94	.2/.8	Falling Stage(" " "
19	12.12.80	" "	1.29	117.0	110.14	0.38	39.27	142.93	.2/.8	" " (Suspension Gauging)
20	14.12.80	Hydro Team	1.18	116.5	94.18	0.36	33.52	142.82	.2/.8	Steady stage (Suspension Gauging)

Continued :

DISCHARGE MEASUREMENTS

SHEET NO: 2. (1981)

STREAM : JUBBA RIVER AT : LUGH GANANA STATION NO : JB.1.

NO	DATE	OBSERVER	GH m	WIDTH m	AREA m	Vm m/sec	Q m / sec	M.S.L	METH	R E M A R K S
	Continued	from sheet	1.							
21	22.2.81	Hydro Team	0.56	34.0	23.16	0.11	2.59	142.20	.2/.8	Base Flow (Lowest gauged level)
22	22.3.81	B.P.Gemmel	1.58	118.0	166.14	0.41	68.67	143.22	.2/.8	Falling Flood. Suspension Gauging.
23	24.3.81	" "	1.97	119.3	215.16	0.60	129.35	143.61	.2/.8	Rising flood. " "
24	24.3.81	" "	2.42	124.0	237.17	0.67	159.67	143.84	.2/.8	Steady Water Level. Suspension Gauging.
25	25.3.81	BPG/Hydro	2.37	124.0	241.24	0.66	159.14	143.79	.2/.8	Rising stage.
26	26.3.81	Hydro Team	4.02	130.0	479.34	1.26	602.92	145.44	.2/.8	Rising to Steady stage. (Suspension)
27	27.3.81	" "	3.86	131.0	518.25	1.02	528.42	145.28	.2/.8	Falling stage. Suspension Gauging.
28	21.4.81	B.P.Gemmel	5.36	136.0	858.18	1.19	1023.10	146.78	V.V.C.	Falling stage. " "
29	22.4.81	" "	5.45	138.0	890.13	1.24	1106.96	146.87	.2;.5;.8	Falling stage. " "
30	23.4.81	" "	5.43	137.0	897.03	1.24	1112.91	146.85	.2/.8	Rising stage. " "
31	1.5.81	" "	6.12	140.8	1086.27	1.38	1463.63	147.54	.2/.8	Falling slowly just after peak flood.
32	2.5.81	B.P.Gemmel	5.93	140.3	1054.10	1.16	1218.02	147.35	V.V.C.	Falling stage. Suspension Gauging.
33	16.8.81	Hydro Team	2.80	122.0	346.40	0.76	264.00	144.22	.2/.8	Falling stage.
34	25.9.81	" "	3.86	131.0	544.60	1.12	607.60	145.28	.2/.8	" "
35	26.9.81	" "	3.80	129.5	530.00	1.08	574.30	145.22	.2/.5;.8	" "

JUBBA RIVER AT LUGH GANANA RATING CURVE

Gauge Height In Meters

NOTE: (1980/81)

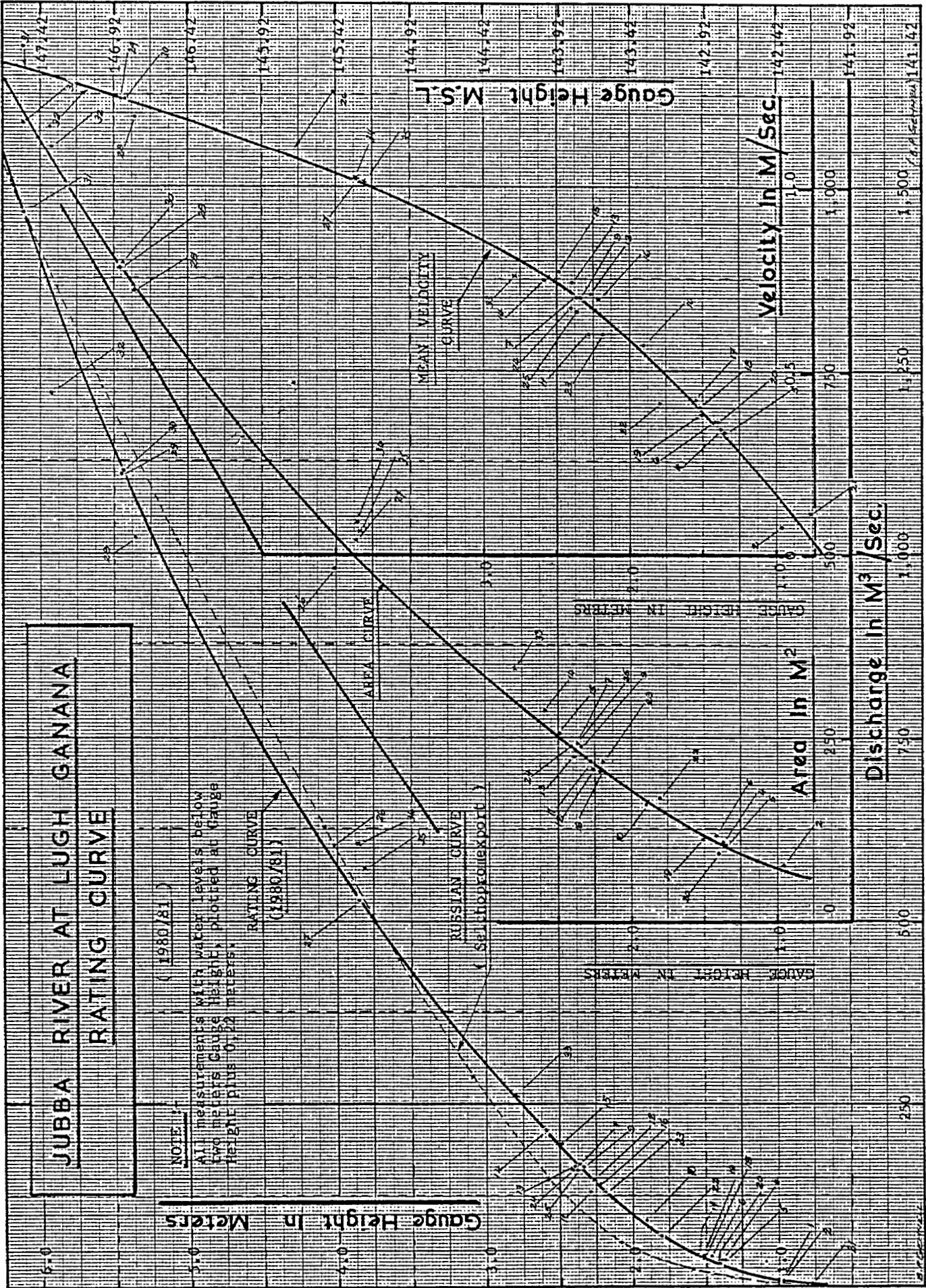
All measurements with water levels below two meters Gauge Height, plotted at Gauge Height plus 0.22 meters.

RATING CURVE
(1980/81)

RUSSIAN CURVE
(Selyudoproekport)

AREA CURVE

MEAN VELOCITY CURVE



Discharge In M³/Sec.

Velocity In M/Sec.

Gauge Height M.S.L.

Gauge Height In Meters

Gauge Height In Meters

JUBBA RIVER AT LUGH GANANA RATING CURVE

(1980 - 1981)

NOTE:

- 1). All levels below 2.0 meters plotted GR + 0.42 meters,
- 2). Discharge measurements No. 1 to 20 refer to 1980, and 21 to 35 refer to 1981.

Intersection Point
GR = 2.66 m, Q = 236 m³/sec.

Intersection Point
GR = 1.825, Q = 28.44 m³/sec.

LOW CURVE
Q = 7.93 m³/sec

MEDIUM CURVE
Q = 12.18 m³/sec

HIGH CURVE
Q = 26.61 m³/sec

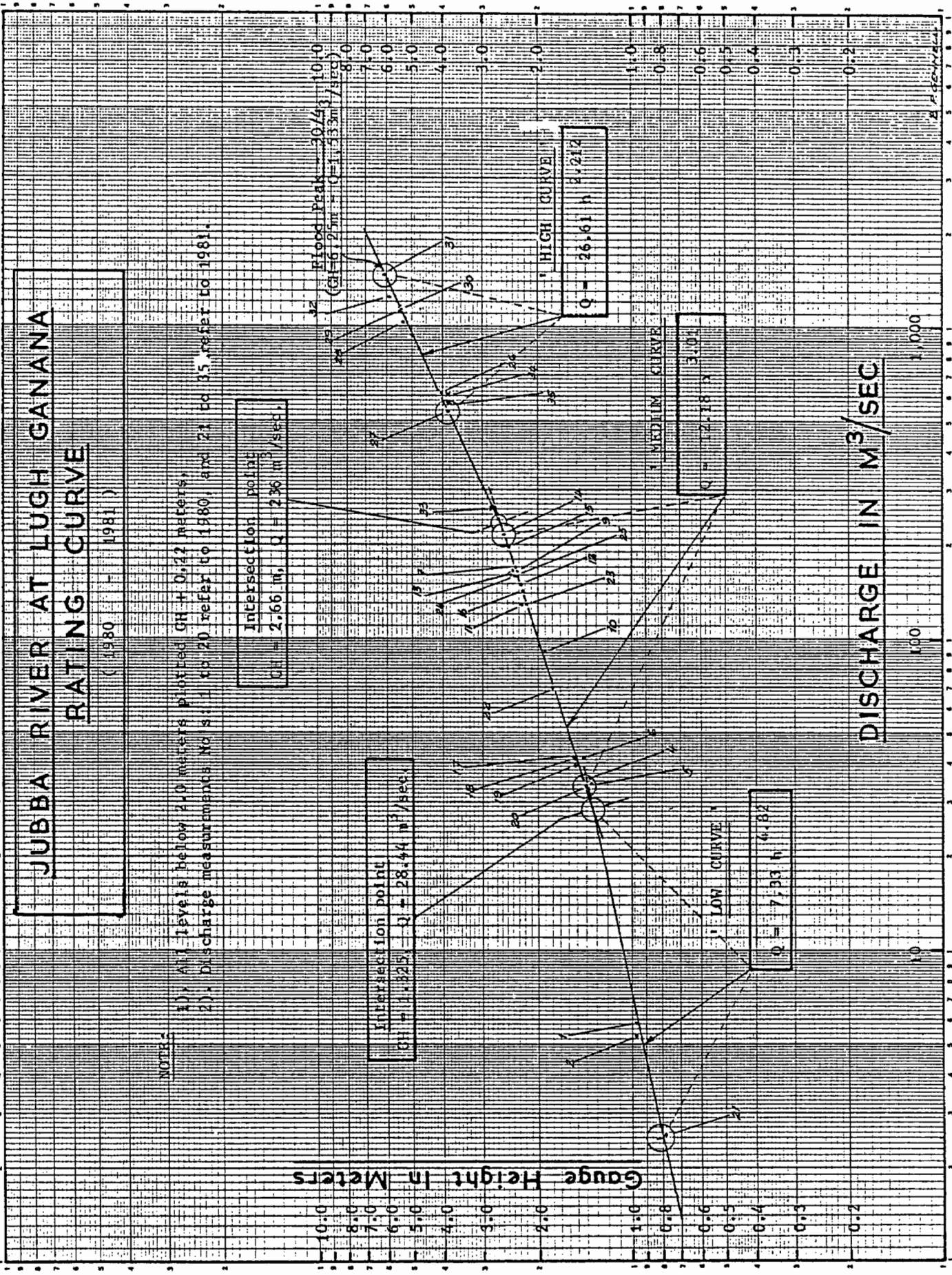
Flood Peak 20/53, 10.0
(GR = 6.75m, Q = 1153 m³/sec)

Gauge Height in Meters

DISCHARGE IN M³/SEC

100 1,000

E. P. GANANA



JUBBA RIVER AT LUGH GANANA CROSS SECTIONS

(1980 & 1981)

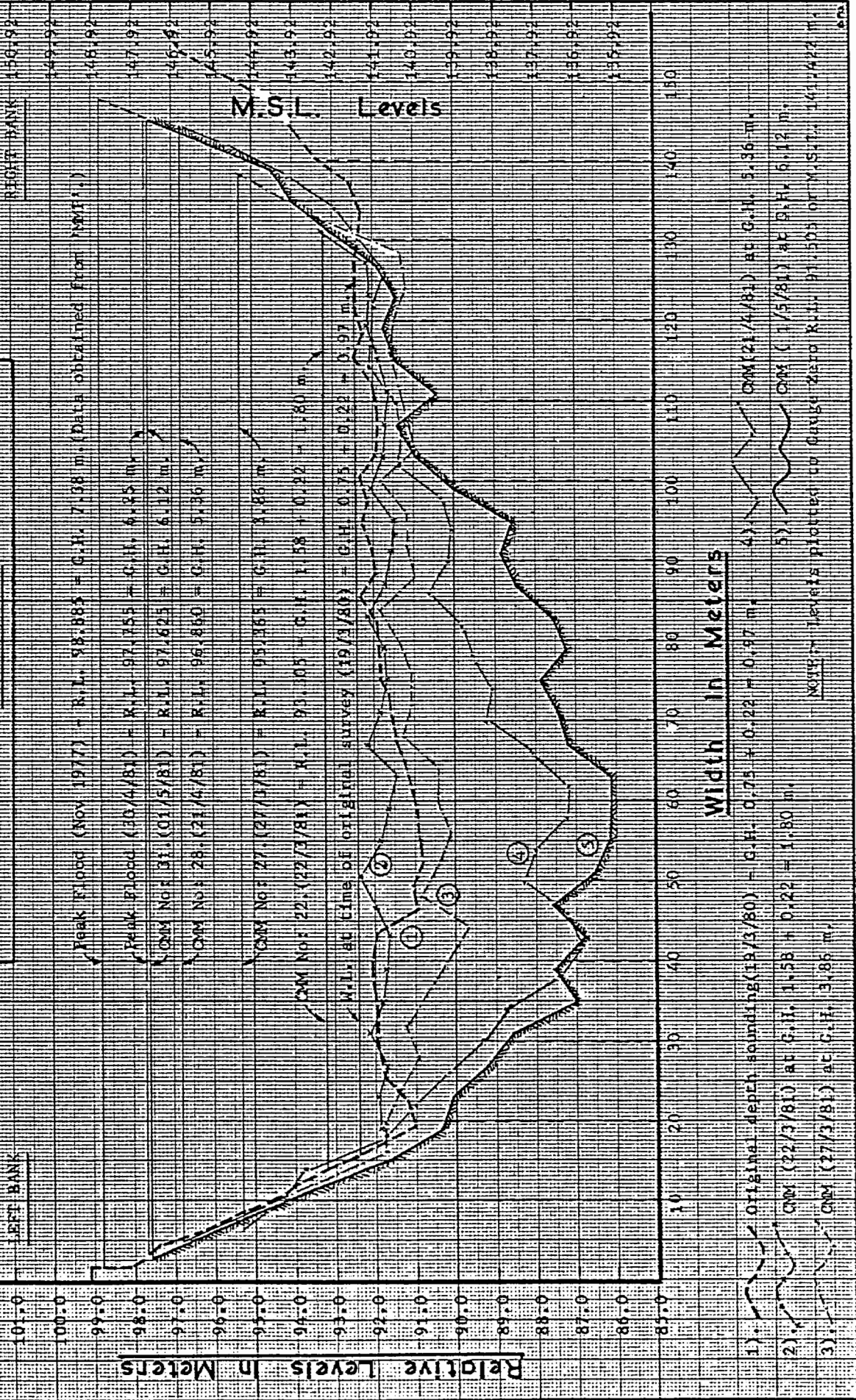


Table 2.2 Riverflow of the Juba River at Kaitoi (mcm)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
1925	(46)	(42)	(52)	(60)	(65)	(51)	(95)	(140)	(130)	(250)	(1,190)	(570)	(2,690)
1926	(230)	(210)	(200)	(210)	(2,200)	(760)	(380)	(910)	(440)	(1,390)	(2,460)	(1,640)	(11,030)
1951	(250)	(89)	(47)	925	1,790	679	460	1,000	655	1,780	1,410	741	9,830
1952	182	25	11	167	683	239	310	708	1,120	1,840	901	113	6,300
1953	26	9	10	77	499	190	738	1,340	474	698	990	162	5,210
1954	45	9	9	629	594	433	827	1,500	1,520	1,800	403	244	8,010
1955	45	37	(12)	77	260	34	148	594	794	1,280	552	131	3,960
1956	64	34	13	246	735	300	423	962	2,530	2,370	836	184	8,700
1957	52	23	149	157	1,190	806	689	689	450	600	786	505	6,100
1958	83	101	57	67	370	199	1,000	1,400	1,300	1,470	1,010	579	7,640
1959	(170)	(24)	(15)	78	646	623	594	637	1,350	1,740	1,600	299	7,780
1960	(92)	(350)	(1,090)	93	15	(470)	(410)	472	670	870	(470)	(47)	5,050
1961	(56)	(35)	(38)	(510)	698	507	702	1,580	1,210	1,940	2,370	1,430	11,080
1962	243	56	40	149	588	119	220	536	735	(1,520)	(840)	(360)	5,410
1963	74	31	31	583	1,540	521	396	461	456	549	562	787	5,990
1964	265	76	39	187	321	337	295	702	-	-	-	-	-
1972								599	605	757	1,070	489	-
1973	145	44	26	25	112	226	275	639	784	1,040	641	223	4,180
1974	64	27	22	267	273	433	396	449	698	501	408	128	3,670
1975	35	23	24	66	313	317	396	807	747	765	610	299	4,400
Max	265	(350)	(1090)	925	(2,200)	806	1,000	1,580	1,520	2,370	(2,460)	(1,640)	(11,080)
Mean	114	66	99	241	679	381	461	806	877	1,220	1,010	470	6,420
Min	26	9	9	25	15	34	(95)	(140)	(130)	(250)	(470)	(47)	(2,690)

Data 1925-26, 1951-62 $1.14Q + 0.46$ where Q is the monthly river flow at Laugh Ganana given by Selchozpromexport, (2), from measurements by Giprovdhoz. 1972 Booker-McConnell, (8).

MEAN DAILY WATER LEVELS

(Meters)

RIVER : JUBBA LOCATION : LUGH GANANA YEAR : 1977

DATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	1.62	1.47	1.41	1.11	2.06	3.40	2.84	2.83	2.82	3.14	5.82	3.94
2	1.64	1.47	1.40	1.13	3.72	3.61	2.82	2.80	2.79	3.06	6.58	3.85
3	1.66	1.50	1.38	1.07	3.34	3.80	2.80	2.76	2.85	2.97	6.86	3.80
4	1.64	1.60	1.36	1.85	2.85	3.88	2.70	2.76	3.09	2.97	6.69	3.71
5	1.63	1.80	1.33	3.48	2.70	3.85	2.63	2.78	3.38	2.95	6.84	3.54
6	1.59	1.79	1.29	3.39	2.77	3.63	2.57	2.76	3.38	2.98	6.98	3.43
7	1.56	1.77	1.26	3.12	3.00	3.68	2.55	2.74	3.30	3.01	6.85	3.27
8	1.54	1.74	1.24	3.03	4.71	3.71	2.53	2.72	3.22	3.09	6.84	3.13
9	1.51	1.72	1.23	3.56	4.85	3.62	2.50	2.77	3.16	3.25	6.44	3.70
10	1.50	1.75	1.23	3.73	3.41	3.47	2.58	2.90	3.07	3.61	6.43	2.92
11	1.51	1.79	1.28	3.60	3.07	3.38	2.67	2.86	3.00	3.80	6.34	2.84
12	1.56	1.81	1.30	4.57	3.64	3.35	2.75	2.80	3.10	3.86	6.04	2.81
13	1.62	1.77	1.31	4.01	3.42	3.34	2.75	2.79	3.34	4.19	5.76	2.80
14	1.65	1.69	1.37	3.52	3.28	3.31	2.84	2.80	3.51	4.22	5.46	2.76
15	1.65	1.63	1.36	3.80	3.14	3.26	2.81	2.79	3.63	4.30	5.29	2.76
16	1.57	1.56	1.33	35.2	2.97	3.20	2.81	2.76	3.55	4.16	4.97	2.66
17	1.55	1.56	1.31	2.92	2.87	3.10	2.82	2.88	3.47	4.00	4.50	2.62
18	1.53	1.54	1.26	2.80	2.76	3.07	2.82	3.12	3.39	4.18	4.23	2.60
19	1.52	1.52	1.25	2.72	2.69	3.00	2.90	3.37	3.45	4.58	4.06	2.59
20	1.47	1.58	1.23	2.64	2.62	2.98	2.90	3.37	3.44	4.41	3.90	2.54
21	1.45	1.59	1.23	2.37	2.48	2.73	2.89	3.25	3.44	4.38	4.08	2.50
22	1.44	1.60	1.22	2.51	2.43	2.81	2.81	3.31	3.51	4.43	3.79	2.46
*23	1.43	1.59	1.22	2.46	2.45	2.73	2.78	3.46	3.75	4.62	4.42	2.49
24	1.44	1.61	1.18	2.36	2.61	3.01	2.79	3.57	3.84	4.33	5.40	2.42
25	1.48	1.54	1.15	2.22	2.75	3.10	2.79	3.47	3.84	4.92	4.62	2.25
26	1.55	1.47	1.14	2.12	2.88	3.02	2.81	3.48	3.77	5.09	3.82	2.17
27	1.62	1.41	1.12	2.12	3.22	2.98	2.90	3.39	3.61	4.99	3.51	2.14
28	1.65	1.42	1.27	2.07	3.62	2.91	2.93	3.28	3.50	4.97	3.69	2.12
29	1.63	-	1.20	1.94	3.23	2.93	2.90	3.15	3.40	4.78	4.04	2.02
30	1.60	-	1.12	2.02	3.23	2.94	2.88	3.03	3.25	4.97	4.05	1.98
31	1.55	-	1.11	-	3.25	-	2.86	2.92	-	5.24	-	1.94
Mean	1.56	1.62	1.30	2.73	3.10	3.26	2.77	3.02	3.38	4.05	5.27	2.80
M(max)	1.66	1.81	1.41	4.57	4.85	3.88	2.93	3.57	3.84	5.24	6.98	3.94
M(min)	1.43	1.41	1.11	1.07	2.06	2.73	2.50	2.72	2.79	2.95	3.51	1.94
Max(A)	1.68	1.84	1.43	4.62	4.89	3.92	2.98	3.60	3.89	5.20	*7.13	3.98
Min(A)	1.42	1.41	1.11	1.07	2.06	2.72	2.48	2.70	2.75	2.94	3.45	1.91
FLOOD PEAK = GH 7.13m (6.11.72) Mean Yearly Gauge Height: 2.91												

MEAN DAILY WATER LEVELS

(Meters)

RIVER :..... JUBBA LOCATION :..... LUGH GANANA YEAR :..... 1978

DATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	2.06	1.65	1.53	2.40	2.26	2.46	2.18	3.28	3.00	3.05	4.00	3.08
2	2.00	1.61	1.60	2.32	2.28	2.40	2.70	3.17	2.98	3.11	4.15	3.01
3	2.00	1.58	2.48	2.28	2.24	2.38	2.32	3.12	3.01	3.18	3.66	2.95
4	1.96	1.56	3.12	2.12	2.21	2.33	2.40	3.06	3.21	3.25	3.60	2.92
5	1.93	1.53	3.14	2.06	2.25	2.22	2.58	3.12	3.16	3.40	3.76	2.88
6	1.83	1.51	3.13	1.97	2.26	2.20	2.99	3.25	3.11	3.59	3.50	2.78
7	1.82	1.49	3.12	2.04	2.43	2.16	3.37	3.20	3.12	3.53	3.46	2.72
8	1.82	1.48	3.00	2.10	2.92	2.13	3.84	3.20	3.14	3.54	3.46	2.62
9	1.82	1.47	2.85	2.31	3.18	2.15	3.74	3.26	3.15	3.59	3.36	2.53
10	1.82	1.45	2.85	2.58	3.22	2.03	3.73	3.29	3.23	3.57	3.30	2.35
11	1.81	1.44	2.84	2.50	3.20	2.03	3.73	3.37	3.36	3.53	3.30	2.23
12	1.81	1.43	2.68	2.53	3.44	1.99	3.70	3.52	3.26	3.68	3.16	2.18
13	1.79	1.42	2.68	2.26	3.51	1.96	3.60	3.69	3.17	3.97	2.97	2.17
14	1.79	1.41	2.68	2.22	3.44	1.92	3.51	3.78	3.08	4.38	2.88	2.16
15	1.78	1.39	2.68	2.09	3.36	1.92	3.43	3.64	3.02	4.59	2.77	2.16
16	1.78	1.38	2.67	2.16	3.35	2.10	3.33	3.49	2.98	4.62	2.70	2.17
17	1.77	1.38	2.46	2.16	3.33	1.91	3.50	3.40	2.98	4.67	2.66	2.12
18	1.75	1.37	2.44	2.12	3.32	1.96	3.55	3.35	2.87	4.72	2.64	2.12
19	1.75	1.37	2.43	2.16	3.31	1.99	3.51	3.32	2.84	4.72	2.64	2.08
20	1.74	1.36	2.41	1.98	3.23	1.96	3.53	3.23	2.91	4.70	2.67	2.05
21	1.71	1.32	2.41	1.99	3.19	1.96	3.77	3.26	2.87	4.73	2.76	2.07
22	1.69	1.32	2.41	2.08	3.07	2.01	3.90	3.34	2.78	4.73	2.61	2.08
23	1.67	1.32	2.47	2.10	2.97	2.05	3.89	3.34	2.76	4.72	2.58	2.09
24	1.67	1.31	2.31	2.09	2.79	2.07	3.69	3.31	2.68	4.70	2.58	2.10
25	1.67	1.30	2.23	2.17	2.75	2.12	3.61	3.28	2.65	4.70	2.56	2.09
26	1.66	1.41	2.29	2.46	2.56	2.16	3.58	3.17	2.59	4.72	2.58	2.05
27	1.66	1.52	2.20	2.42	2.57	2.20	3.54	3.07	2.53	4.65	2.82	2.05
28	1.66	1.60	2.20	2.43	2.51	2.27	3.38	3.00	2.56	4.20	3.12	2.03
29	1.66	-	2.27	2.27	2.46	2.31	3.37	2.94	2.66	4.10	3.22	1.94
30	1.69	-	2.64	2.22	2.45	2.15	3.39	2.95	2.75	4.44	3.24	1.93
31	1.67	-	2.49	-	2.33	-	3.35	2.96	-	4.46	-	1.87
Mean	1.78	1.44	2.61	2.22	2.85	2.12	3.36	3.27	2.95	4.11	3.09	2.31
M(max)	2.06	1.65	3.14	2.58	3.51	2.46	3.90	3.78	3.36	4.73	4.15	3.08
M(min)	1.66	1.30	1.53	1.97	2.21	1.91	2.18	2.94	2.53	3.05	2.56	1.87
Max(A)	2.09	1.66	3.16	2.63	3.58	2.48	3.95	3.84	3.40	5.15	4.20	3.15
Min(A)	1.65	1.28	1.50	1.95	2.18	1.85	2.16	2.92	2.50	2.95	2.55	1.86
	PEAK FLOOD = GH 5.15m (22.10.78) Mean Yearly Gauge Height: 2.68											

MEAN DAILY WATER LEVELS

(Meters)

RIVER : JUBBA LOCATION : LUGH GANANA YEAR : 1979

DATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	1.86	1.69	1.68	1.87		3.40	2.71	2.68	1.99	2.46	3.37	2.46
2	1.84	1.79	1.69	1.78		3.20	2.64	2.72	1.98	2.60	3.33	2.56
3	1.83	1.81	1.63	2.06		3.21	2.64	2.81	1.94	2.74	3.32	2.79
4	1.83	2.00	1.59	1.99		3.08	2.63	2.72	1.85	2.79	3.34	2.79
5	1.81	2.13	1.54	2.10		3.03	2.59	2.64	1.85	2.84	3.35	2.84
6	1.76	2.19	1.52	2.07		3.02	2.62	2.61	1.86	2.86	3.37	2.86
7	1.73	2.10	1.49	2.11		3.04	2.71	2.56	1.86	2.78	3.33	2.78
8	1.72	1.96	1.44	2.09		3.08	2.72	2.50	1.79	2.80	3.25	2.80
9	1.69	1.95	1.42	2.09		3.05	2.72	2.54	1.75	2.73	3.20	2.73
10	1.67	1.90	1.42	2.03		3.02	2.66	2.60	1.69	2.65	3.28	2.66
11	1.68	1.85	1.41	2.00		3.07	2.58	2.59	1.82	2.59	3.35	2.59
12	1.67	1.83	1.40	2.20		3.06	2.56	2.58	1.92	2.57	3.38	2.57
13	1.66	1.76	1.38	2.22		3.22	2.54	2.59	1.90	2.37	3.30	2.50
14	1.62	1.73	1.36	2.67		3.27	2.30	2.56	1.88	2.47	3.22	2.47
15	1.61	1.66	1.33	2.15		3.22	2.19	2.52	1.88	2.39	3.10	2.49
16	1.58	1.64	1.31	2.05		3.08	2.15	2.52	2.11	2.52	2.96	2.52
17	1.57	1.68	1.30	1.95		3.00	2.11	2.52	2.59	2.54	2.78	2.54
18	1.56	1.67	1.27	2.01		3.02	2.08	2.57	2.37	2.67	2.71	2.61
19	1.55	1.65	1.34	2.49		3.00	2.08	2.82	2.50	2.69	2.75	2.69
20	1.56	1.73	1.45	2.48		3.00	2.11	3.10	2.45	2.74	2.81	2.74
21	1.58	1.89	1.62	2.50		2.98	2.12	2.74	2.43	2.82	2.82	2.82
22	1.60	1.90	1.94	2.45		2.98	2.12	2.62	2.27	2.92	2.74	2.82
23	1.75	1.85	1.97	2.20		2.96	2.12	2.60	2.34	3.09	2.72	2.92
24	1.80	1.82	2.00	2.13		2.92	2.13	2.60	2.03	3.21	2.62	3.09
25	1.87	1.79	2.00	2.46		2.83	2.13	2.60	1.99	3.38	2.65	3.21
26	1.87	1.78	2.01	2.90		2.72	2.15	2.56	2.01	3.35	2.71	3.38
27	1.87	1.76	2.00	3.12		2.71	2.15	2.42	2.21	3.35	2.70	3.35
28	1.75	1.74	1.99	3.09		2.67	2.13	2.32	2.67	3.52	2.55	3.54
29	1.72	-	1.96	3.10		2.65	2.12	2.19	2.15	3.54	2.51	3.60
30	1.70	-	1.95	2.89		2.68	2.13	2.12	2.42	3.54	2.50	3.52
31	1.67	-	1.92	-		-	2.26	2.01	-	3.37	-	3.36
Mean	1.71	1.84	1.62	2.31		3.01	2.35	2.57	2.15	2.87	3.00	2.86
M(max)	1.87	2.13	2.01	3.12		3.40	2.72	3.10	2.67	3.54	3.38	3.60
M(min)	1.55	1.64	1.27	1.78		2.65	2.08	2.01	1.69	2.37	2.50	2.46
Max(A)	1.88	2.21	2.01	3.15		3.45	2.74	3.12	2.70	3.56	3.40	3.63
Min(A)	1.54	1.62	1.25	1.74		2.62	2.07	2.00	1.68	2.35	2.47	2.45
	PEAK FLOOD: May (?)					Mean Yearly Gauge Height: -						

MEAN DAILY WATER LEVELS

(Meters)

RIVER :..... JUBBA..... LOCATION :..... LUGH GANANA..... YEAR :1980.....

DATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	1.36	1.13	1.00	0.94	1.38	1.83	2.29	2.00	2.25	2.16	2.56	1.61
2	1.36	1.13	1.00	0.94	1.36	1.82	2.36	1.96	2.30	2.45	2.47	1.63
3	1.35	1.12	0.99	0.94	1.42	1.87	2.37	1.94	2.48	2.77	2.38	1.64
4	1.34	1.12	0.99	0.93	1.41	1.91	2.35	1.94	2.52	2.80	2.33	1.61
5	1.34	1.11	0.99	0.93	1.79	1.88	2.33	1.95	2.48	2.80	2.24	1.59
6	1.32	1.11	0.98	0.93	1.67	1.92	2.30	2.05	2.53	2.78	2.20	1.58
7	1.32	1.10	0.98	0.93	1.77	1.92	2.36	2.07	2.23	2.70	2.20	1.55
8	1.31	1.10	0.98	0.93	1.93	1.92	2.42	2.06	2.26	2.58	2.16	1.54
9	1.30	1.09	0.98	0.92	1.91	1.92	2.39	2.08	2.24	2.47	2.19	1.52
10	1.29	1.09	0.98	0.92	1.93	1.95	2.35	2.17	2.21	2.42	2.15	1.47
11	1.29	1.08	0.97	0.92	2.13	1.93	2.33	2.17	2.20	2.41	2.04	1.45
12	1.29	1.08	0.97	0.92	2.37	1.91	2.35	2.16	2.14	2.40	1.99	1.44
13	1.28	1.07	0.97	0.92	2.48	1.86	2.34	2.18	2.09	2.39	1.95	1.39
14	1.28	1.07	0.97	0.93	2.60	1.81	2.37	2.20	2.09	2.36	1.94	1.38
15	1.27	1.06	0.96	0.97	2.58	1.81	2.49	2.28	2.09	2.36	1.94	1.37
16	1.25	1.06	0.96	1.38	2.60	1.81	2.52	2.40	2.09	2.36	1.91	1.34
17	1.24	1.06	0.96	1.29	2.72	1.81	2.57	2.40	2.01	2.38	1.86	1.30
18	1.24	1.05	0.96	1.22	2.71	1.80	2.52	2.30	2.01	2.41	1.83	1.29
19	1.23	1.04	0.96	1.10	2.59	1.76	2.38	2.20	2.02	2.40	1.81	1.28
20	1.22	1.04	0.96	1.07	2.44	1.72	2.30	2.15	2.02	2.39	1.80	1.26
21	1.21	1.03	0.95	1.09	2.38	1.72	2.30	2.13	2.02	2.38	1.82	1.24
22	1.20	1.03	0.95	1.50	2.36	1.71	2.30	2.12	2.03	2.35	1.81	1.23
23	1.20	1.03	0.95	1.50	2.32	1.76	2.20	2.12	2.09	2.34	1.77	1.23
24	1.19	1.02	0.95	1.42	2.04	1.81	2.22	2.07	2.16	2.25	1.72	1.22
25	1.19	1.02	0.95	1.42	1.92	1.83	2.22	2.02	2.22	2.21	1.72	1.22
26	1.18	1.02	0.94	1.50	1.92	1.87	2.17	2.03	2.22	2.19	1.70	1.21
27	1.17	1.01	0.94	1.45	1.89	1.89	2.12	2.03	2.21	2.14	1.66	1.21
28	1.16	1.01	0.94	1.39	1.85	1.94	2.06	2.02	2.19	2.21	1.66	1.20
29	1.15	1.00	0.94	1.40	1.83	2.00	2.00	2.02	2.17	2.56	1.64	1.20
30	1.15	-	0.94	1.39	1.82	2.10	1.97	2.01	2.16	2.57	1.68	1.19
31	1.14	-	0.94	-	1.80	-	1.96	2.18	-	2.58	-	1.19
Mean	1.25	1.06	0.96	1.11	2.06	1.86	2.30	2.11	2.19	2.44	1.97	1.37
M(max)	1.36	1.13	1.00	1.50	2.72	2.10	2.57	2.40	2.53	2.80	2.56	1.64
M(min)	1.14	1.00	0.94	0.92	1.36	1.71	1.96	1.94	2.01	2.14	1.64	1.19
Max(A)	1.36	1.14	1.00	1.50	2.76	2.15	2.60	2.45	2.60	2.85	2.58	1.65
Min(A)	1.14	1.00	0.94	0.92	1.34	1.71	1.95	1.93	2.00	2.12	1.62	1.18
	FLOOD PEAK: 2.85 m (Oct 4th.)						Mean Yearly Gauge Height: 1.72					

MEAN DAILY WATER LEVELS

(Meters)

RIVER : JUBBA LOCATION : LUGH GANANA YEAR : 1981

DATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	1.17	0.92	0.80	3.80	6.15	2.53	1.90	2.40	2.78	3.52	3.02	2.09
2	1.16	0.91	0.80	3.71	5.93	2.48	1.91	2.40	2.75	3.52	2.92	2.09
3	1.15	0.90	0.79	3.70	5.77	2.43	1.99	2.42	2.75	3.46	2.88	2.08
4	1.14	0.89	0.78	3.66	5.69	2.39	2.02	2.53	2.76	3.43	2.78	2.05
5	1.13	0.88	0.89	3.59	5.46	2.36	2.05	2.62	2.78	3.20	2.91	2.04
6	1.12	0.87	0.89	3.18	5.22	2.34	2.05	2.71	3.00	3.13	2.95	1.99
7	1.11	0.86	0.92	3.35	5.03	2.31	2.05	2.70	3.50	3.10	2.68	1.99
8	1.10	0.86	0.89	3.64	4.96	2.29	2.09	2.67	3.40	3.04	2.68	1.97
9	1.07	0.85	0.85	3.65	4.74	2.27	2.10	2.70	3.55	3.16	2.73	1.94
10	1.05	0.85	0.85	3.55	4.28	2.26	2.12	2.67	3.50	3.34	2.74	1.92
11	1.04	0.84	0.85	3.47	4.02	2.24	2.12	2.61	3.43	3.39	2.71	1.90
12	1.03	0.83	0.84	3.30	3.88	2.18	2.07	2.66	3.28	3.55	2.63	1.88
13	1.01	0.82	0.84	3.48	3.76	2.18	2.05	2.68	3.30	3.72	2.56	1.86
14	0.99	0.81	0.84	3.74	3.70	2.18	1.99	2.90	3.30	3.75	2.51	1.84
15	0.97	0.80	0.84	4.20	3.57	2.17	1.96	2.88	3.38	3.72	2.47	1.82
16	0.97	0.81	1.64	4.86	3.58	2.21	1.94	2.80	3.40	3.79	2.44	1.80
17	0.96	0.83	2.43	4.80	3.64	2.21	1.92	2.80	3.40	3.85	2.41	1.78
18	0.96	0.83	2.98	4.95	3.57	2.21	1.94	2.80	3.40	4.00	2.38	1.77
19	0.96	0.83	2.58	5.42	3.57	2.17	1.95	2.83	3.40	4.00	2.35	1.77
20	0.96	0.83	2.21	5.26	3.40	2.12	2.03	2.93	3.45	3.85	2.32	1.76
21	0.95	0.82	2.09	5.26	3.30	2.07	2.06	2.95	3.58	3.70	2.29	1.74
22	0.95	0.81	1.73	5.41	3.18	2.02	2.07	2.95	3.96	3.64	2.26	1.68
23	0.95	0.80	1.59	5.37	3.09	1.97	2.18	2.98	4.00	3.62	2.24	1.62
24	0.95	0.80	2.02	5.56	3.02	1.96	2.36	3.06	3.99	3.61	2.22	1.64
25	0.95	0.80	2.76	5.50	2.97	1.95	2.36	3.06	3.90	3.60	2.20	1.64
26	0.95	0.80	3.94	5.72	2.89	1.94	2.38	3.04	3.79	3.51	2.18	1.64
27	0.94	0.80	3.70	5.68	2.82	1.92	2.37	3.00	3.68	3.66	2.16	1.64
28	0.94	0.80	2.94	5.78	2.75	1.94	2.36	3.00	3.61	3.30	2.14	1.64
29	0.94	-	3.75	5.87	2.70	1.92	2.36	2.98	3.60	3.24	2.12	1.63
30	0.93	-	4.14	6.09	2.65	1.92	2.35	2.96	3.58	3.18	2.10	1.62
31	0.93	-	4.20	-	2.60	-	2.37	2.85	-	3.11	-	1.60
Mean	1.01	0.85	1.85	4.70	3.93	2.17	2.11	2.79	3.41	3.51	2.50	1.82
M(max)	1.17	0.92	4.20	6.09	6.15	2.53	2.38	3.06	4.00	4.00	3.02	2.09
M(min)	0.93	0.80	0.78	3.18	2.60	1.92	1.90	2.40	2.75	3.04	2.10	1.60
Max(A)	1.17	0.92	4.60	6.23	6.25*	2.62	2.39	3.10	4.05	4.03	3.08	2.09
Min(A)	0.93	0.80	0.78	3.00	2.58	1.70	1.67	2.39	2.75	3.04	2.10	1.60
	Peak Flood level 6.25 m.*						Mean Yearly Gauge Height: 2.55					

S E C T I O N (B)

JUBBA AT BARDHEERE

- 1 - History sheets
- 2 - Site photographs
- 3 - Station Installation data
- 4 - Site sketch
- 5 - Recorder details (sketch)
- 6 - Site surveys
- 7 - List of Discharge Measurements
- 8 - Rating Curve (natural scale)
- 9 - Rating Curve (log/log scale)
- 10 - Rating Table
- 11 - Cross Sections
- 12 - Mean Daily Water Levels (Tabulated)

RIVER FLOW GAUGING STATIONHISTORY NOTES

RIVER : JUBBA RIVER

AT : BARDHEERE

STN. NO: JB.2.

DATE	TIME	REMARKS	SIGN
22.03.80	0730	<p><u>B.A.P.Gemmell</u></p> <p>Initial visit to this station. Located the Recorder House and 'MP' Point. Only the 4-6 meter gauge post standing, the 0-4 meter posts destroyed. Three old staff gauge stands just u/s of present site, but all twisted out of shape, apparently during flood of Nov. 1977. The ferry broke loose and was washed onto the gauges, no replacement gauges since that time.</p> <p>In the Recorder House found a 'SIAP' strip chart Recorder. Instrument had been installed on the 15/10 1978, then visited once some twenty days later, then neglected until this visit. The instrument had been installed by some Germans apparently attached to the Bardheere Dam Survey Project. When the Instrument was installed, no indication was made whether the well or the Inlet Pipes had been cleaned, nor whether the W.L inside the Well was the same as the river level. The instrument functioned for a month.</p> <p>The Instrument was cleaned and found to be in working order. Instrument was restarted and reset to levels obtained from the well after desilting and flushing of the Inlet pipes. The flushing of the Inlet pipes was done by filling the well full of water from a water tanker.</p> <p>Depth from the 'MP' point to the silt level 5.72 m. Depth " " 'MP' " " " water " 5.40 m, giving an inside W.L. of 0.14 m. GH.</p> <p>The 'MP' point was given an R.L. value 100.48, obtained from old documents. The Benchmark was located by relating the 'MP' point to the various concrete blocks in the area. The Benchmark sketch indicates that the 'BM' is the cross on the concrete block and not the ring bolt. Therefore the cross has the value R.L. 100 and the ring bolt 100.100.</p> <p>Surveyed Water level slopes and Inlet pipe levels, also section through the Recorder House with gap in the middle as the water was too deep.</p>	B.P.G.
23.03.80	0800	<p><u>Continued:-</u></p> <p>Checked the Recorder again and reset to correct values Surveyed 'MB' point on the Bridge and painted white. Also included in survey footbridge deck curve and various points around the Recorder House.</p> <p>Depth to the Water level from 'MB' on Bridge 7.92 m. Painted Benchmark with white paint and RL value(100.0) Rechecked depth to water level in well = 5.39 meter giving WL of 0.15m. Water level in river -0.11 meters.</p>	B.P.G.

RIVER FLOW GAUGING STATIONHISTORY NOTESRIVER : JUBBA RIVERAT : BARDHEERESTN. NO: JB.2.

DATE	TIME	REMARKS	SIGN									
23.03.80	1100	<p><u>Continued:-</u></p> <p>Water sample collected at Temperature 31.0 C and a reading of 2,500 micrmhos.</p> <p>The Recorder is 'SIAP' strip chart - six month plus duration. No: 525417. Spare ink and pen in Housing.</p> <p>Site Sketch drawn. Local Ministry of Agriculture staff indicate no Staff Gauge readings since the large flood of 1977.</p>	B.P.G.									
30.04.80	0700	<p><u>B.A.P.Gemmell</u></p> <p>Checked the station and carried out check survey of the gauge etc. Installed the 2-4 m. gauge, W.L. too high at the time to install the 0-2 meter gauge. The support iron and gauges left at Ministry Offices.</p> <p>W.L. on 29/4 = 0.48 m., and on 30/4 = 0.58 at 0700 Hrs.</p>										
	1200	<p>W.L. = 0.52 m.</p> <p>Flood arrived at 0700hrs on 27/4/80, 1200 hrs on 29/4 = 0.58 m. peak.</p> <p>Time scale on 'SIAP' Recorder = 6 cms/day, Vertical scale = 1:20.</p> <p>W.L in the well = 0.58 m.</p> <p>Survey of the slope indicated hardly any slope. CMM discharge measurement taken. W.L. = 0.57 m.</p> <p>Depth to the WL. from the 'MB' point 7.25 m = 0.56m gauge height.</p>	B.P.G.									
23.05.80	1730	<p><u>Hydro Team</u></p> <p>Checked station W.L. below the 2-0m gauge level.</p> <p><u>Surveyed Levels.</u></p> <table style="margin-left: 40px;"> <tr> <td>2.75</td> <td>-</td> <td>2 meter level</td> </tr> <tr> <td>3.23</td> <td>-</td> <td>W.L. = 1.52 GH.</td> </tr> <tr> <td>1.21</td> <td>-</td> <td>F.M. = 3.54 GH.</td> </tr> </table> <p>Recorder not checked at time.</p>	2.75	-	2 meter level	3.23	-	W.L. = 1.52 GH.	1.21	-	F.M. = 3.54 GH.	
2.75	-	2 meter level										
3.23	-	W.L. = 1.52 GH.										
1.21	-	F.M. = 3.54 GH.										
24.05.80	0745	<p>Rechecked levels W.L. at time = 1.48 m GH. The chart was registering 1.44 m GH.</p> <p>Depth to W.L. in well = 4.07 m = 1.47 m GH.</p> <p>Carried out discharge measurement and surveyed slope of the water = $\frac{0.09}{193 \text{ m}}$ = Slope 0.00047</p> <p>The M.O.A. man wanted to remove the recorder when the flood was rising</p>										
25.05.80	0800	<p>Water level at time = 1.24 meters. Discharge gauging taken.</p> <p>It appears that this large flood may have been locally generated from the tributaries upstream of Bardheere, as it does not appear to have come from Lugh.</p>	B.P.G.									

RIVER FLOW GAUGING STATIONHISTORY NOTESRIVER : JUBBA RIVERAT : BARDHEERESTN. NO: JB.2.

DATE	TIME	R E M A R K S	SIGN
2/06/80	0745	<u>B.A.P.Gemmell</u> Rechecked the station after visit by Hydro Team as some details inconclusive. W.L. at time = 0.90 m. GH. 'MP' depth to W.L. = 4.66 m = 0.88 m. GH. (OK). Silt level at 5.73 depth = -0.20 meters. Surveyed the large floodmarks and present W.L. for slope details (see surveys for details). Recorder chart changed, will last for at least 6 months. Discharge measurement taken. Observer confirms that the large flood was locally generated.	B.P.G.
8/07/80	0800	<u>Hydro Team</u> Took discharge measurement from d/s side bridge face. W.L. at time = 1.61 m (to be checked). Adjusted = 1.40m. Depth to W.L. in well = 4.20 m = 1.34 m GH. Took survey of floodmarks and water slope.	ASH
17/08/80	0930	<u>Hydro Team</u> W.L. at time 1.74 m. GH. - Took discharge measurement. Well W.L. at time 1.11 m. - This appears doubtful?	
10/10/80	0730	<u>Hydro Team</u> W.L. at time = 1.71 m GH. Water below the gauge. <u>Level Readings</u> 3.65 - 2.0 m level. Therefore GH = 1.71 m. 3.94 - W.L.	
	1645	Checked the Recorder - W.L. still 1.71 m., Depth to the W.L. in well = 3.81 m = 1.73 m (OK). Located an observer - Will start work from the 10/10. Information obtained indicates that no observations taken even after request to the head of M.O.A. Office at Bardheere.	A.A.D.
29/10/80	0815	<u>B.A.P.Gemmell</u> W.L. at time = 1.26 m GH. Depth to W.L. in well 4.28m = GH. 1.26 m. (OK). Depth to silt level = 5.77m = -0.23m GH. Discharge measurement taken. The clock on the recorder had stopped, appears that the clock had not been fully wound on two previous trips. Still no daily gauge readings from the Ministry staff Tried to employ other observers apart from Ministry, but no luck. People expected the normal monthly rate for one days work. Unfortunately this sort of situation is not uncommon, and rather distressing, and can be comical, if not so serious.	B.P.G.

RIVER FLOW GAUGING STATIONHISTORY NOTESRIVER : JUBBA RIVERAT : BARDHEERESTN. NO: JB.2.

<u>DATE</u>	<u>TIME</u>	<u>R E M A R K S</u>	<u>SIGN</u>
15/12/80	0800	<p><u>Hydro Team</u></p> <p>W.L. at time = 0.51 m. GH. - Depth to the W.L. in the Well = 4.93 m = GH. 0.61 m. Checked the Recorder - the clock had stopped again. Filled the pen and re-started the clock.</p>	A.S.H.
16/12/80	0800	<p><u>Hydro Team</u></p> <p>Took discharge measurement - Depth to W.L. from 'MB' 7.33 m = GH 0.48 meters. 'MP' level = GH. 0.59 meters.</p>	
25/02/81	0800	<p><u>Hydro Team</u></p> <p>Took discharge gauging at -0.20 m GH. - Depth to W.L. in the well = 5.42 m = GH. 0.12 m GH. - Depth to silt level 0.00m, well cleaned out.</p> <p>Depth to top Inlet Pipe = 5.55 m. Depth to low " " = 6.11 m. Depth to Well bottom = 6.43 m.</p> <p>Water level on chart approximately 0.12 meters. Installed the 0-2m gauge stand with the two, 2.0 m points level, with no overlap.</p> <p>Recorder reset after cleaning to new W.L. in well, after flushing the well. Still no Observer reading the gauges.</p>	A.S.H.
7/05/81	1200	<p><u>B.A.P.Gemmell & Ibrahim Musa.</u></p> <p>Flew over the station and took photographs of the station. It would appear that the flood was at its peak or just started to go down. All the tributaries on both banks of the river were contributing heavily to the flow between Lugh and Bardheere. Apparently this was also the situation when members of the Juba Sugar Project flew over the same area previously.</p> <p>a). The W.L. was approximately 1.5 meters below the bridge deck. b). Flood waters approximately 0.75 m above the floor boards of the Recorder House. c). Approach road on right bank under water for 200m. d). Water upstream of approach road appears still, and clear having deposited the silt, in contrast to the muddy waters of the main stream.</p>	B.P.G
11/06/81	1100	<p><u>B.P.Gemmell</u></p> <p>Visited the station by Air with the German 'Freedom from Hunger' representative. This was the only visit during this flood period due the appalling road conditions. The German 'FFH' man had discussions with</p>	B.P.G

RIVER FLOW GAUGING STATIONHISTORY NOTESRIVER : JUBBA RIVERAT : BARDHEERESTN. NO : JB.2.

DATE	TIME	REMARKS	SIGN
11/06/81	1200	<p><u>B.P.Gemmell</u> the D.C. and the Agricultural man with regard to the Onion seed requests, and also visited some of the damaged flood areas and Farms,</p> <p>The Ministry people had just started to build the wall around the Recorder House, which was supposed to have been done some time ago. Ahmed Ali had removed the SIAP Recorder and the replacement Leupold & Stevens instrument was installed. The flood mark was very clear inside the Recorder House = 0.62 m above the floor boards which returns a GH of 6.20 m. The lower gauges 0-4 m. washed away, large tree just u/s of Recorder House fell down over the gauges just missing the Recorder House.</p> <p>W.L. at time of visit 1.67 m(GH), see survey details. Depth to W.L. in well = 3.86 m. = GH. 1.68 m. (O.K.). The float would have been held at a level approximately 0.67 m, below the peak flood level by the floor boards of the Recorder House. Remember this point when checking chart relation to W.L.</p> <p>Surveyed levels at Recorder House, and section across the bridge and on along the flood plain for Slope Area calculations, to be coupled with section which was plumbed during discharge measurement taken at the same time, for the lower end of the channell section.</p> <p>The Benchmark is completely covered with sand which was deposited from the high flood. - The TBM next to the Recorder used for all present surveys.</p> <p>The replacement (L&S) Recorder is weight driven with chart duration of one year. (Instrument No: 30636/60) Vertical scale = 1:10. - Time scale equals 2.4"/day.</p> <p><u>NOTE:-</u> a).The recorder had worked well until the 4/4/81. b).The Observer started reading the gauge on the 4/4/81, and continued until the 12/5/81 then stopped as the water had fallen below the 4 m, level as there were no more gauges. He was then instructed to measure the depth to WL. from the 'MB' on the bridge. ('MB' R.L.= 102.75 m.) M.S.L. = 96.79 m., and the <u>G.H.= 7.81 m.</u></p> <p>W.L. at time of gauging 1.67 meters. New chart put on the instrument, and abottle of black L&S ink required at the station.</p> <p>Left at 1300 hrs, with the protection wall construction continuing. All tyres on Aircraft deflated.(?).</p>	B.P.G.

RIVER FLOW GAUGING STATIONHISTORY NOTESRIVER : JUBBA RIVERAT : BARDHEERESTN. NO: JB.2.

DATE	TIME	REMARKS	SIGN
18.08.81	1500	<u>HYDRO TEAM</u> Checked station and carried out discharge gauging at corrected WL of 2.28 meters. Made notes on recorder chart.	
19.08.81	0800	<u>HYDRO TEAM</u> Took discharge measurement at adjusted WL of 2.13 m. Well needs desilting. Depth to WL in well 3.48 m. giving inside GH of 2.06 meters.	
28.09.81	0900	<u>HYDRO TEAM</u> Took discharge gauging on falling water level. WL at time of gauging 3.40m to 3.29m. Checked the recorder made notes on chart.	
29.09.81	1100	<u>HYDRO TEAM</u> Took gauging between 3.01m and 2.91m (mean 2.96m) Depth to WL in well = 2.73 meters = 2.81 meters WL inside well . Made notes on recorder chart.	
15.11.81	0800	<u>HYDRO TEAM</u> Took measurement (Discharge gauging) at WL 1.70 m.	
16.11.81	0910	<u>B.P.GEMMELL</u> Checked station : Surveyed Water Level and checked Benchmark and 'MP' and 'MB' reference points. (See survey sheet). Water Level at time 1.56 meters. Depth to water level in well 3.45 meters giving inside WL of 2.09 meters. Inlet pipes blocked as the inside WL is higher than the river level. Cut the recorder chart and reset recorder to inside water level. The well will have to be desilted and pipes cleaned at a later date, when water level is lower and 0-4 meter gauge posts are re-installed to replace the ones washed away in May. Discharge measurement taken at WL 1.56 meters. The new gauge observer had been taking readings of WL depths from bridge 'MB' point since beginning of Oct. but readings do not tie up with either spot observations or the recorder chart. All the data was collected for what it is worth.	B.P.G

S I T E P H O T O G R A P H S

JUBBA AT BARDHEERE



BARDHEERE - (24.4.80) - Looking at the 'BM'
top of concrete block where spot
is shown. (R.L. 100.00 - MSL = 94.042 m). The
top of metal Ring R.L. 100.10 - MSL = 94.14m).
'BM' situated between bridge & Recorder on L/B.



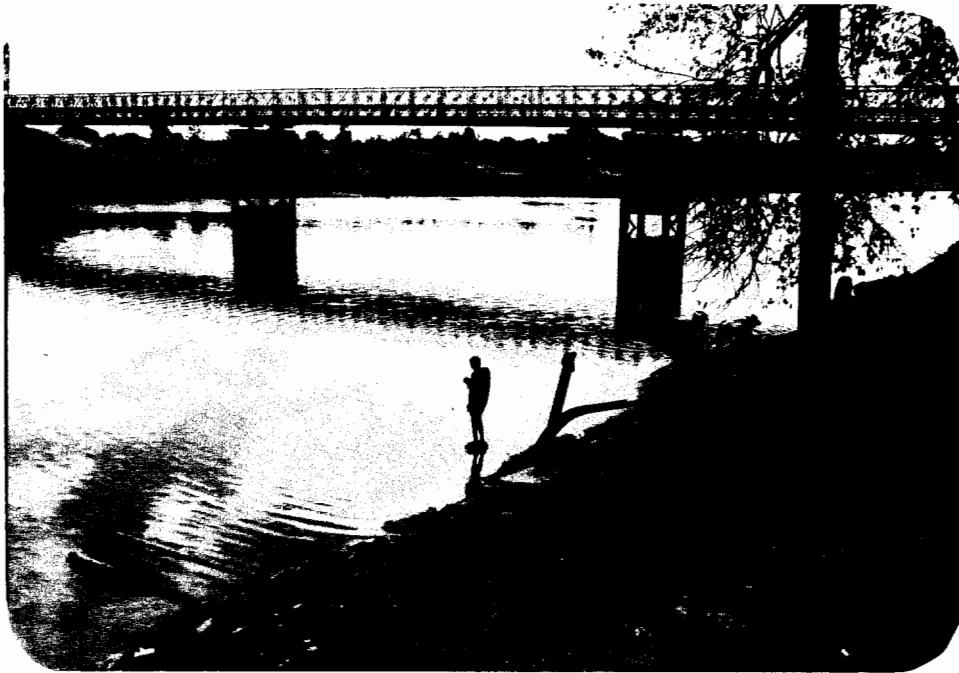
BARDHEERE - (24.3.80) - Looking from the left bank
near the Recorder House to the right bank
bridge abutment. 4-6 meter gauge on left. This gauge
accepted as the reference point for the replacement of
the other gauges. There is a TBM on corner of concrete
trough nearest the Recorder House (R,L. 100.793 m).

S I T E P H O T O G R A P H S

JUBBA AT BARDHEERE



BARDHEERE - (24.3.80) - Looking into Recorder House over 'TBM' on corner of trough being pointed out by Ahmed Ali Dejene ('X' cut into the stone on the corner - R.L. 100.793 m, and an MSL. value of 94.835 m).



BARDHEERE - (24.3.80) - Looking upstream along the left bank at the present 4-6 meter gauge post, the old twisted set of gauges, bent by the ferry during past floods. Note old gauges all overlap. The two inlet pipes are visible.

STREAM FLOW GAUGING STATION

STATION INSTALLATION RECORD

STREAM : JUBBA RIVER LOCATION : BARDHEERE STN. NO : JB.2.
LATITUDE : 02°19' N LONGITUDE : 42° 17' E ALTITUDE : 115.0m

BENCHMARK DESCRIPTION :

Small cross cut into a concrete block(0.80x0.80x0.25 m) situated on the L/B between the bridge and the Recorder House, approx. 25 meters from the edge of the river. Value R.L.= A.D. 100.00 (M.S.L. = 94.042). Ring-Bolt in same block has R.L value 100.10 (M.S.L. 94.14). A cross on the wall corner near Recorder has an R.L. value of 100.793 - TBM(1).

STAFF GAUGE DESCRIPTION :

The staff gauges consist of one meter enamel gauge plates graduated in centimeters and fixed to two meter 'I' beam support stands embedded in concrete foundations. The 4-6 meter gauge was found intact and the 0-2 & 2-4 m. gauges were later installed in level relation to the top gauge.

DATE OF INSTALLATION : Range 0-6 m. completed GAUGE ZERO : RL = 94.94m.
Original gauges (24 /5/1963) in 1980. M.S.L = 89.23 m.
Present 4-6 m gauge probably pre-1977 floods. M.S.L = 88.98 m.

RECORDER DESCRIPTION :

Leupold & Stevens (A-35) strip chart Recorder with weight drive - six month plus duration. Time scale 2.4"/day, vertical scale 1:10. (One traverse of chart=2.5m) - Instrument No: 30636/60. Recorder set in house on 1-0m dia. concrete ring stilling well, with two 0.10m dia. inlet pipes fixed with stopcocks inside the well. The inlet pipes 0-50m apart and set at the bottom of the stilling well.

DATE OF INSTALLATION : 11/6/80 (Present inst.) GAUGE ZERO: R.L. 94.05m.
Original L&S instrument removed Oct. 1977. Replaced (Bottom of well)
by SIAP Instrument Oct. 1978 and removed 11/6/80.

CONTROL DESCRIPTION :

This site has a channel control which will tend to have a shifting rating, with the emphasis mainly on the lower levels after large flood events. Large portions of the bank collapsed during the large 1981 floods, removing the lower gauges at the station.

OTHER EQUIPMENT :

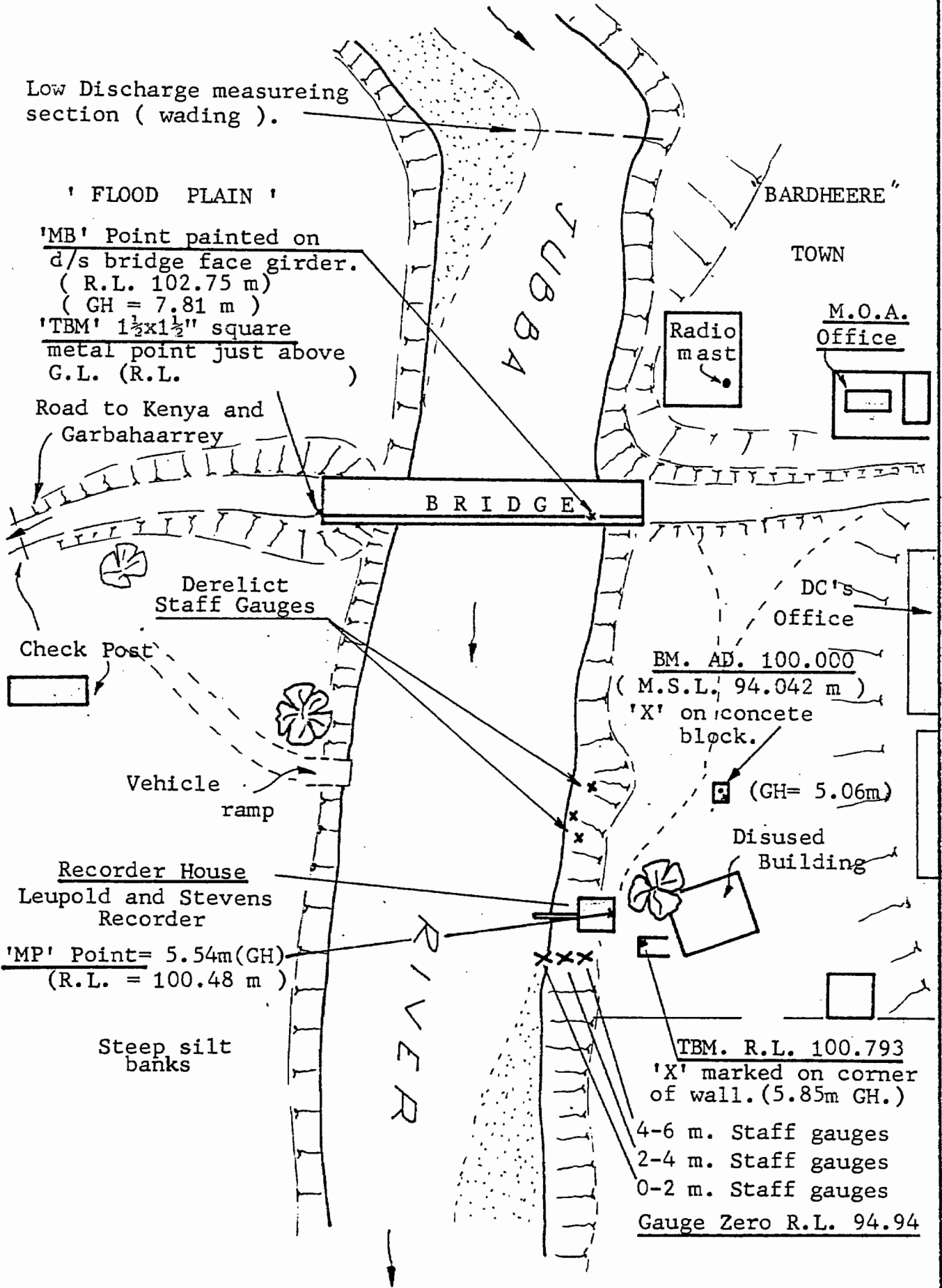
The Bridge at this site was installed in 1978 (Oct.) therefore no 'MB' readings prior to 1980, when 'MB' point installed. 'MP' Point is an arrow head mark on the top of the concrete ring under the floor boards. Reference point from which water level in the well is obtained by measuring the depth to the W.L. from the said point. The values for the 'MP' are as follows:- R.L. = 100.48 m, M.S.L. = 94.52 m, and the G.H = 5.54 m. (Note: the top of the floor boards have a value 5.59m GH.).

NOTES : a). The G.Z. value of 89.23 m M.S.L, originally used suggests that either the original values were not used when the present 4-6 meter gauge was installed, or that the gauges had been set in a type of overlapping system. Note that all levels since 1980 are in level sequence.

b). The benchmark at present is covered with sand deposits from the large flood of May 5th 1981. The 'MB' point is equal to 7.81 meters Gauge Height.

S I T E S K E T C H

BARDHEERE GAUGING STATION



Low Discharge measuring section (wading).

' FLOOD PLAIN '

'MB' Point painted on d/s bridge face girder.
(R.L. 102.75 m)
(GH = 7.81 m)

'TBM' 1½x1½" square metal point just above G.L. (R.L.)

Road to Kenya and Garbahaarrey

BARDHEERE

TOWN

Radio mast

M.O.A. Office

BRIDGE

Derelict Staff Gauges

DC's Office

Check Post

BM. AD. 100.000
(M.S.L. 94.042 m)
'X' on concrete block.

(GH= 5.06m)

Vehicle ramp

Disused Building

Recorder House
Leupold and Stevens Recorder

'MP' Point = 5.54m(GH)
(R.L. = 100.48 m)

Steep silt banks

RIVER

TBM. R.L. 100.793
'X' marked on corner of wall. (5.85m GH.)

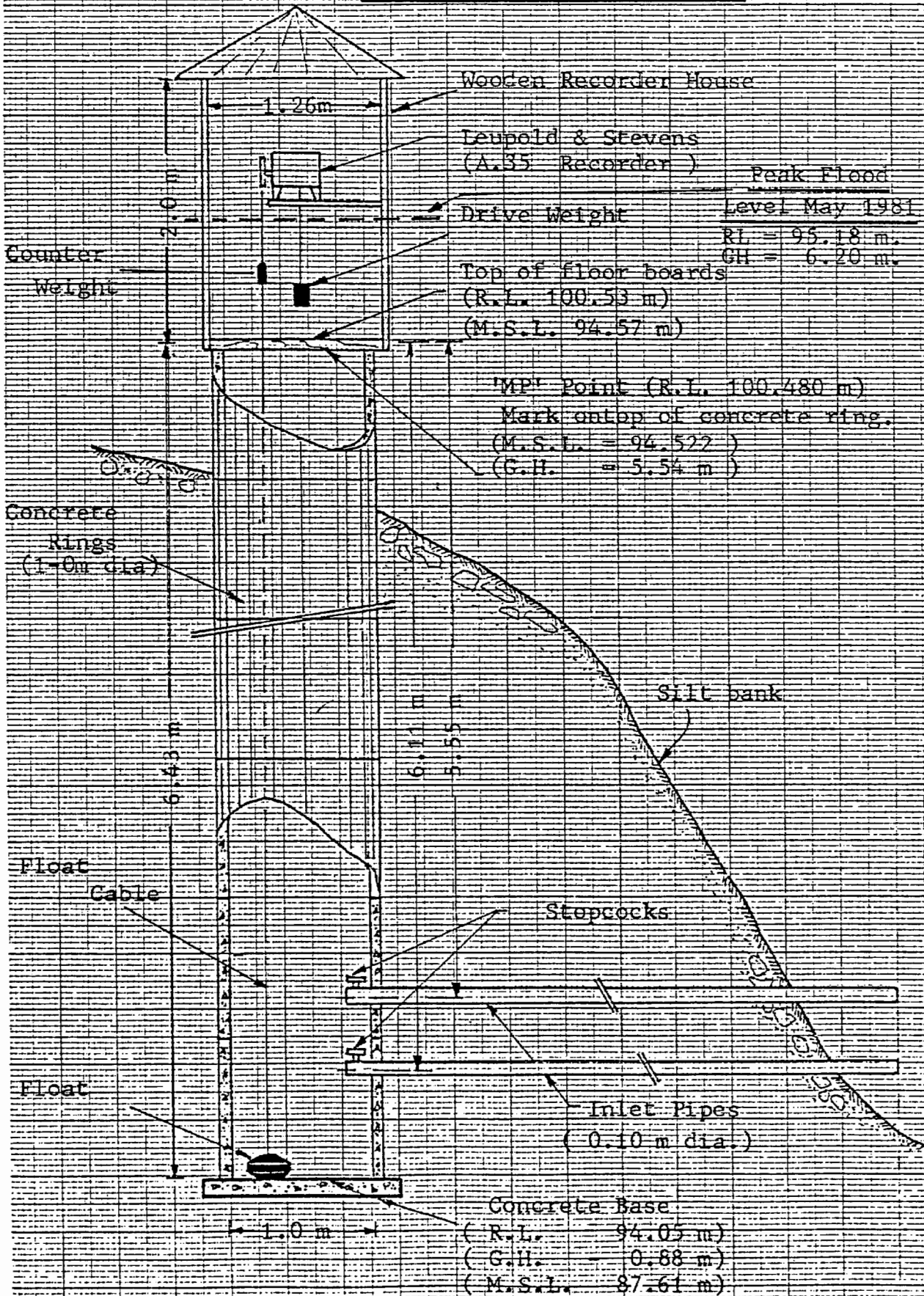
4-6 m. Staff gauges
2-4 m. Staff gauges
0-2 m. Staff gauges

Gauge Zero R.L. 94.94

NOT TO SCALE

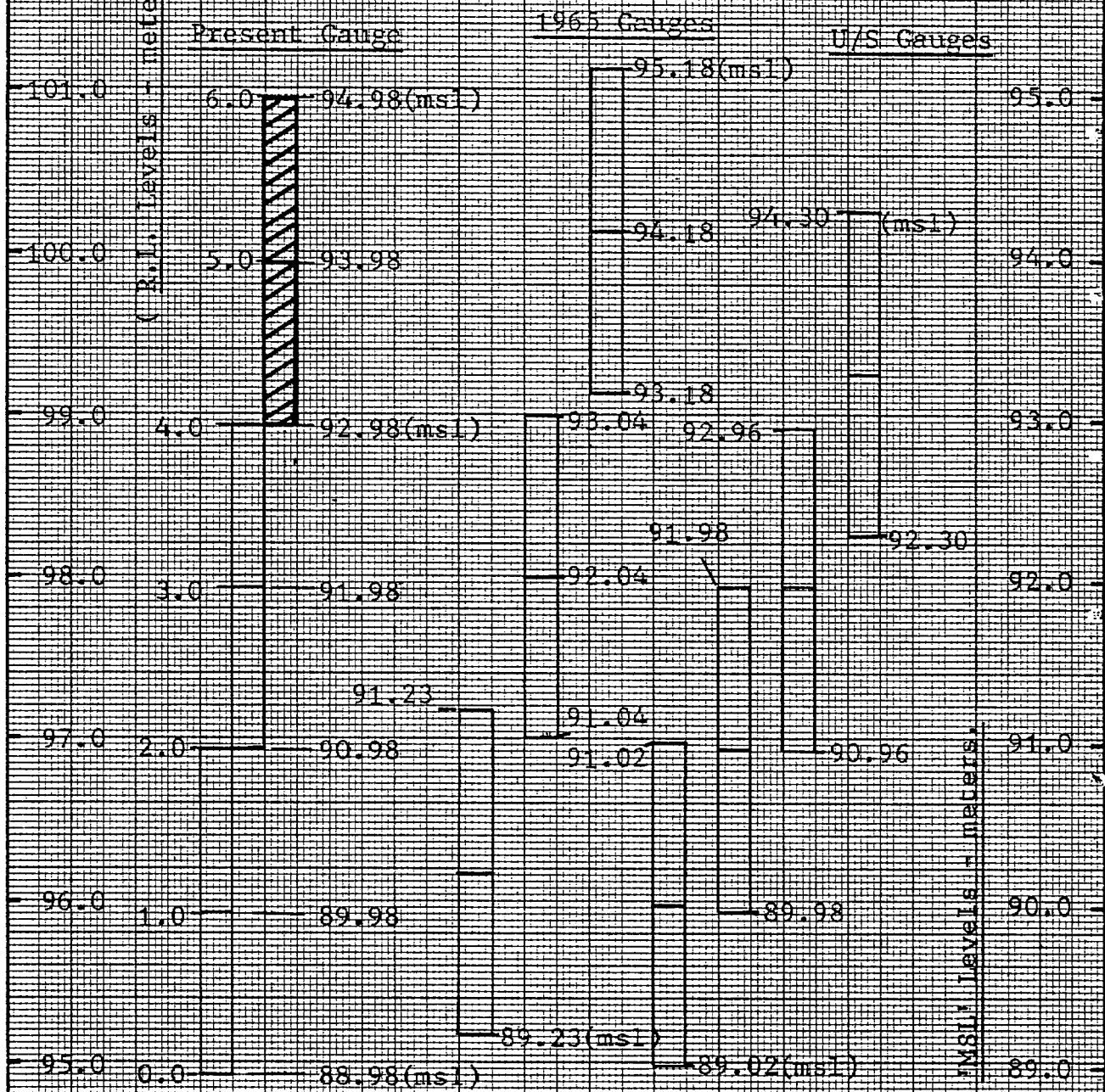
RECORDER DETAILS

JUBBA RIVER AT BARDHEERE



NOT TO SCALE

JUBBA RIVER AT BARDHEERE - GAUGE DETAILS



- (A.) The main gauges at Recorder House. The 4-6 meter gauge was the only remaining gauge of the set in January 1980. The four lower meters installed in 1980, but were washed away 5.5.81 flood, leaving the 4-6 meter intact.
- (B.) Gauge levels as at May 1965, after correction of -0.43 meters to MSL levels on 9.9.64 (See Volume 2 - Sect H. 3b.)
- (C.) Gauges set 30 meters U/S of Recorder House. Damaged by ferry pontoon Nov. 1977, and completely washed away by Flood of May 1981.

SITE : JUBBA RIVER LOCATION : BARDHEERE (JB.2.)

DATE : 23/3/80 TIME : 1000 Hrs. WATER LEVEL : -0.11m GH.

REMARKS : Survey of 'MB' & Bridge deck levels, and levels at Rec. House.

B.S	I.S	F.S	RISE	FALL	R.L.	DIST	ANG	R E M A R K S
3.150					100.000			BM. AD 100.000 (Conc.)
	0.400		2.750		102.750			'MB' level on Bridge
	0.450			0.050	102.700			Bridge corner d/s, L/B
	0.320		0.130		102.830			1/4 Distance across deck
	0.190		0.130		102.960			1/2 " " "
	0.300			0.110	102.850			3/4 " " "
	0.550			0.250	102.600			R/B side of Bridge.
		3.150		2.600	100.000			BM. AD 100.000
1.125					"			CP,
	2.185			1.060	98.940			Bottom 4-6 m Gauge.
	1.270		0.915		99.855			Rec. House step.
	1.400			0.130	99.825			G.L. Rec. House.
(+	2.000)				101.825			G.L.(6.0)m, from Rec.
<u>23/3/80</u>			<u>Survey of W.L. slope & Inlet pipes.</u>					
0.375					100.000			BM. 100.000 (AD).
		3.695		3.320	96.680			CP,
0.195					"			
	2.080			1.885	94.795	245.0		W.L. slope u/s.
	2.080		0.000	0.000	"	148.0		W.L. " d/s.
	2.080		"	"	"	95.0		W.L. " u/s.
	2.085			0.005	94.790	160.0		W.L. " d/s.
		1.705	0.380		95.170			WE & WL, CP (stone)
3.830					"			
	4.190			0.360	94.810			Low Inlet Pipe at G.L.
	3.865		0.325		95.135			Top " " " "
	4.115			0.250	94.885			Low pipe at end.
	3.825		0.290		95.175			Top " " end.
NOTE: Slope levels virtually indicate no slope.								
Surveyed: B.A.P.Gemmell.								

SITE : JUBBA RIVER LOCATION : BARDHEERE (JB.2.)

DATE : 3/6/80 TIME : 0745 Hrs. WATER LEVEL : 0.90 G.H.

REMARKS : Check survey levels and water level slopes.

B.S	I.S	F.S	RISE	FALL	R.L.	DIST	ANG	REMARKS
1.380					100.000			BM. AD 100.00.
	1.270		0.110		100.110			Top of Iron Ring
	0.587		0.683		100.793			X on wall near Recorder
	0.900			0.313	100.480			'MP' Point(Rec. House)
		0.587	0.313		100.793			C.P. 'X' on wall
0.138					"			"
	1.985			1.847	98.946			Bottom of 4-6m gauge
	2.375			0.390	98.556			High flood mark
	1.985		0.390		98.946			Top 4 m gauge
	4.953			2.968	95.978			Top of Concrete at W.L.
	5.083			0.130	95.848			W.L. next to concrete
		4.953	0.130		95.978			Top Conc used as TBM.
3.670					"			CP. "
	1.090		2.580		98.560	137.0	50°	F.M. U/S.
	3.800			2.710	95.850			W.L. at point.
	1.070		2.730		98.580	170.0	57°	F.M. U/S
	3.800			2.730	95.850			W.L. at point.
	1.150		2.50		98.500	110.0	0°	F.M. at Section R/B
	3.820			2.670	95.830	106.0		W.L. at point.
	1.170		2.650		98.480	128.0	335°	F.M. D/S
	3.830			2.660	95.820			W.L. at point.
	1.190		2.640		98.460	240.0	305°	F.M. D/S
	3.840			2.650	95.810			W.L. at point.
	3.810		0.030		95.840	5.0		W.L. L/B at section
	1.085		2.725		98.565	0.0		F.M. L/B at section
		3.670		2.585	95.980			Top concrete (TBM).
<u>NOTE</u> : Slope for the flood levels = $\frac{0.11}{34.5} = 0.00319$								
Slope for W.L. 0.90m GH = $\frac{0.04}{34.5} = 0.00116$								
								<u>Surveyed</u> : B.P.Gemmell

SITE : JUBBA RIVER LOCATION : BARDHEERE (JB. 2.).....

DATE : 8/7/80 & 29/10/80 TIME : 0800 & 0815 Hrs WATER LEVEL : 1.40 & 1.26 m.

REMARKS : Check Surveys during inspection visits.....

B.S	I.S	F.S	RISE	FALL	R.L.	DIST	ANG	REMARKS
0.780					100.000			BM. AD 100.000
	3.830			3.050	96.950			Zero of Gauge '2'
	4.435			0.605	96.350			WL at time.
	4.400		0.035		96.380			Floodmark
		0.780	3.620		100.000			BM. AD 100.00
<u>8/7/80</u>								
Water level therefore equals 1.395 meters. This survey was carried out by the Trainee's, so the results are not guaranteed.								
<hr/>								
<u>29/10/80</u>								
<u>CHECK SURVEY</u>								
2.210					96.940			2-0 Gauge level.
	1.210		1.000		97.940			3-0 Gauge level.
	2.950			1.740	96.200			W.L. at time.
	2.710		0.240		96.440			High floodmark (Recent)
	2.880			0.170	96.270			Lower floodmark.
		2.210	0.670		96.940			2-0 Gauge level.
2.210		2.210	1.910	1.910	0.000			
<hr/>								
MP =	100.48 m.							<u>W.L. CALCULATIONS</u>
MB =	102.75 (Bridge)							Depth to W.L. = 4.28 m
G.Z. =	94.94 m.							W.L. in well = 96.20 m
TBM(X) =	100.793 m.							G.Z. = 94.95 m
								Well W.L. = 1.25 m.
2.680					98.950			Top of 4-0 gauge
	1.680		1.000		99.950			" 5-0 "
	0.820		0.860		100.790			TBM (X) R.L. 100.795 m.
	1.130			0.310	100.480			MP Recorder House.
<hr/>								
Surveyed:- B.A.P.Gemmell								

SITE : JUBBA RIVER..... LOCATION : BARDHEERE..... (JB.2.).....

DATE : 11/6/81..... TIME : 1300 Hrs..... WATER LEVEL : 1.67m GH....

REMARKS : Continuation of May 3rd flood peak cross section survey.....

B.S	I.S	F.S	RISE	FALL	R.L.	DIST	ANG	R E M A R K S
					Continued:.....			
					101.460	115.0		
					102.300	118.0		
					102.500	119.5		TBM Bridge peg U/S
0.520					102.680			TBM Bridge peg.
		2.580		2.060	100.620	155.5		
1.000								
		2.050		1.050	99.570	243.5		
2.100								
		1.290	0.810		100.380	382.5		
2.290								
		1.620	0.670		101.051	472.0		Instrument (FM) Approx.
								End of section.
NOTE:-								
Upstream of the overspill section of the flood section is situated								
a flood protection bund, which would have reduced the velocities								
considerably. Aerial photographs show the water u/s of the bund								
as being clear and not silt laden as the water d/s of the bund								
which is being supplied with fresh water from the bridge area.								
								Surveyed: B.A.P.Gemmell

SURVEY SHEET

SHEET No: 10.

SITE : JUBBA RIVER LOCATION : BARDHEERE (JB. 2.)

DATE : 16/11/81 TIME : 0915 Hrs. WATER LEVEL : 1.82 m.

REMARKS : Check level survey at Recorder House & to 'MB' Point on Bridge.

B.S	I.S	F.S	RISE	FALL	R.L.	DIST	ANG	R E M A R K S
0.175					100.79			TBM (X) R.L. 100.793.
	2.025			1.850	98.94			4 meter gauge level
	4.205			2.180	96.76			W.L. (?) 14/11/81.
	4.460			0.260	96.50			W.L. 16/11/81 (0915 Hr)
		0.175	4.290		100.79			TBM (X) near Recorder
1.235								" (CP)
	1.550			0.320	100.47			'MP' Recorder House
		1.235	0.320		100.79			TBM (X)
1.410		1.410	4.610	4.610	0.00			
								<u>CHECK SURVEY OF 'MB' POINT ON BRIDGE</u>
1.235					100.79			TBM (X).
		0.475	0.76		101.55			U/S Corner New wall.
1.680								" (CP)
		0.480	1.20		102.75			'MB' Point on bridge.
NOTE:								
1).	The gauge height of the 'MP' Point is equal to 7.81 meters.							
2).	Level of TBM = 5.85m gauge height.							
3).	Level of 'MP' = 5.54m " "							
4).	Level of 'BM' = 5.06m " "							
								Surveyed: B.A.P.Gemmell

DISCHARGE MEASUREMENTS

SHEET No: 1.

NO	DATE	OBSERVER	GH m	WIDTH m	AREA m	V _m m/sec	Q m ³ /sec	METH	M.S.L	R E M A R K S
1	22.03.80	B.P.Gemmel	-0.11	57.0	26.05	0.165	4.31	C.M.M	88.87	Low recession (Wading gauging, U/S)
2	30.04.80	" "	0.57	85.0	176.60	0.290	49.17	"	89.55	Steady
3	24.05.80	Hydro Team	1.47	92.0	340.00	0.520	173.66	"	90.45	
4	25.05.80	" "	1.48	92.0	335.76	0.520	171.79	"	90.46	
5	3.06.80	B.P.Gemmel	0.90	85.0	257.55	0.310	80.41	"	89.88	Steady stage
6	8.07.80	Hydro Team	1.40	88.0	296.38	0.560	166.37	"	90.38	
7	17.08.80	" "	1.27	91.0	249.77	0.580	144.00	"	90.25	
8	10.10.80	" "	1.71	93.5	304.79	0.810	247.79	"	90.69	
9	29.10.80	B.P.Gemmel	1.26	85.0	224.27	0.610	135.84	"	90.24	Falling stage
10	16.12.80	Hydro Team	0.48	82.0	149.66	0.260	38.20	"	89.46	" "
11	22.02.81	" "	-0.20	21.0	11.43	0.190	2.13	"	88.78	Baseflow recession (Wading gauging U/S)
12	11.06.81	Ahmed Ali	1.67	72.0	367.40	0.300	111.44	"	90.65	Steady Flow (Results ?)
13	11.06.81	B.P.Gemmel	6.72	104.0	905.00	1.590	1435.00	S/A	95.70	Flood Peak 1977(MMP F/M) Main channel
				400.0	534.00	0.390	205.78	"	"	" " (Overspill channel L/B)
				504.0	1439.00	1.140	1640.78			Totals
14	11.06.81	B.P.Gemmel	6.47	100.0	876.68	1.580	1383.00	S/A	95.45	Flood Peak 1977(Original Est) Channel.
				375.0	410.00	0.310	125.34	S/A	"	" " (Overspill channel L/B)
				475.0	1286.68	1.170	1508.34			Totals
15	11.06.81	B.P.Gemmel	6.20	98.0	845.00	1.550	1310.00	S/A	95.18	Flood Peak(4.5.81) Main channel
				325.0	306.50	0.280	85.00	S/A	"	" " (Overspill channel L/B)
				423.0	1151.50	1.210	1395.00			Totals

STREAM : JUBBA RIVER AT : BARDHEERE STATION NO : JB.2.

JUBBA RIVER AT BARDHEERE

RATING CURVE

(1980/81)

NOTE: 1) Rating curve plotted at Gauge Height in Meters
to avoid negative gauge values.

2) MSL levels are used to refer to actual gauge
levels.

DISCHARGE RATING CURVE

AREA CURVE

VELOCITY CURVE

Gauge Height in Meters (Adjusted)

Area in M²

Velocity in M/Sec

Discharge in M³/Sec

Gauge Height MSL (Actual Levels)

Peak (Nov) 1977
Peak (Nov) 1977
Peak (Nov) 1981
Peak (Nov) 1981

Peak (Nov) 1981
Peak (Nov) 1981

Peak (Nov) 1981
Peak (Nov) 1981

Peak (Nov) 1981
Peak (Nov) 1981

Peak (Nov) 1981
Peak (Nov) 1981

Peak (Nov) 1981
Peak (Nov) 1981

Peak (Nov) 1981
Peak (Nov) 1981

Peak (Nov) 1981
Peak (Nov) 1981

Peak (Nov) 1981
Peak (Nov) 1981

Peak (Nov) 1981
Peak (Nov) 1981

Peak (Nov) 1981
Peak (Nov) 1981

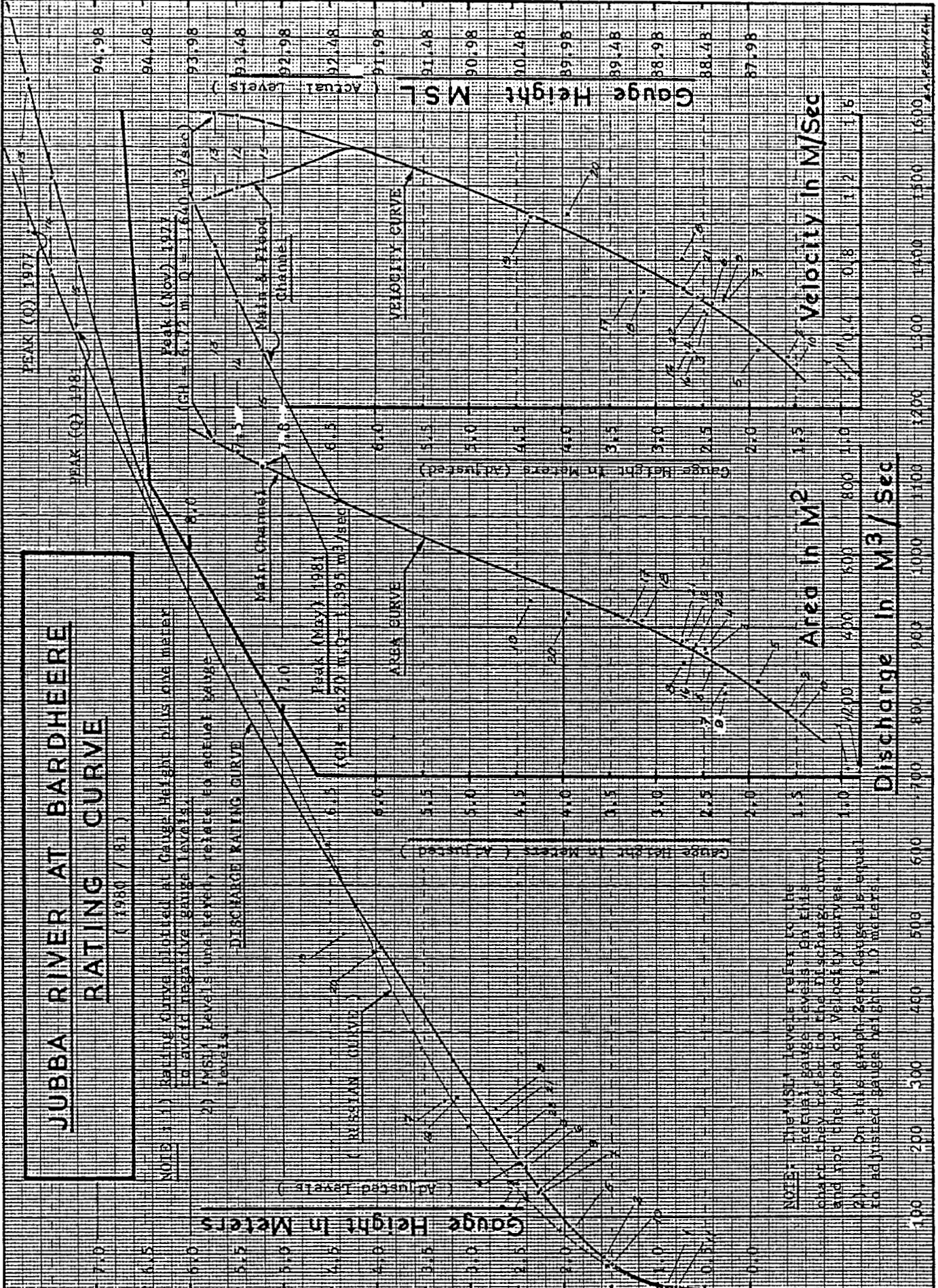
Peak (Nov) 1981
Peak (Nov) 1981

Peak (Nov) 1981
Peak (Nov) 1981

Peak (Nov) 1981
Peak (Nov) 1981

Peak (Nov) 1981
Peak (Nov) 1981

Peak (Nov) 1981
Peak (Nov) 1981



JUBBA RIVER AT BARDEERE

RATING CURVE

(1980 / 81)

NOTE: This Rating Curve plotted at actual gauge height plus one meter. The adjusted gauge height has been used to avoid the minus gauge readings.

2) Measurements 1 - 10 observed in 1980, and 11 - 22 observed in 1981.

FLOOD PEAK (Nov) 1977
 GH = 6.72 meters
 Q = 1,640 m³/sec.

HIGH CURVE
 Q = 45.2 m³/sec

Intersection point
 GH = 6.30 m, Q = 1,026 m³/sec

Intersection point
 GH = 2.877 m, Q = 275.20 m³/sec

Intersection point
 GH = 1.12 m, Q = 16.75 m³/sec

LOW CURVE
 Q = 8.56 m³/sec

MEDIUM CURVE
 Q = 11.97 m³/sec

FLOOD CURVE
 Q = 15.6 m³/sec

FLOOD PEAK (May) 1981
 GH = 6.20 meters
 Q = 1,595 m³/sec.

Gauge Height in Meters

Discharge in m³/sec

JUBBA RIVER AT BARDHEERE

CROSS SECTIONS

(1980 & 1981)

NOTE: SOUNDINGS taken from D/S side of bridge sidewalk. Large shift in bed level, similar to conditions observed at W.S.H. during peak flood. Five soundings would have lowered the bed level a few meters more.

Peak Flood (Nov. 1977) - R.L. 101.66 = G.H. 6.72 m.

Peak Flood (4/5/81) - R.L. 101.14 = G.H. 6.20 m.

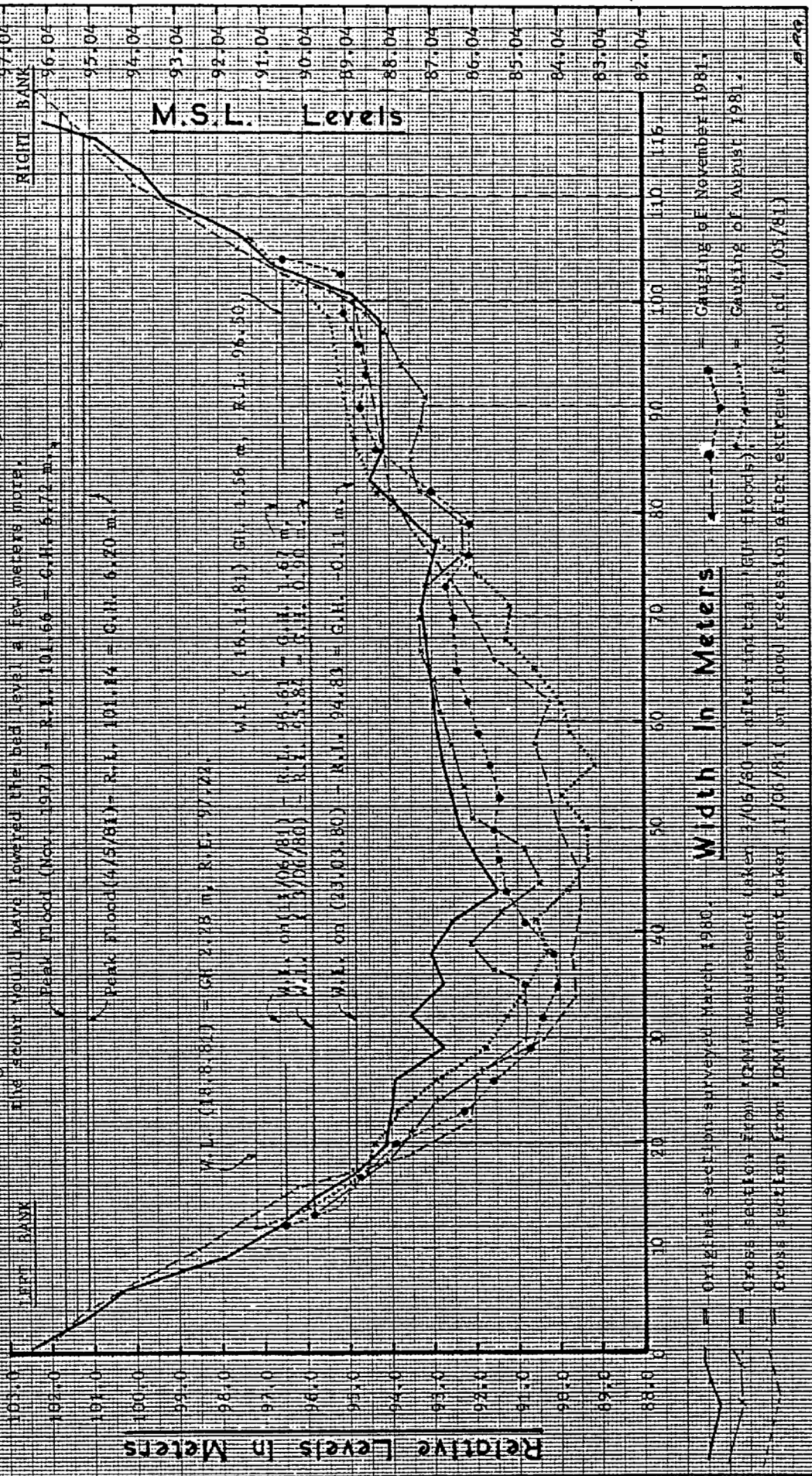
W.L. (18.2.81) = G.H. 2.78 m, R.L. 97.02

W.L. (18.11.81) G.H. 1.56 m, R.L. 96.50

W.L. (18/05/81) - R.L. 95.83 = G.H. 1.67 m

W.L. (3/06/80) - R.L. 95.83 = G.H. 0.90 m

W.L. on (23/03.80) - R.L. 94.83 = G.H. -0.11 m.



Original section surveyed March 1980. - CAUSING OF NOVEMBER 1981.

Cross section from FDM measurement taken 5/05/80 after initial (G.H. 1.67 m). - CAUSING OF AUGUST 1981.

Cross section from FDM measurement taken 11/01/81 on flood recession after extreme flood 01/05/81.

MEAN DAILY WATER LEVELS

(Meters)

RIVER :..... JUBBA LOCATION :..... BARDHEERE YEAR :..... 1980

DATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.18	-0.04	-0.13	-0.13	0.48	0.92	0.99	1.03	1.10	1.26	1.64	0.68
2	0.17	-0.04	-0.14	-0.13	0.39	0.91	1.10	0.99	1.21	1.26	1.66	0.66
3	0.17	-0.05	-0.14	-0.13	0.36	0.90	1.22	0.99	1.35	1.56	1.68	0.64
4	0.15	-0.05	-0.14	-0.13	0.47	0.85	1.36	1.04	1.40	1.90	1.61	0.64
5	0.15	-0.06	-0.14	-0.13	0.62	0.93	1.45	1.05	1.59	1.93	1.53	0.63
6	0.14	-0.06	-0.14	-0.13	0.55	1.03	1.50	1.01	1.63	1.93	1.46	0.65
7	0.13	-0.07	-0.14	-0.14	0.45	1.00	1.49	1.02	1.59	1.91	1.38	0.66
8	0.12	-0.07	-0.14	-0.14	0.39	0.96	1.44	1.06	1.64	1.85	1.33	0.64
9	0.12	-0.08	-0.15	-0.14	0.55	0.96	1.40	1.11	1.33	1.80	1.30	0.62
10	0.12	-0.08	-0.15	-0.14	0.53	0.97	1.43	1.09	1.36	1.74	1.40	0.60
11	0.11	-0.09	-0.15	-0.14	1.31	1.00	1.53	1.12	1.34	1.63	1.34	0.60
12	0.11	-0.09	-0.15	-0.14	3.09	1.02	1.50	1.17	1.31	1.53	1.38	0.58
13	0.10	-0.09	-0.15	-0.15	2.03	1.04	1.43	1.22	1.30	1.48	1.21	0.56
14	0.08	-0.10	-0.15	-0.15	1.55	1.02	1.45	1.20	1.24	1.46	1.12	0.53
15	0.07	-0.10	-0.15	-0.15	1.56	1.00	1.47	1.18	1.18	1.43	1.04	0.51
16	0.06	-0.11	-0.15	-0.15	1.81	0.93	1.43	1.22	1.18	1.42	1.01	0.49
17	0.05	-0.11	-0.15	-0.16	1.77	0.87	1.51	1.32	1.17	1.44	0.98	0.47
18	0.04	-0.11	-0.15	-0.16	1.67	0.84	1.61	1.37	1.10	1.45	0.97	0.44
19	0.03	-0.12	-0.15	-0.17	1.72	0.88	1.72	1.49	1.10	1.47	0.96	0.43
20	0.03	-0.12	-0.15	-0.17	1.85	0.90	1.73	1.51	1.11	1.50	0.91	0.40
21	0.03	-0.12	-0.15	0.02	1.74	0.86	1.62	1.45	1.11	1.52	0.88	0.38
22	0.02	-0.12	-0.15	0.38	1.65	0.80	1.53	1.35	1.11	1.48	0.84	0.36
23	0.02	-0.12	-0.11	0.33	1.56	0.77	1.44	1.26	1.12	1.44	0.84	0.35
24	0.01	-0.13	-0.11	0.16	1.48	0.77	1.38	1.20	1.19	1.40	0.85	0.34
25	0.01	-0.13	-0.12	0.10	1.45	0.76	1.38	1.21	1.26	1.38	0.86	0.32
26	0.00	-0.13	-0.12	0.08	1.38	0.75	1.37	1.18	1.32	1.34	0.90	0.31
27	-0.01	-0.13	-0.12	0.22	1.30	0.77	1.31	1.15	1.32	1.30	0.89	0.29
28	-0.01	-0.13	-0.12	0.41	1.18	0.80	1.23	1.12	1.31	1.26	0.79	0.28
29	-0.02	-0.13	-0.12	0.54	1.07	0.88	1.18	1.12	1.29	1.24	0.75	0.27
30	-0.02	-	-0.13	0.55	0.99	0.91	1.13	1.11	1.27	1.24	0.72	0.25
31	-0.05	-	-0.13	-	0.94	-	1.08	1.11	-	1.51	-	0.24
Mean	0.06	-0.10	-0.15	0.05	1.22	0.90	1.40	1.18	1.28	1.52	1.14	0.48
M(max)	0.18	-0.04	-0.11	0.55	3.09	1.04	1.73	1.51	1.64	1.93	1.68	0.68
M(min)	0.03	-0.13	-0.15	-0.17	0.36	0.75	0.99	0.99	1.10	0.72	0.72	0.24
Max(A)	0.18	-0.04	-0.11	0.55	3.54	1.05	1.76	1.55	1.68	1.96	1.70	0.70
Min(A)	-0.03	-0.13	-0.15	-0.17	0.34	0.34	0.95	0.98	1.09	1.24	0.70	0.23
	Peak Flood 3.54m (12/5/80)						Mean Yearly Gauge Height: 0.75m					

MEAN DAILY WATER LEVELS

(Meters)

RIVER : ... JUBBA LOCATION : BARDHEERE YEAR : 1981 ..

DATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.22	0.01	-0.22	3.65	5.53	2.28	1.19	1.69	2.32	2.82	2.99	0.96
2	0.21	0.00	-0.22	3.45	5.85	2.20	1.18	1.67	2.26	2.80	2.94	0.94
3	0.21	0.00	-0.23	3.04	5.80	2.15	1.18	1.67	2.16	2.76	2.73	0.92
4	0.20	-0.01	-0.23	2.99	6.20	2.08	1.20	1.68	2.12	2.74	2.55	0.90
5	0.20	-0.02	-0.24	2.94	5.75	2.02	1.20	1.75	2.08	2.66	2.53	0.88
6	0.19	-0.02	-0.24	2.82	5.70	1.96	1.24	1.85	2.08	2.54	2.47	0.86
7	0.19	-0.04	-0.24	2.95	5.30	1.90	1.24	1.95	2.15	2.46	2.30	0.84
8	0.18	-0.04	-0.25	3.42	4.80	1.85	1.27	2.06	2.30	2.42	2.10	0.82
9	0.18	-0.05	-0.25	3.41	4.61	1.78	1.30	2.14	2.75	2.40	1.92	0.80
10	0.17	-0.06	-0.26	2.96	4.56	1.72	1.33	2.12	2.90	2.56	1.62	0.78
11	0.16	-0.07	-0.26	2.86	4.19	1.67	1.35	2.06	2.96	2.68	1.54	0.76
12	0.16	-0.08	-0.27	2.78	3.81	1.63	1.37	2.02	3.05	2.82	1.54	0.74
13	0.15	-0.09	-0.27	2.69	3.67	1.60	1.39	1.96	2.92	2.94	1.48	0.72
14	0.14	-0.10	-0.28	3.30	3.86	1.57	1.42	2.00	2.84	2.98	1.55	0.69
15	0.13	-0.11	-0.15	3.69	4.25	1.55	1.42	2.14	2.78	3.02	1.70	0.67
16	0.13	-0.12	-0.03	3.01	3.98	1.53	1.39	2.30	2.79	3.02	1.56	0.65
17	0.12	-0.13	0.43	4.11	3.90	1.51	1.33	2.33	2.80	3.37	1.50	0.62
18	0.12	-0.14	0.35	4.63	3.86	1.54	1.24	2.25	2.83	3.44	1.40	0.60
19	0.12	-0.15	0.11	4.50	3.67	1.56	1.18	2.15	2.85	3.52	1.34	0.58
20	0.10	-0.16	1.24	4.89	3.55	1.55	1.16	2.15	2.86	3.62	1.30	0.56
21	0.09	-0.16	1.93	5.25	3.35	1.52	1.15	2.28	2.88	3.55	1.26	0.54
22	0.09	-0.17	1.52	4.99	3.18	1.46	1.15	2.26	3.02	3.38	1.23	0.52
23	0.08	-0.18	1.45	5.01	3.05	1.42	1.20	2.36	3.34	3.22	1.20	0.50
24	0.07	-0.19	2.10	5.05	2.90	1.38	1.36	2.44	3.62	3.12	1.16	0.49
25	0.06	-0.20	1.58	4.94	2.76	1.34	1.50	2.62	3.83	3.05	1.12	0.43
26	0.06	-0.20	4.10	5.23	2.68	1.30	1.62	2.68	3.85	3.03	1.09	0.46
27	0.05	-0.21	3.18	5.33	2.62	1.28	1.70	2.56	3.70	3.01	1.06	0.45
28	0.04	-0.21	3.38	5.37	2.55	1.24	1.72	2.46	3.30	3.07	1.03	0.44
29	0.03	-	3.38	5.37	2.47	1.22	1.72	2.38	2.95	2.96	1.00	0.42
30	0.02	-	3.75	5.39	2.40	1.20	1.72	2.34	2.85	2.90	0.98	0.41
31	0.02	-	3.66	-	2.34	-	1.70	2.30	-	2.92	-	0.39
Mean	0.15	-0.10	1.71	4.00	3.97	1.63	1.36	2.15	2.84	2.96	1.67	0.66
M(max)	0.22	0.02	3.75	5.39	6.18	2.28	1.72	2.68	3.85	3.62	2.99	0.96
M(min)	0.02	-0.21	-0.28	2.69	2.34	1.20	1.15	1.68	2.08	2.40	0.98	0.39
Max(A)	0.22	0.02	4.20	5.45	6.20*	2.31	1.72	2.68	3.85	3.62	2.99	0.97
Min(A)	0.02	-0.21	-0.29	2.65	2.31	1.20	1.13	1.67	2.06	2.38	0.98	0.39
	Peak Flood 6.20m GH* (4/5/81)						Mean Yearly Gauge Height: 1.92m					

S E C T I O N (C)

JUBBA AT JAMAMME

- 1 - History sheets
- 2 - Site photographs
- 3 - Station Installation data
- 4 - Site sketch
- 5 - Recorder details (sketch)
- 6 - Site surveys
- 7 - List of Discharge Measurements
- 8 - Rating Curve (natural scale)
- 9 - Rating Curve (log/log scale)
- 10 - Rating Table
- 11 - Cross Sections
- 12 - Mean Daily Water Levels (Tabulated)

RIVER FLOW GAUGING STATIONHISTORY NOTES

RIVER : JUBBA

AT : JAMAME

STN. NO: JB 3.

DATE	TIME	REMARKS	SIGN
24.03.80	1030	<p><u>B.P.Gemmell</u></p> <p>First visit to the station. The river was dry (only trickle). Took cross section of the wadi bed from the D/S side of the bridge. Looked for the original benchmark. Probably located, very faint 'X' on D/S, R/B bridge abutment, included in check survey, but new TBM AD.100.00 painted on D/S L/B abutment. Old BM & TBM surveyed in relation to the gauges and recorder structure. Also surveyed section through the gauges and recorder house.</p> <p><u>Note:</u> Information obtained from Gelib files- gauges have different gauge zero's.</p> <p>Measured depth from MP point on recorder house to silt deposit in well.</p> <p>Depth from MP to water in well = 7.08m. Depth " " " silt " " = 7.82m.</p> <p>The inlet pipes cannot be seen from the outside, must be covered with silt deposits.</p> <p>Gauges = 0-2m = silted upto 0.50 GH 2-4m = " " 3.30 GH 4-6m = " " 4.80 GH</p> <p>Photographs of section, bridge and benchmark taken. Water quality tests <u>K = 1.0 cell</u>, Temp = 36.5°C 0.955 X 10³ 1.14 X 10³ at 25°C reading</p> <p>The recorder was found to be out of order. Float and counterweight missing and paper spools jammed. Instrument removed from the housing and returned to Mogadishu.</p> <p>(Ministry of Agriculture officer) requested to have the well desilted and the outside pipes located. The gauge observer has not been reading the gauge from the end of November 1979. Infact he is "useless". He was reprimanded, but it appears that it may not have much effect.</p> <p>Check whether river is affected by any tidal effects. Site sketch also drawn. Collected some W.L observations.</p>	B.P.G
11.06.80	0900	<p><u>Hydro Team</u></p> <p>Checked station- water level at time 0.48m. Took current meter discharge measurement (V.V.C) method. Dug the silt away from the gauges.</p> <p>Depth to W.L in well from MP = 5.91m. Depth to the silt = 6.02m.</p> <p><u>Note:</u> No cleaning out operations had been carried out since the previous visit- not even the request to 'Magambo' at Gelib had any results. No interest at all shown.</p>	B.P.G

RIVER FLOW GAUGING STATIONHISTORY NOTESRIVER : JUBBAAT : JAMAMESTN. NO: JB 3.

DATE	TIME	R E M A R K S	SIGN
12.06.80	0830	<u>Hydro Team</u> Took discharge measurement at W.L 0.63 GH. Surveyed W.L and high floodmark at the bridge. FM = 3.22m above gauge zero of present water level. Collected water levels from the observer.	
9.07.80	0930	<u>Hydro Team</u> W.L at time 0.98m. at 1440hrs = 1.00m. Gauged the river. (V.V.C method). Surveyed slope of wadi and maximum flood (see survey sheets).	B.P.G
11.07.80	1500	<u>Hydro Team</u> Gauged river at GH 1.52/1.54m. Depth to W.L in well = 5.13m, Depth to silt 7.95m.	
12.07.80	1230	Gauged at 1.59 to 1.60m. (V.V.C method)	
11.08.80	1120	<u>Hydro Team</u> Gauged at 1.02m GH. Water level steady (0.2/0.8 method). <u>Note</u> : When checking Hydro Team surveys their TBM not related to BM 100.00?	
18.10.80	1200	<u>B.P.Gemmell</u> W.L at time 1.92m. Peak flood (recent) had been to approx. 2.85m on the original middle gauge. The top gauge has been dug out. Reason not known.	
	1530	Took Float measurement between gauges and the bridge, over distance of 50 meters. (See gauged details). <u>Note</u> : Depth to W.L at bridge from MB = 7.68m. Depth to water level in well from MP on well ring = 4.58m. Depth to silt level in well from well ring MP = 7.78m (Water level at time of floats 1.78m. MP point = 6.50m above gauge zero, therefore water level in well = W.L 1.92. Falling slower than the river due to pipes being silted.	B.P.G
20.10.80	1340	<u>B.P.Gemmell</u> Checked the water level = 1.76m <u>Note</u> : There is a benchmark on the L/B bridge abutment which must be related to the new BM AD 100.00 painted on D/S L/B abutment. <u>NOTES FROM JUBBA SUGAR ESTATE.</u> Information obtained from the Agronomist in April 1980, Jubba sugar stopped pumping when 2 m ³ /sec was	

RIVER FLOW GAUGING STATIONHISTORY NOTESRIVER : JUBBAAT : JAMAMESTN. NO: JB 3.

DATE	TIME	REMARKS	SIGN
20.10.80		<p><u>Continued</u></p> <p>left in the river. Pumps were started at one time and the draw down caused the river to run backwards. At present pumps extract $5.0\text{m}^3/\text{sec}$, new station will extract a further $4.50\text{m}^3/\text{sec}$. Minimum flow required in the river will be 10m^3 just to maintain the sugar scheme.</p> <p>Therefore a flow in the order of $20\text{m}^3/\text{sec}$ will be required to maintain flow for the D/S extractions. Billharzia exists in the irrigation canals. Rating of $25\text{m}^3/\text{sec}$ exists at the Marrere gauge site. Jubba sugar will be forwarding all data from 1977 to Mogadishu. Flow in the order of $1500\text{m}^3/\text{sec}$ experienced in large floods of 1977 (Nov). This data will help to establish data at Jamame.</p>	B.P.G
7.11.80	1525	<p><u>Hydro Team</u></p> <p>W.L at time 2.38m - gauged 0.2/0.8 method. Rising stage finished at 2.40m.</p>	
8.11.80	0940	<p><u>Hydro Team</u></p> <p>W.L at time 2.50 finished also at 2.50m. Depth to W.L = 4.34m. (W.L inside well 2.12m). Check levels between New BM and old BM found on L/B U/S side of bridge carried out.</p>	
9.11.80	1140	<p><u>Hydro Team</u></p> <p>Left Jamame. W.L at time 2.49m (Inside depth to W.L = 4.32m). Observer had not read the gauge. After installation of 3rd gauge observer instructed to start taking daily observations.</p> <p>OBSERVER'S NAME: ?</p> <p>Recorder appears silted. Needs wood to make the base for recorder installation.</p>	B.P.G
28.02.81	0900	<p><u>Mohamed & Abdulahi</u></p> <p>Wadi dry -</p> <p>MP to W.L in well = 7.25m</p> <p>MP to silt in well = 7.75m</p> <p>MP to bottom of well = 8.00m</p> <p>The well was desilted. But point of pipes outlet to river not located.</p> <p>MP to bottom pipe = 7.70m</p> <p>MP to top pipe = 7.15m</p> <p>Recorder in housing but not working needs wood for shelf. Also the metal plate for writing on the chart. Observer not reading the gauge.</p>	B.P.G

RIVER FLOW GAUGING STATIONHISTORY NOTESRIVER : JUBBAAT : JAMAMESTN. NO: JB 3.

<u>DATE</u>	<u>TIME</u>	<u>R E M A R K S</u>	<u>SIGN</u>
7.05.81		<u>B.P.Gemmell</u> Flight through Lugh, Bardherra and Jamame. Peak at Bardherra flooded into the recorder. Lower Jubba flooded but not round the back of the sugar estate yet.	
19.05.81		<u>B.P.Gemmell</u> Flight over lower Jubba peak was at Marrere sugar scheme. Water had gone round the back through the wadi shebelli, and water had joined up with the lake Wamo. In general water had spread over larger areas than previous flight. Mapped inundated areas.	B.P.G
19.05.81	1415	<u>Ahmed Ali</u> Arrived station = W.L at time 5.70m. Took a gauging. Area flooded. Levelled new BM to old BM (mark on D/S L/B abutment No 97?). <u>Note</u> : Old Bm = 1.36m Below present BM.	
20.05.81	1200	<u>Ahmed Ali</u> Gauged river at W.L 5.70m. Waded to recorder house. Depth of water in well from MP point = 1.20m.	
21.05.81	0830	<u>Ahmed Ali</u> W.L at time = 5.73m. Flood peak gauged (3 point method) Depth to W.L in well 1.17m. <u>Note</u> : water going in well through pipe joints and not inlet pipes.	
22.05.81	0910	<u>Ahmed Ali</u> W.L = 5.70m falling - gauged (0.2/0.8 method)	
23.05.81	0800	<u>Ahmed Ali</u> Gauged at 5.64m.	
25.05.81		water rose to GH 5.70 again. <u>Special Note</u> : 1) The road to Jelib past Kamsuma was breached on 20/5/81. 2) Water had been flowing over the road at Sinjibar near gauging station, about one month. 3) Water from the "Far Wamo" started to flow over the main road back to the river on the 24th May at Burr Kay.	B.P.G

RIVER FLOW GAUGING STATIONHISTORY NOTES

RIVER : JUBBA

AT : JAMAME

STN. NO: JB.3.

DATE	TIME	REMARKS	SIGN																
11.09.81	1000	<p><u>Hydro Team</u></p> <p>Checked the station. Took discharge measurement at Water levels 3.36 to 3.34 meters.</p>																	
8.11.81	1030	<p><u>B.P.Gemmell</u></p> <p>Checked station site. Water level at time 4.16 meters on the gauge. Then carried out discharge measurement at bridge, from D/S face. Note that the propellor on the instrument was a replacement from another meter original damaged at Belet Uen.</p> <p>Located another 'BM' on the U/S left bank bridge abutment. Marked with a triangle (Δ) with the following inscription along side:-</p> <p>B.M.J. 1 M.M.P. 79 Appears to be McDonalds & Partners B.M.</p> <p>The Hydro Benchmark on the left bank D/S connected to this Benchmark. Hydro 'BM' = AD 100.00 and the MMP BM = RL 98.62 meters.</p> <p><u>Recorder</u></p> <p>The Instrument was removed requires spares and some repairs. Depth to the WL in the well from 'MP' point 2.59 m.</p> <p><u>W.L. Surveys</u></p> <table border="1"> <thead> <tr> <th>Reading</th> <th>Difference</th> <th>RL</th> <th>Remarks</th> </tr> </thead> <tbody> <tr> <td>1.19</td> <td></td> <td>96.20</td> <td>Top 6.0m gauge.</td> </tr> <tr> <td>3.05</td> <td>1.86</td> <td>94.34</td> <td>WL at gauge</td> </tr> <tr> <td>0.42</td> <td>2.63</td> <td>96.97</td> <td>'MP' Rec. House</td> </tr> </tbody> </table> <p>Therefore the WL in the Well = 94.38, falling behind the fall in the river.</p>	Reading	Difference	RL	Remarks	1.19		96.20	Top 6.0m gauge.	3.05	1.86	94.34	WL at gauge	0.42	2.63	96.97	'MP' Rec. House	B.P.G.
Reading	Difference	RL	Remarks																
1.19		96.20	Top 6.0m gauge.																
3.05	1.86	94.34	WL at gauge																
0.42	2.63	96.97	'MP' Rec. House																
9.11.81	1300	<p><u>Hydro Team</u></p> <p>Gauged the river again, WL = 3.96 meters. Collected Water Level data from office in Jamaame. Left note at Fanoole for Mugambo Abdul Hadar to forward Water level data for Jelib and Malenda to Mogadishu. Also Lugh Ganana data.</p>	B.P.G.																

S I T E P H O T O G R A P H S

JUBBA AT JAMAAME



JAMAAME - (25.3.80) - Looking at the 'BM'
Installed at time as no others
located. This 'BM' was installed as the Hydro-
-logical reference point with an R.L. value of
AD. 100.00.



JAMAAME - (25.3.80) - Looking upstream along the
left bank at the Recorder House and well.
The 'MP' Point is at the door (top of the concrete
ring, a small arrow mark chipped into the concrete,
with an R.L. value of 96.97 m.)

S I T E P H O T O G R A P H S

JUBBA AT JAMAAME



JAMAAME - (25.3.81) - Looking downstream from the gauging station on the left bank. The bridge is approximately 150 meters D/S of the station. Note that the river bed is lower than the Gauge Zero. The gauge visible in the picture is the 0-2 meter stand, which is partially silted up.



JAMAAME - (25.3.80) - Looking at the Gauges on the left bank from the Recorder House. There are six one meter plates, but the range is less than six meters because the gauges overlap. The top gauge was removed and replaced in level sequence to the second gauge in November 1980.

STREAM FLOW GAUGING STATION

STATION INSTALLATION RECORD

STREAM : JUBBA LOCATION : JAMAME STN. NO : JB 3.

LATITUDE : 00^o- 04'- 00 N. LONGITUDE : 42^o- 44'- 09 E. ALTITUDE : 10.0

BENCHMARK DESCRIPTION :

- 1) TBM - (RL 100.00) mark painted on D/S, L/B abutment deck near joint between bridge and abutment. (See photographs)
- 2) Original 'BM' from various documents indicate 'BM' 294 A (MSL 10.64m) situated on D/S R/B abutment & 'BM' 294 'B' (MSL 10.495m) situated on L/B U/S abutment. (At present not positively identified).

STAFF GAUGE DESCRIPTION :

Three gauge posts (wooden beams) with 2 meters cast alloy gauges attached. Gauges calibrated in two centimeter divisions. Each two meter set of gauges with varying zero's (Gauges overlap). (See detailed sketch).

DATE OF INSTALLATION : April 20th. 1963

GAUGE ZERO : RL 90.48m

RECORDER DESCRIPTION :

- 1) Recorder stilling well consists of concrete rings (1.0m dia.) with two inlet pipes from the river at the lower levels.
- 2) Instrument was found vandalised - not replaced to date.
- 3) When installed, will be a Leupold & Stevens (A 35) weight driven recorder.

DATE OF INSTALLATION : (Circa) 1963

GAUGE ZERO : RL 88.97m

CONTROL DESCRIPTION :

The bridge situated 40 meters D/S of gauges will be the control for high flows, but there will be a shifting rating at low stages due to the sand bed.

OTHER EQUIPMENT :

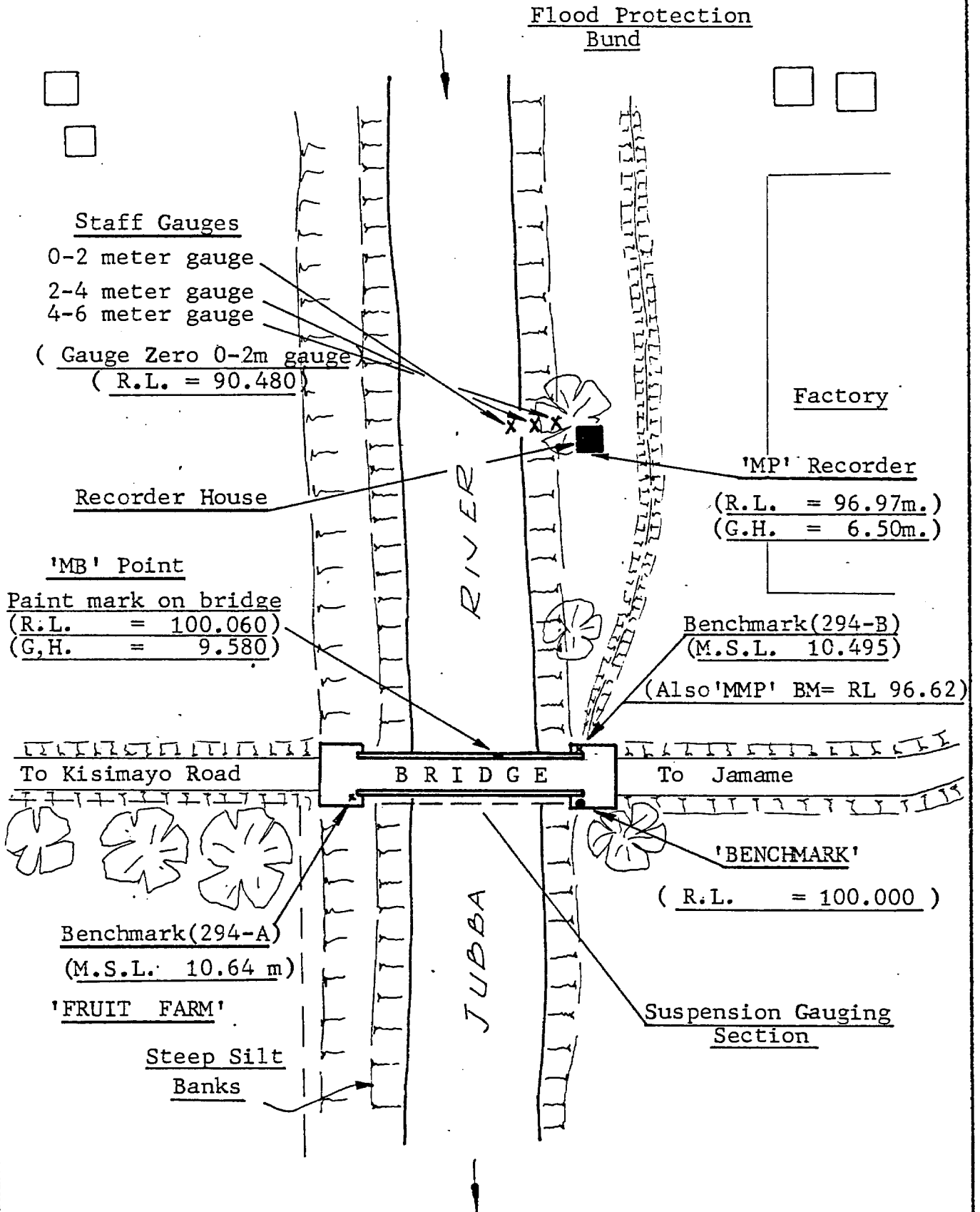
- 1) 'MP' point on the top of the recorder well rings, used to measure the depth to W.L in the well. = RL 96.97m.
- 2) 'MB' point on U/S bridge deck RL 100.06m.
- 3) Originally all gauges with overlaps, 0.25m between 0-2 & 2-4m gauges and 0.09m between 2-4 & 4-6m posts. Actual gauge range only 5.66m.
- 4) (MMP) Benchmark located 8.11.80 - R.L. = 98.62 (1.38m lower than BM)

NOTES :

- 1) Since the initial inspection, the 4-6m gauge has been washed out and replaced. 'MOA' personnel state that the top gauge was replaced in level sequence to the 2-4m gauge (28.02.81) This would leave only one overlap of 0.25m between 0-2 & 2-4m posts, and will increase total range of gauges to 5.75m.

S I T E S K E T C H

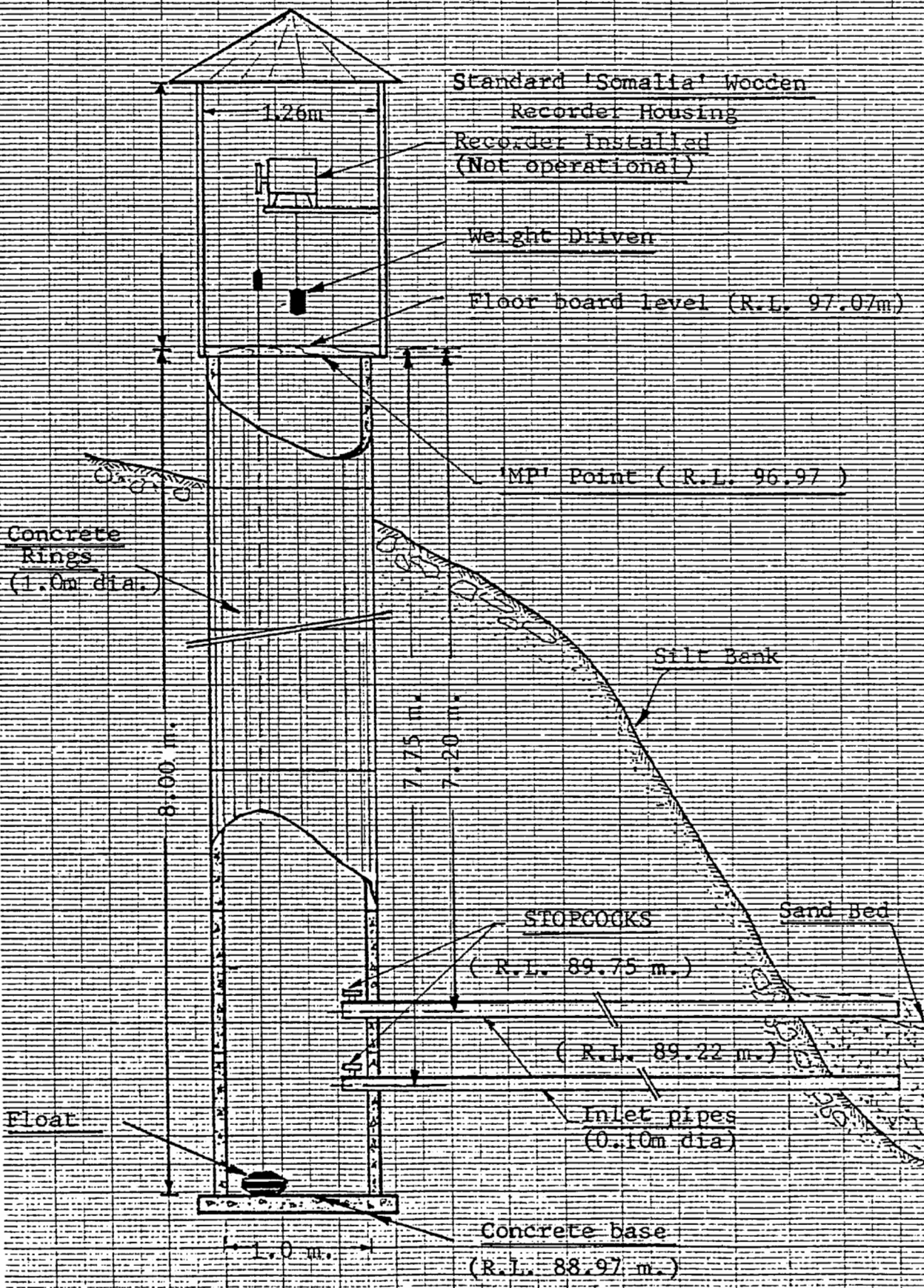
JUBBA RIVER AT JAMAME BRIDGE



NOT TO SCALE

RECORDER DETAILS

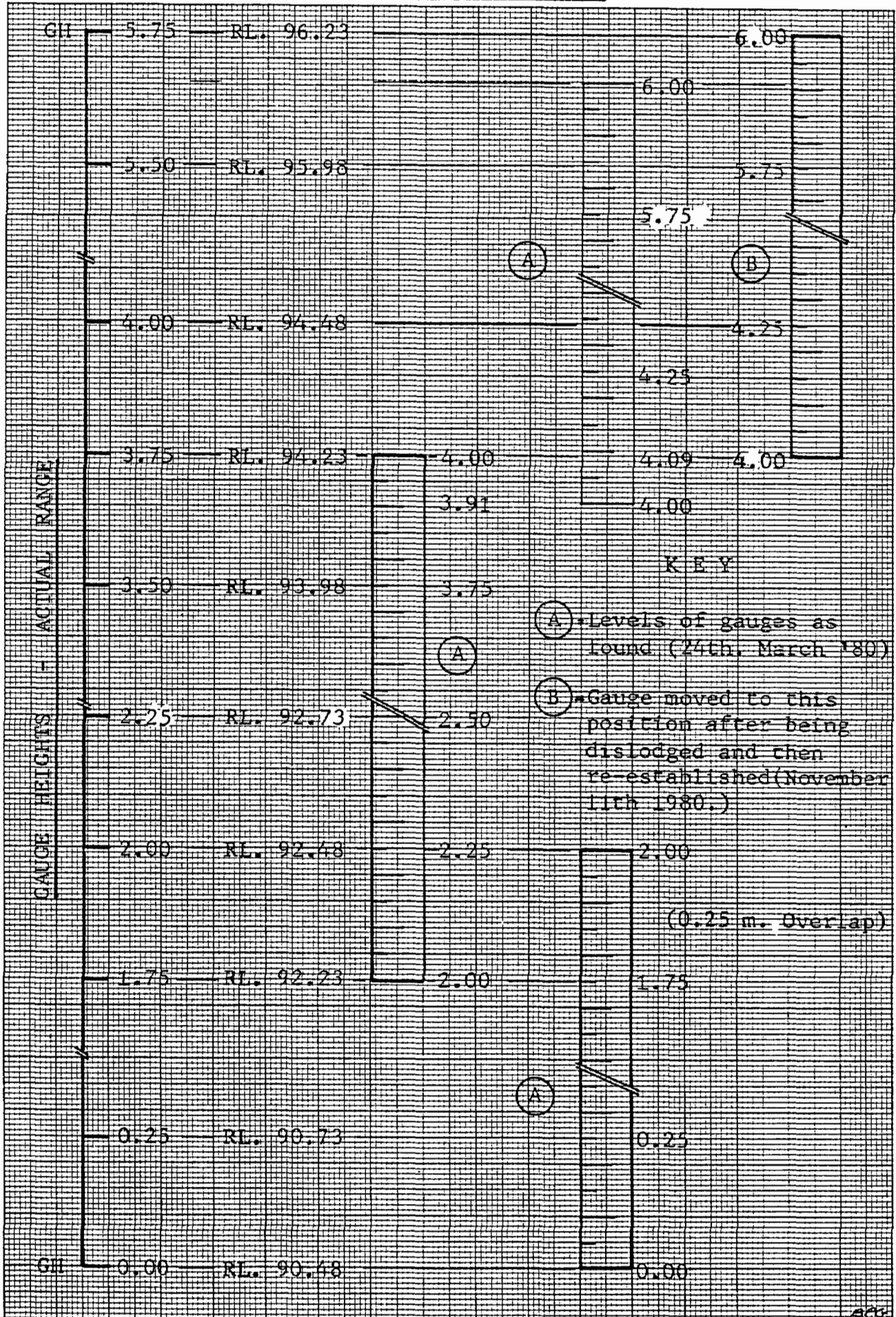
JUBBA RIVER AT JAMAMME



BPC

NOT TO SCALE

JUBBA RIVER AT JAMAAME



DISCHARGE MEASUREMENTS

STREAM : JUBBA AT : JAMAME STATION NO : JB 3

NO	DATE	OBSERVER	GH m	WIDTH m	AREA m	Vm m/sec	Q m ³ /sec	METH	M.S.L	R E M A R K S
1	11.6.80	Hydro Team	0.48	55.0	108.05	0.65	70.48	C.M.M		Steady (V.V.C method)
2	12.6.80	"	0.63	55.0	121.23	0.62	74.50	"		Steady during gauging
3	9.7.80	"	0.99	62.0	156.58	0.65	102.11	"		Rising stage
4	11.7.80	"	1.53	58.0	163.64	0.81	132.82	"		" "
5	12.7.80	"	1.60		incomplete					Equipment failed
6	11.8.80	"	1.02	55.0	135.00	0.73	98.26	"		Steady stage
7	7.11.80	"	2.39	58.0	183.34	0.87	159.59	"		Rising stage
8	8.11.80	"	2.50	60.0	20.30	0.85	178.30	"		" "
9	19.5.81	Ahmed Ali	5.70	64.0	418.56	1.24	519.97	"		Fluctuating peak levels
10	20.5.81	"	5.70	64.0	415.60	1.17	485.45	"		" " "
11	21.5.81	"	5.73	64.1	415.09	1.28	529.70	"	+	Peak flood 1981
12	22.5.81	"	5.70	64.1	412.10	1.25	513.12	"		Rising stage
13	24.5.81	"	5.65	63.3	429.25	1.18	507.02	"		Falling stage
14	11.9.81	Hydro Team	3.35	58.0	249.00	0.92	229.97	"		Falling Stage (3.36 - 3.34 m)
15	8.11.81	B.Gemnell	4.18	63.0	333.60	0.97	322.70	"		" " (4.20 - 4.16 m)
16	9.11.81	Hydro Team	3.92	59.0	301.74	0.92	278.40	"		Steady.
17	18.11.80	B.Gemnell	1.92	56.0	187.00	0.77	144.64	FLOAT		Slow recession.
*	Measurement	carried out		by consultant		&'WFP	Staff	(Local	staff on	public Holidays)

*

JUBBA RIVER AT JAMAAME

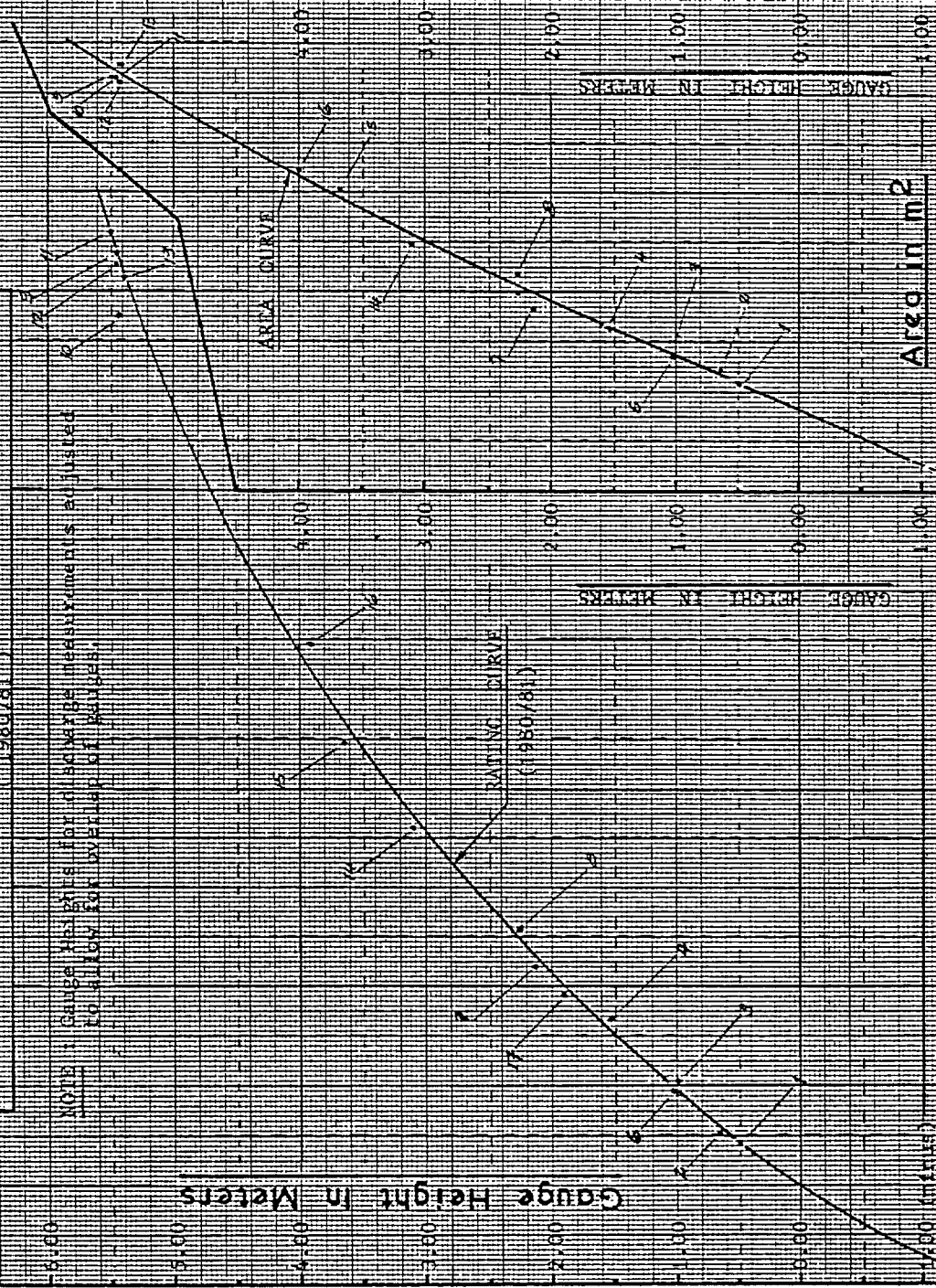
RATING CURVES

(1980/81)

NOTE: Gauge heights for discharge measurements adjusted to allow for verticality of gauges.

Gauge Height in Meters

Gauge Height in Meters (M.S.L.)



Area in m²

Velocity in m/sec

GAUGE HEIGHT IN METERS

GAUGE HEIGHT IN METERS

GAUGE HEIGHT IN METERS

Discharge in m³/sec

Velocity in m/sec

(Not Available)

DATE: 1980/81

JUBBA RIVER AT JAMAAME

RATING CURVES

(1980 / 81)

NOTE: 1) Curve plotted at plus two meters.

2) The intersection point on the curve is approximately at the bank overflow point.

Gauge Height in Meters

Gauge Height in Meters

Intersection Point
 $CH = 6.50 \text{ m}$, $Q = 370.2 \text{ m}^3/\text{second}$

MAIN CURVE

$Q = 14,181.7428$

FLOOD CURVE
 $Q = 3,671.2465$

NOTE:

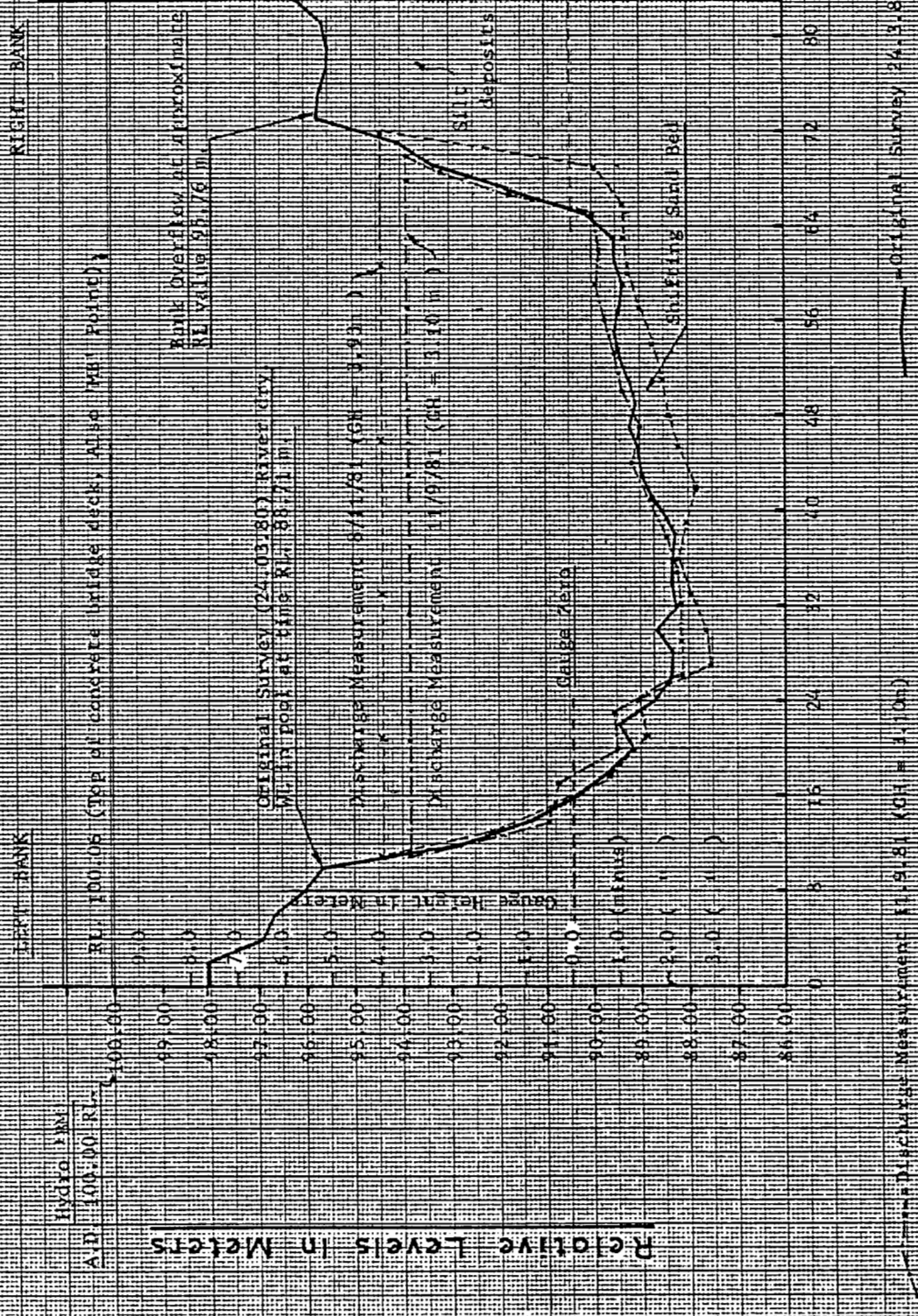
- The present Gauge Zero is approximately between 1.50 to 2.00 meters above the shifting river bed.
- There was probably an extra set of gauges below the present Gauge Zero level. The 1967/68 Rating Diagrams indicate the presence of a seventh gauge.

Discharge in m^3/sec

JUBBA RIVER AT JAMAAME CROSS SECTIONS

(1980 / 81)

(M.S.L) Levels in Meters (Not Available)



Width in Meters

Original Survey 24.3.80 (River dry at time)

P. 23/8/80

MEAN DAILY WATER LEVELS

(Meters)

RIVER : JUBBA LOCATION : JAMAMME YEAR : 1980

DATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	-0.25	-0.95	-1.25	↑	-0.96	1.42	0.06	1.41	0.96	0.62	1.64	0.38
2	-0.33	-0.96	-1.27		-1.04	1.15	0.05	1.31	0.93	0.72	1.37	0.33
3	-0.34	-0.97	-1.28		-1.00	0.91	0.06	1.19	0.85	0.99	1.38	0.23
4	-0.37	-0.99	-1.30		-1.10	0.57	0.09	0.99	0.78	1.09	1.57	0.21
5	-0.41	-1.00	-1.31		-1.09	0.50	0.23	0.87	0.76	1.15	2.38	0.18
6	-0.46	-1.00	-1.34	Y	-0.64	0.48	0.35	0.82	0.76	1.13	2.41	0.29
7	-0.48	-1.03	-1.35	R	-0.42	0.44	0.45	0.62	0.73	1.06	2.44	0.09
8	-0.50	-1.04	-1.38	D	-0.48	0.39	0.75	0.61	0.69	0.99	2.38	0.15
9	-0.53	-1.06	-1.44		-0.56	0.38	0.96	0.62	0.82	0.96	2.18	0.18
10	-0.57	-1.07	-1.44		-0.61	0.54	1.41	0.65	1.05	1.40	1.95	0.09
11	-0.59	-1.09	-1.48	R	-0.45	0.54	1.54	1.02	1.48	2.08	1.84	0.05
12	-0.60	-1.10	-1.49	E	-0.25	0.59	1.60	0.65	1.76	2.57	1.60	0.03
13	-0.61	-1.11	-1.49	V	-0.31	0.51	1.57	0.65	1.93	2.65	1.53	0.02
14	-0.63	-1.13	-1.49	I	-0.52	0.47	1.37	0.64	1.79	2.61	1.54	-0.05
15	-0.65	-1.14	-1.52	R	+0.24	0.54	1.37	0.73	1.57	2.48	1.43	-0.06
16	-0.67	-1.14	-1.53		3.15	0.57	1.57	0.82	1.44	2.29	1.50	-0.12
17	-0.68	-1.17	-1.55		2.77	0.60	1.78	0.86	1.29	2.06	1.41	-0.21
18	-0.68	-1.18	-1.55		2.21	0.62	1.75	0.93	1.25	1.86	1.15	-0.28
19	-0.68	-1.19	-1.56	↓	1.87	0.61	1.65	1.02	1.15	1.79	1.03	-0.31
20	-0.70	-1.20	-1.58	↑	2.16	0.59	1.63	1.13	1.06	1.75	0.93	-0.44
21	-0.72	-1.22	↑	E	2.54	0.51	1.69	1.02	0.97	1.69	0.91	-0.46
22	-0.75	-1.23	R	C	2.39	0.42	1.71	1.06	0.82	1.67	0.90	-0.49
23	-0.76	-1.24	D	A	2.35	0.33	1.90	1.20	0.81	1.72	0.81	-0.56
24	-0.78	-1.25		R	2.58	0.30	2.08	1.42	0.79	1.69	0.69	-0.66
25	-0.79	-1.25		T	2.58	0.32	2.28	1.65	0.73	1.69	0.62	-0.69
26	-0.81	-1.24	R		2.38	0.27	2.20	1.64	0.61	1.74	0.57	-0.70
27	-0.82	-1.23	E		2.18	0.21	2.02	1.55	0.62	1.78	0.56	-0.75
28	-0.84	-1.23	V	↓	1.94	0.15	1.82	1.44	0.65	1.74	0.58	-0.81
29	-0.88	-1.25	I	-1.48	1.75	0.10	1.64	1.24	0.62	1.75	0.57	-0.82
30	-0.89	-	R	-0.96	1.74	0.06	1.51	1.09	0.61	1.72	0.50	-0.83
31	-0.92	-	↓	-	1.68	-	1.46	1.02	-	1.67	-	-0.86
Mean	-0.64	-1.13	(1.43)	(1.22)	0.74	0.50	1.31	1.02	1.01	1.65	1.35	-0.17
M(max)	-0.92	0.95	1.25	-0.96	3.15*	1.42	2.28	1.65	1.93	2.65	2.44	0.38
M(min)	-0.25		DRY	DRY	-1.10	0.06	0.05	0.61	0.61	0.62	0.50	0.86
Max(A)	-0.95	0.94	1.25	-0.96	3.30	1.50	2.35	1.70	1.95	2.70	2.50	0.42
Min(A)	-0.20	1.25	DRY	DRY	-1.10	0.06	0.05	0.60	0.61	0.62	0.45	0.86
	Peak Flood 3.30m* (16/5/80)						Mean Yearly Gauge Height: -					

NOTE: Bracket Figures mean of flow days only.

MEAN DAILY WATER LEVELS

(Meters)

RIVER :...JUBBA..... LOCATION :.....JAMAMME..... YEAR :.1981..

DATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	-0.91	-1.56	DRY	5.05	5.41	4.76	1.67	2.19	4.25	5.17	5.51	1.88
2	-0.95	-1.58	"	5.10	5.41	4.43	2.59	2.22	4.25	5.17	5.30	1.76
3	-0.95	-1.58	"	5.17	5.43	4.27	1.51	2.25	3.85	5.31	5.10	1.68
4	-0.96	-1.59	"	5.23	5.40	3.94	1.45	2.28	3.85	5.31	4.90	1.64
5	-1.03	-1.62	"	5.27	5.39	3.82	1.45	2.22	3.97	5.29	4.60	1.60
6	-1.06	-1.61	"	5.30	5.39	3.68	1.53	2.20	3.55	5.21	4.35	1.51
7	-1.09	-1.62	"	5.35	5.39	3.74	1.50	2.18	3.57	5.13	4.23	1.48
8	-1.09	-1.66	"	5.39	5.41	3.47	1.48	2.21	3.49	5.07	4.16	1.44
9	-1.10	-1.68	"	5.33	5.39	3.32	1.45	2.22	3.45	4.99	3.96	1.40
10	-1.10	-1.68	"	5.31	5.35	3.16	1.42	2.34	3.21	4.91	3.68	1.35
11	-1.14	-1.64	"	5.30	5.33	3.00	1.48	2.57	3.12	4.84	3.54	1.29
12	-1.15	-1.62	"	5.32	5.33	2.86	1.64	2.89	3.55	4.77	3.35	1.27
13	-1.18	-1.62	"	5.33	5.33	2.75	1.71	2.91	3.85	4.07	3.17	1.26
14	-1.19	-1.62	"	5.33	5.33	2.73	1.69	3.05	3.95	4.21	3.09	1.24
15	-1.20	-1.66	"	5.35	5.41	2.75	1.69	3.05	4.35	4.31	2.88	1.22
16	-1.22	DRY	"	5.39	5.43	2.70	1.69	3.01	4.65	4.51	2.15	1.15
17	-1.20	"	"	5.43	5.43	2.61	1.69	2.95	4.71	4.61	3.21	1.03
18	-1.22	"	"	5.43	5.43	2.48	1.75	2.91	4.65	4.71	2.70	1.02
19	-1.24	"	"	5.43	5.45	2.35	1.76	2.85	4.57	4.95	2.64	0.99
20	-1.30	"	"	5.44	5.45	2.24	1.74	2.93	4.57	5.13	2.75	0.91
21	-1.33	"	"	5.42	5.48	2.21	1.65	2.95	4.37	5.17	2.79	0.84
22	-1.35	"	"	5.40	5.45	2.20	1.57	3.44	4.25	5.29	2.70	0.78
23	-1.34	"	"	5.39	5.41	2.19	1.46	3.45	4.25	5.35	2.54	0.73
24	-1.35	"	"	5.37	5.39	2.19	1.38	3.36	4.15	5.39	2.38	0.68
25	-1.37	"	"	5.43	5.35	2.18	1.26	3.34	4.17	5.41	2.25	0.64
26	-1.42	"	"	5.43	5.43	2.11	1.20	3.23	4.18	5.43	2.17	0.60
27	-1.45	"	1.46	5.42	5.39	2.02	1.13	3.25	4.21	5.47	2.08	0.56
28	-1.46	"	1.79	5.42	5.35	1.94	1.19	3.39	4.77	5.51	2.02	0.51
29	-1.48	-	2.59	5.40	5.33	1.82	1.32	3.63	5.15	5.53	1.96	0.50
30	-1.48	-	4.36	5.42	5.29	1.74	1.57	4.23	5.15	5.53	1.90	0.49
31	-1.55	-	5.15	-	5.25	-	1.90	4.25	-	5.51	-	0.47
Mean	-1.22	(-1.62)	(3.05)	5.35	5.39	2.86	1.53	2.90	4.14	5.07	3.30	1.07
M(max)	-1.55	1.56	5.15	5.44	5.48	4.76	1.90	4.25	5.15	5.53	5.51	1.81
M(min)	-0.91	DRY	DRY	5.05	5.25	1.74	1.13	2.18	3.12	4.07	1.90	0.47
Max(A)	-1.55	1.56	5.20	5.50	5.55	5.00	2.00	4.25	5.16	5.53	5.51	1.85
Min(A)	-0.99	DRY	DRY	5.05	5.00	1.70	1.10	2.00	3.10	4.00	1.86	0.46
	Peak Flood 5.53m(29/10/81)			Mean Yearly Gauge Height: -								

NOTE: Bracket Figures mean of flow days only.

S E C T I O N (D)

WATER LEVEL CORRELATION GRAPHS

- 1 - Jubba River at LUGH GANANA/BARDHEERE
- 2 - Jubba River at LUGH GANANA/MAREERY
- 3 - JUbba River at MAREERY / JAMAMME

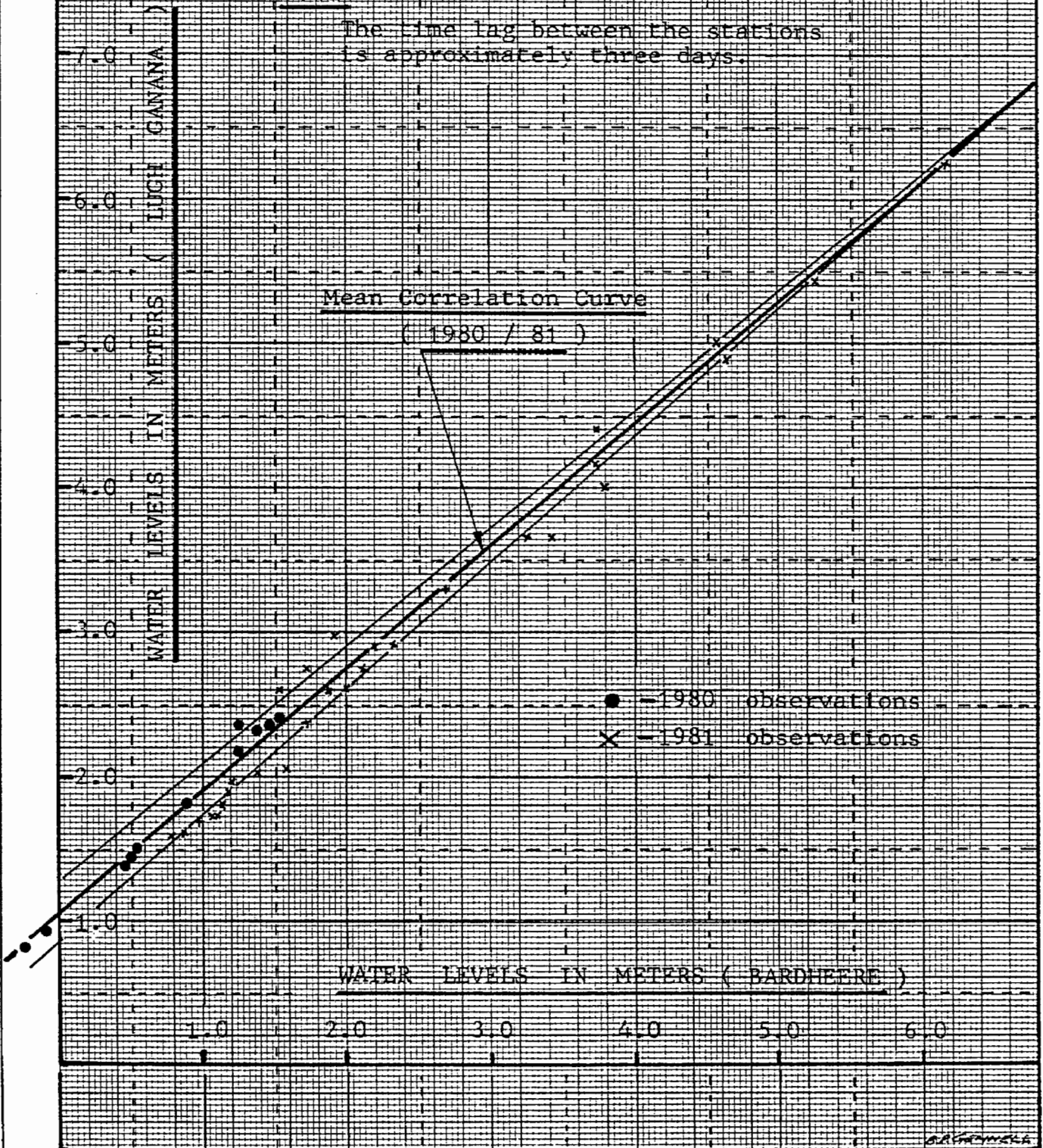
WATER LEVEL CORRELATION - JUBBA RIVER

LUGH CANANA AND BARDHEERE

(1980 / 81)

NOTE:

The time lag between the stations is approximately three days.



ORINOWELA

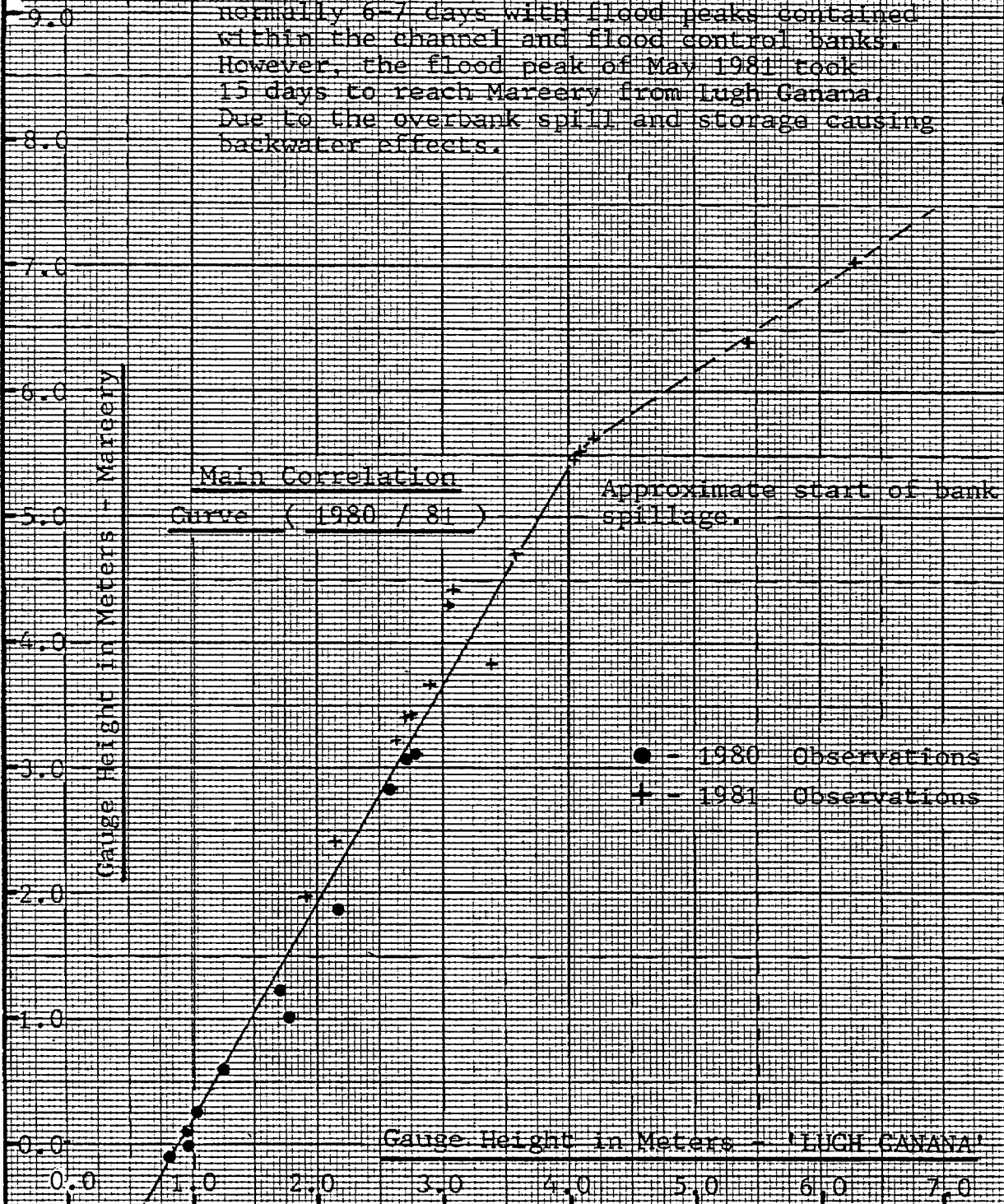
WATER LEVEL CORRELATION - JUBBA RIVER

LUGH CANANA AND MAREERY

(1980 / 81)

NOTE:

The time lag between the stations is normally 6-7 days with flood peaks contained within the channel and flood control banks. However, the flood peak of May 1981 took 15 days to reach Mareery from Lugh Canana. Due to the overbank spill and storage causing backwater effects.



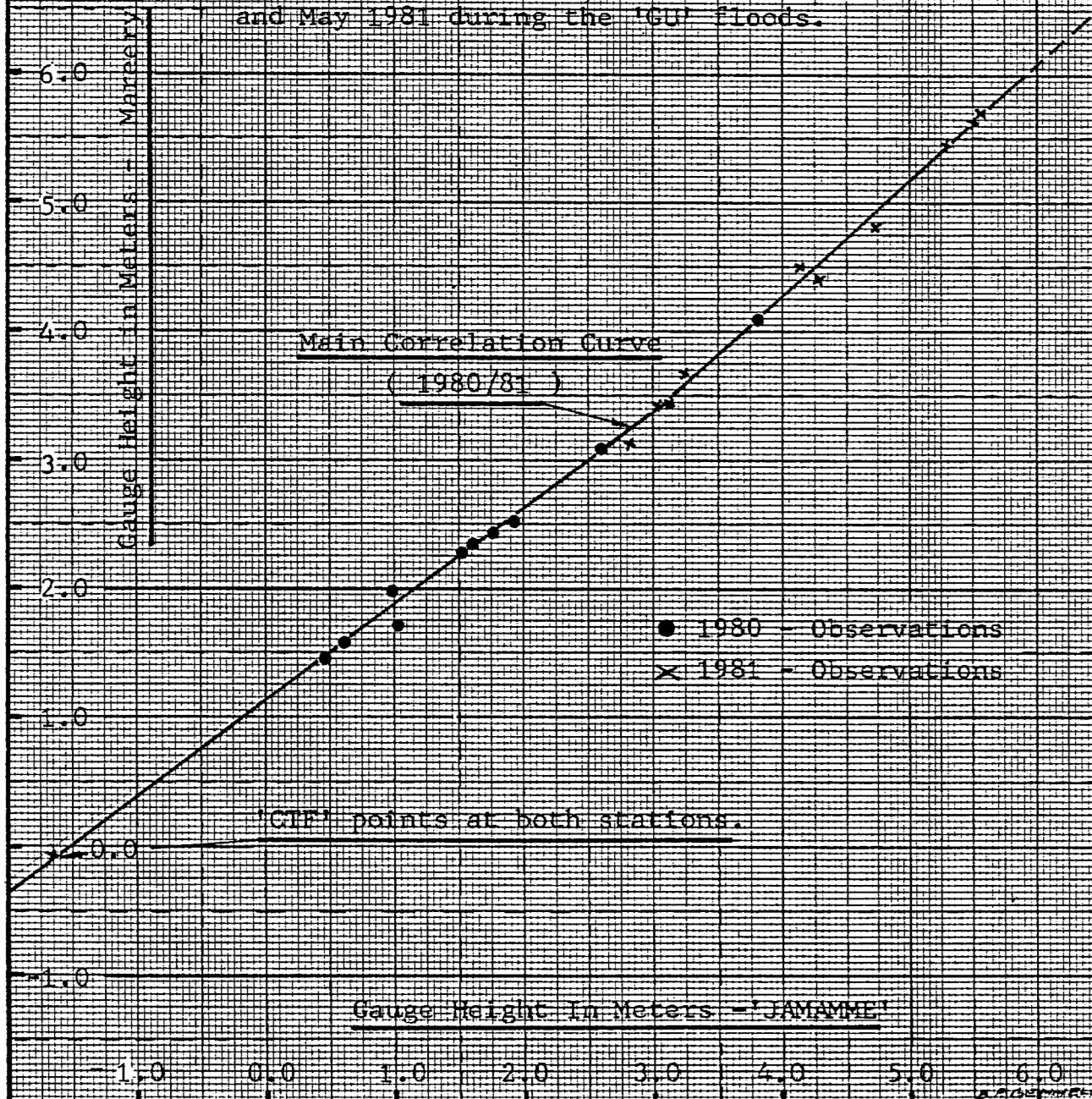
WATER LEVEL CORRELATION - JUBBA RIVER

MARREERY AND JAMAMME

(1980 / 81)

NOTE :

Time lag between the stations is one day when flow is confined to the main channel. Increases to two and maybe three days at very high levels when the whole area is flooded, similar to April and May 1981 during the 'GU' floods.



S E C T I O N (E)

STAGE AND DISCHARGE DATA SHEETS

- 1 - JUBBA RIVER - 1977/79
 - a. Lugh Ganana (1980/81 Rating)

- 2 - JUBBA RIVER - 1980
 - a. Lugh Ganana
 - b. Bardheere
 - c. Jamamme

- 3 - JUBBA RIVER - 1981
 - a. Lugh Ganana
 - b. Bardheere
 - c. Jamamme

4. - JUBBA RIVER - 1951 / 1981
 - a. Lugh Ganana discharge summary sheet.

STAGE AND DISCHARGE DATA SHEET

Year: 1980

J U B B A

River:

Station	Quantity	Units	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec		
LUGH GANANA	MEAN MONTHLY (GH)	Meters	1.25	1.06	0.96	1.11	2.06	1.86	2.30	2.11	2.19	2.44	1.97	1.37		
	MEAN MONTHLY (Q)	M ³ /Sec	21.81	9.89	6.16	12.21	107.80	79.03	149.40	115.50	129.00	178.80	94.61	31.26		
	MEAN DAILY VOLUME	M ³ x 10 ⁶	1.88	0.85	0.53	1.06	9.31	6.83	12.91	9.96	11.15	15.45	8.17	2.70		
	MONTHLY VOLUME	M ³ x 10 ⁶	58.28	24.65	16.43	31.80	288.61	204.90	400.21	308.76	334.50	478.95	245.10	83.70		
	MONTHLY VOLUME	Percent (%)	2.35	1.00	0.66	1.28	11.66	8.28	16.16	12.47	13.51	19.34	9.90	3.38		
	ANNUAL MEANS :	MONTHLY(VOL) :	206.32	M ³ x 10 ⁶	DAILY(VOL) :	6.76	M ³ x 10 ⁶	DAILY(Q) :	78.24	M ³ /Sec	ANNUAL DISCHARGE: 2,476					M ³ x10 ⁶
	MEAN MONTHLY (GH)	Meters	0.06	- 0.10	- 0.15	0.05	1.22	0.90	1.40	1.18	1.28	1.52	1.14	0.48		
	MEAN MONTHLY (Q)	M ³ /Sec	12.00	4.38	3.09	11.20	126.90	80.00	159.80	120.20	137.30	184.80	113.80	38.20		
	MEAN DAILY VOLUME	M ³ x 10 ⁶	1.04	0.38	0.27	0.97	10.96	6.91	13.81	10.39	11.86	15.97	9.83	3.30		
	MONTHLY VOLUME	M ³ x 10 ⁶	32.24	11.02	8.37	29.10	339.76	207.30	428.11	322.09	355.80	495.07	294.90	102.30		
MONTHLY VOLUME	Percent (%)	1.23	0.42	0.32	1.11	12.94	7.89	16.30	12.27	13.55	18.85	11.23	3.90			
ANNUAL MEANS :	MONTHLY(VOL) :	218.84	M ³ x 10 ⁶	DAILY(VOL) :	7.18	M ³ x 10 ⁶	DAILY(Q) :	83.10	M ³ /Sec	ANNUAL DISCHARGE: 2,626					M ³ x10 ⁶	
MEAN MONTHLY (GH)	Meters	- 0.64	- 1.13	-	-	0.74	0.50	1.31	1.02	1.01	1.65	1.35	- 0.17			
MEAN MONTHLY (Q)	M ³ /Sec	24.25	11.14	3.45	0.66	82.17	70.02	114.20	97.35	96.78	135.50	116.70	40.67			
MEAN DAILY VOLUME	M ³ x 10 ⁶	2.10	0.96	0.30	0.06	7.10	6.05	9.87	8.41	8.36	11.71	10.08	3.51			
MONTHLY VOLUME	M ³ x 10 ⁶	65.10	27.84	0.03	0.93	220.10	181.50	305.97	260.71	250.80	363.01	302.40	108.81			
MONTHLY VOLUME	Percent (%)	3.12	1.33	Trace	0.04	10.55	8.70	14.66	12.49	12.02	17.39	14.49	5.21			
ANNUAL MEANS :	MONTHLY(VOL) :	173.93	M ³ x 10 ⁶	DAILY(VOL) :	5.70	M ³ x 10 ⁶	DAILY(Q) :	65.97	M ³ /Sec	ANNUAL DISCHARGE: 2 087					M ³ x10 ⁶	
JAMANME	MEAN MONTHLY (GH)	Meters														
	MEAN MONTHLY (Q)	M ³ /Sec														
	MEAN DAILY VOLUME	M ³ x 10 ⁶														
	MONTHLY VOLUME	M ³ x 10 ⁶														
	MONTHLY VOLUME	Percent (%)														
	ANNUAL MEANS :	MONTHLY(VOL) :		M ³ x 10 ⁶	DAILY(VOL) :		M ³ x 10 ⁶	DAILY(Q) :		M ³ /Sec	ANNUAL DISCHARGE:					M ³ x10 ⁶
	MEAN MONTHLY (GH)	Meters														
	MEAN MONTHLY (Q)	M ³ /Sec														
	MEAN DAILY VOLUME	M ³ x 10 ⁶														
	MONTHLY VOLUME	M ³ x 10 ⁶														
MONTHLY VOLUME	Percent (%)															
ANNUAL MEANS :	MONTHLY(VOL) :		M ³ x 10 ⁶	DAILY(VOL) :		M ³ x 10 ⁶	DAILY(Q) :		M ³ /Sec	ANNUAL DISCHARGE:					M ³ x10 ⁶	

STAGE AND DISCHARGE DATA SHEET

River: JUBBA

Year: 1981

Station	Quantity	Units	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
<u>LUGH GANANA</u>	MEAN MONTHLY (GH)	Meters	1.01	0.85	1.85	4.70	3.93	2.17	2.11	2.79	3.41	3.51	2.50	1.82
	MEAN MONTHLY (Q)	M ³ /Sec	7.76	3.46	77.77	816.10	549.40	125.60	115.30	257.50	401.30	427.80	192.10	73.98
	MEAN DAILY VOLUME	M ³ x 10 ⁶	0.67	0.30	6.72	70.51	47.47	10.85	9.96	22.25	34.67	36.96	16.60	6.39
	MONTHLY VOLUME	M ³ x 10 ⁶	20.77	8.40	208.32	2115.30	1471.57	325.50	308.76	689.75	1040.10	1145.76	498.00	198.09
	MONTHLY VOLUME	Percent (%)	0.26	0.10	2.59	26.34	18.33	4.05	3.84	8.59	12.95	14.27	6.20	2.47
	ANNUAL MEANS :	MONTHLY(VOL) :	M ³ x 10 ⁶	669.19	22.00	DAILY(VOL) :	254.63	M ³ /Sec	ANNUAL DISCHARGE :	8,030	M ³ x 10 ⁶			
<u>BARDHEERE</u>	MEAN MONTHLY (GH)	Meters	0.15	- 0.10	1.71	4.00	3.97	1.63	1.36	2.15	2.84	2.96	1.67	0.66
	MEAN MONTHLY (Q)	M ³ /Sec	18.10	4.38	219.90	699.10	692.00	206.80	152.00	307.50	446.40	470.3	213.20	53.70
	MEAN DAILY VOLUME	M ³ x 10 ⁶	1.56	0.38	19.00	60.40	59.79	17.87	13.13	26.57	38.57	40.63	18.42	4.64
	MONTHLY VOLUME	M ³ x 10 ⁶	48.36	10.64	589.00	1812.00	1853.49	536.10	407.03	823.67	1157.10	1259.53	552.60	143.84
	MONTHLY VOLUME	Percent (%)	0.53	0.12	6.41	19.71	20.16	5.83	4.43	8.96	12.59	13.70	6.01	1.56
	ANNUAL MEANS :	MONTHLY(VOL) :	M ³ x 10 ⁶	766.11	25.19	DAILY(VOL) :	291.55	M ³ /Sec	ANNUAL DISCHARGE :	9,194	M ³ x 10 ⁶			
<u>JAMAME</u>	MEAN MONTHLY (GH)	Meters	- 1.22	- 1.62	-	5.35	5.39	2.86	1.53	2.90	4.14	5.07	3.30	1.07
	MEAN MONTHLY (Q)	M ³ /Sec	9.22	1.42	41.76	501.26	508.00	223.00	127.80	226.00	335.20	455.60	259.40	100.20
	MEAN DAILY VOLUME	M ³ x 10 ⁶	0.80	0.12	3.61	43.31	43.89	19.27	11.04	19.53	28.96	39.36	22.41	8.66
	MONTHLY VOLUME	M ³ x 10 ⁶	24.80	3.36	111.91	1299.30	1360.59	578.10	342.24	605.43	868.80	1220.16	672.30	268.46
	MONTHLY VOLUME	Percent (%)	0.34	0.05	1.52	17.66	18.50	7.86	4.65	8.23	11.81	16.59	9.14	3.65
	ANNUAL MEANS :	MONTHLY(VOL) :	M ³ x 10 ⁶	612.95	20.15	DAILY(VOL) :	233.22	M ³ /Sec	ANNUAL DISCHARGE :	7,356	M ³ x 10 ⁶			
	MEAN MONTHLY (GH)	Meters												
	MEAN MONTHLY (Q)	M ³ /Sec												
	MEAN DAILY VOLUME	M ³ x 10 ⁶												
	MONTHLY VOLUME	M ³ x 10 ⁶												
	MONTHLY VOLUME	Percent (%)												
	ANNUAL MEANS :	MONTHLY(VOL) :												

Note:
These figures only apply to the main channel flow.

J U B B A R I V E R

STATION : LUGH GANANA

(Streamflow in $m^3 \times 10^6$)

PERIOD: 1951 / 1981

Year	Jan 1	Feb 2	Mar 3	Apr 4	May 5	Jun 6	Jul 7	Aug 8	Sep 9	Oct 10	Nov 11	Dec 12	TOTAL ($m^3 \times 10^6$)	Max 'Q' (m^3/sec)	MIN 'Q' (m^3/sec)
1951	205	95	76	793	1562	573	383	841	565	1559	1226	645	8523	1,030	20.6
1952	172	49	34	159	592	204	260	611	982	1612	785	117	5578 *	860	10.6
1953	53	30	31	82	434	174	640	1168	410	600	853	154	4628	650	8.8
1954	68	30	29	547	517	363	720	1310	1322	1578	347	217	7048	980	9.7
1955	71	59	34	84	233	59	136	506	689	1120	472	125	3588	676	10.3
1956	95	59	34	226	635	256	362	844	886	2105	728	166	6386 *	1,430	10.2
1957	76	48	150	150	996	697	589	680	381	522	677	439	5406	705	14.3
1958	97	101	76	72	319	1734	873	1275	1172	1240	819	619	8396	690	19.4
1959	166	48	41	102	554	529	509	565	1179	1500	1371	265	6829	1,205	8.7
1960	103	428	1152	103	41	456	645	455	581	753	990	597	6314 *	668	9.4
1961	80	60	65	586	603	422	603	1379	1052	1698	2094	1256	9899	1,320	21.0
1962	211	71	61	145	506	120	193	463	609	1361	728	308	4766	598	14.3
1963	49	39	56	734	1342	454	340	391	316	487	490	696	5393	755	13.8
1964	217	93	65	149	203	251	266	678	635	1366	816	375	5114 *	777	15.5
1965	340	91	23	28	81	36	66	132	235	1671	1283	525	4511	985	8.2
1966	136	75	87	195	562	391	337	496	899	691	715	260	4847	390	26.0
1967	79	57	70	212	678	132	447	1020	868	1848	2035	854	8300	1,105	22.4
1968	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1969	-	-	-	-	-	-	-	-	-	-	430	155	-	-	-
1970	163	137	281	630	504	855	458	659	969	1730	1353	196	7935	1,250	28.9
1971	97	67	74	156	522	422	611	568	638	1596	1052	329	6133	970	27.5
1972	138	118	144	293	822	562	587	686	596	881	1065	362	6254 *	1,065	27.5
1973	144	77	52	(65)	74	41	61	768	(687)	1213	676	20	(3878)	720	-
1974	3	0	0	41	213	474	430	608	987	617	439	56	3868	655	-
1975	12	18	14	74	182	92	558	1130	980	1049	648	88	4845	730	-
1976	42	15	22	59	1114	713	573	498	557	587	943	141	4264 *	1,095	-
1977	123	126	69	744	871	942	679	822	1090	1573	2727	695	10393	2,052	10.3
1978	185	89	585	348	723	303	1041	980	750	1624	836	401	7870	1,045	24.3
1979	164	185	140	393	(595)	790	428	560	317	734	784	728	5818	(510)	21.8
1980	58	25	16	32	289	205	400	309	335	479	245	84	2476 *	265	5.0
1981	21	8	208	2115	1472	326	309	690	1040	1146	498	198	8030	1,533	2.3
MEAN	116	80	127	321	595	434	466	727	749	1205	938	369	6113	921	15.6

Sum of Monthly Means:- 6,127 $m^3 \times 10^6$

NOTE:- Bracketed figures 1973(Lugh/Kaitoi correlation - Selchozpromexport). 1979 - Mean values used.

DATA SOURCE: A). Selchozpromexport 1965 & 1973. B). 'MMP' & Ministry of Agriculture records 1973/79. C). D.P.Gemmill 1980/81. Note that data for period 1977 to 1981 computed from 1980/81 rating curve. NOTE: The asterisk denotes leap year.

S E C T I O N (F)

1. RIVER STAGE HYDROGRAPHS (1980)

a). JUBBA

i). Lugh Ganana

ii). Bardheere

b). JUBBA

i). Mareery

ii). Jamamme

2. RIVER STAGE HYDROGRAPHS (1981)

a). JUBBA

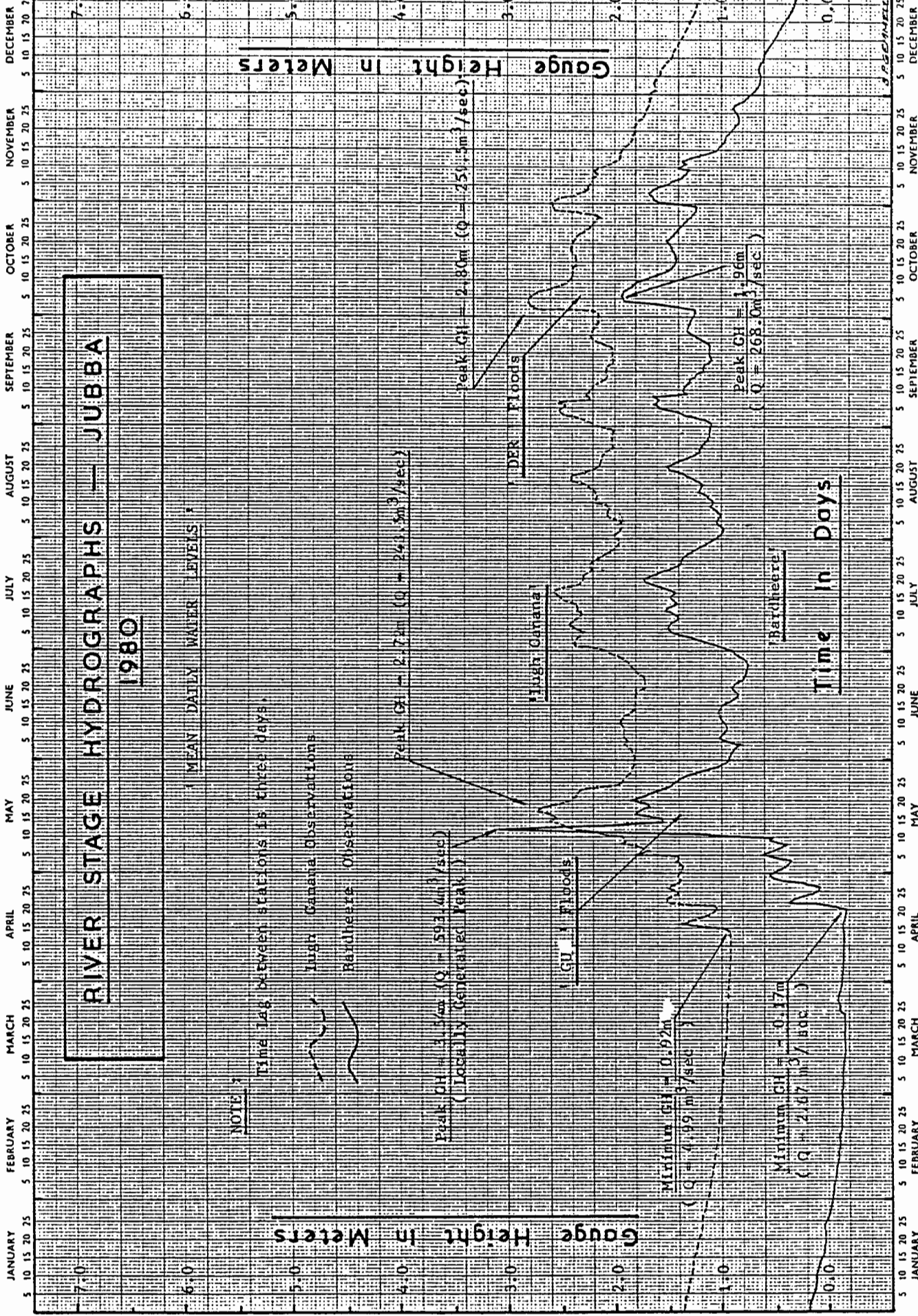
i). Lugh Ganana

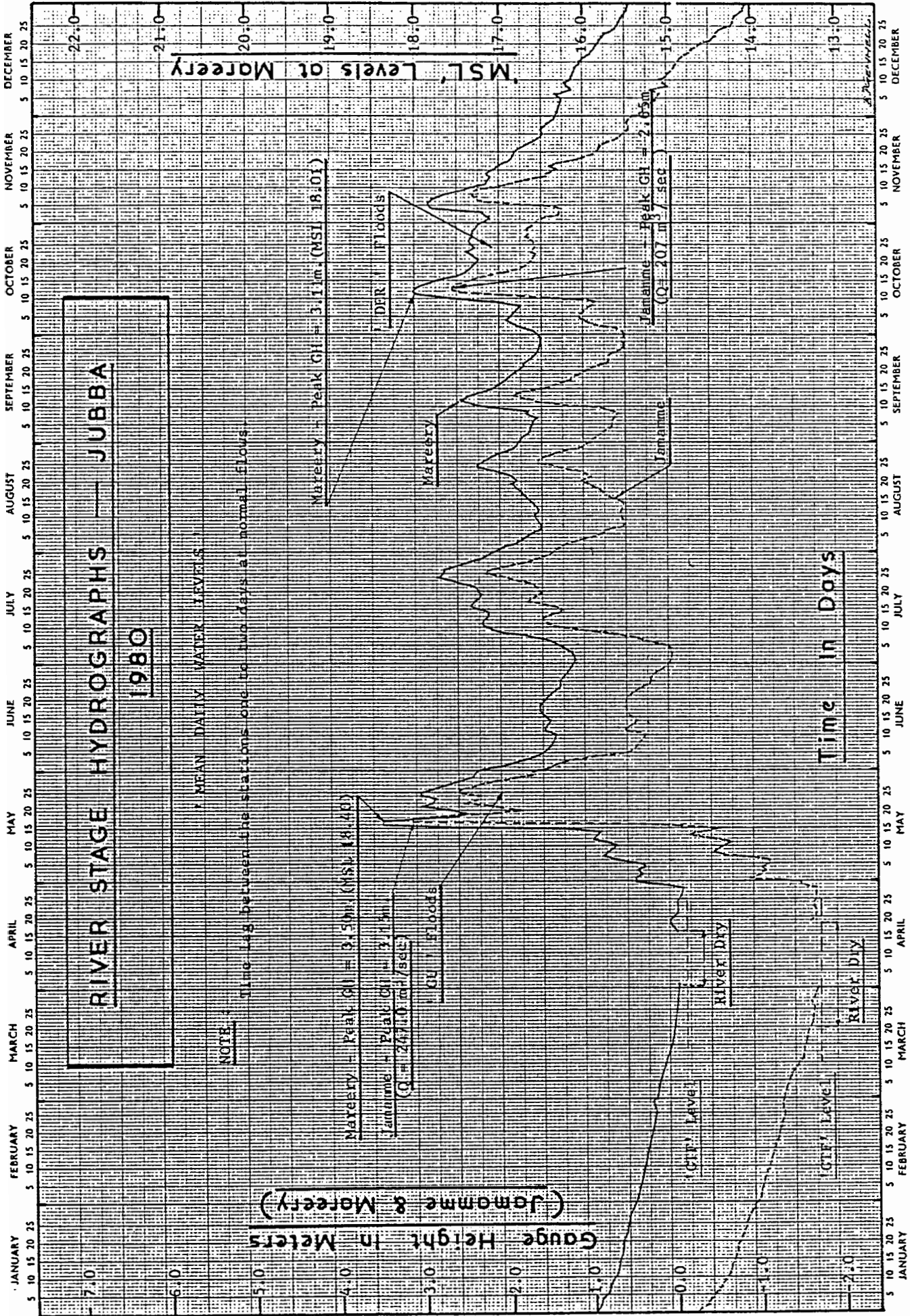
ii). Bardheere

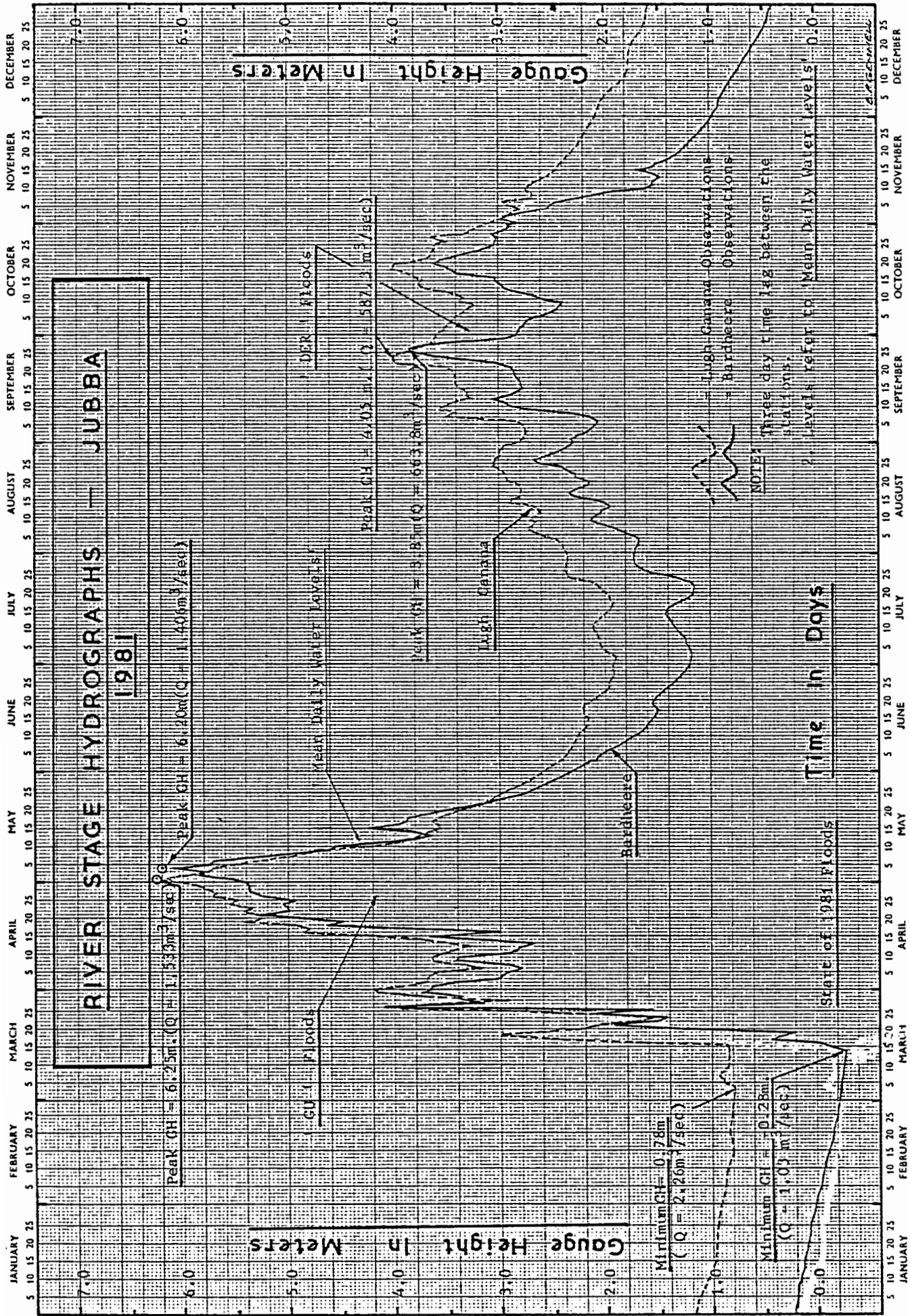
b). JUBBA

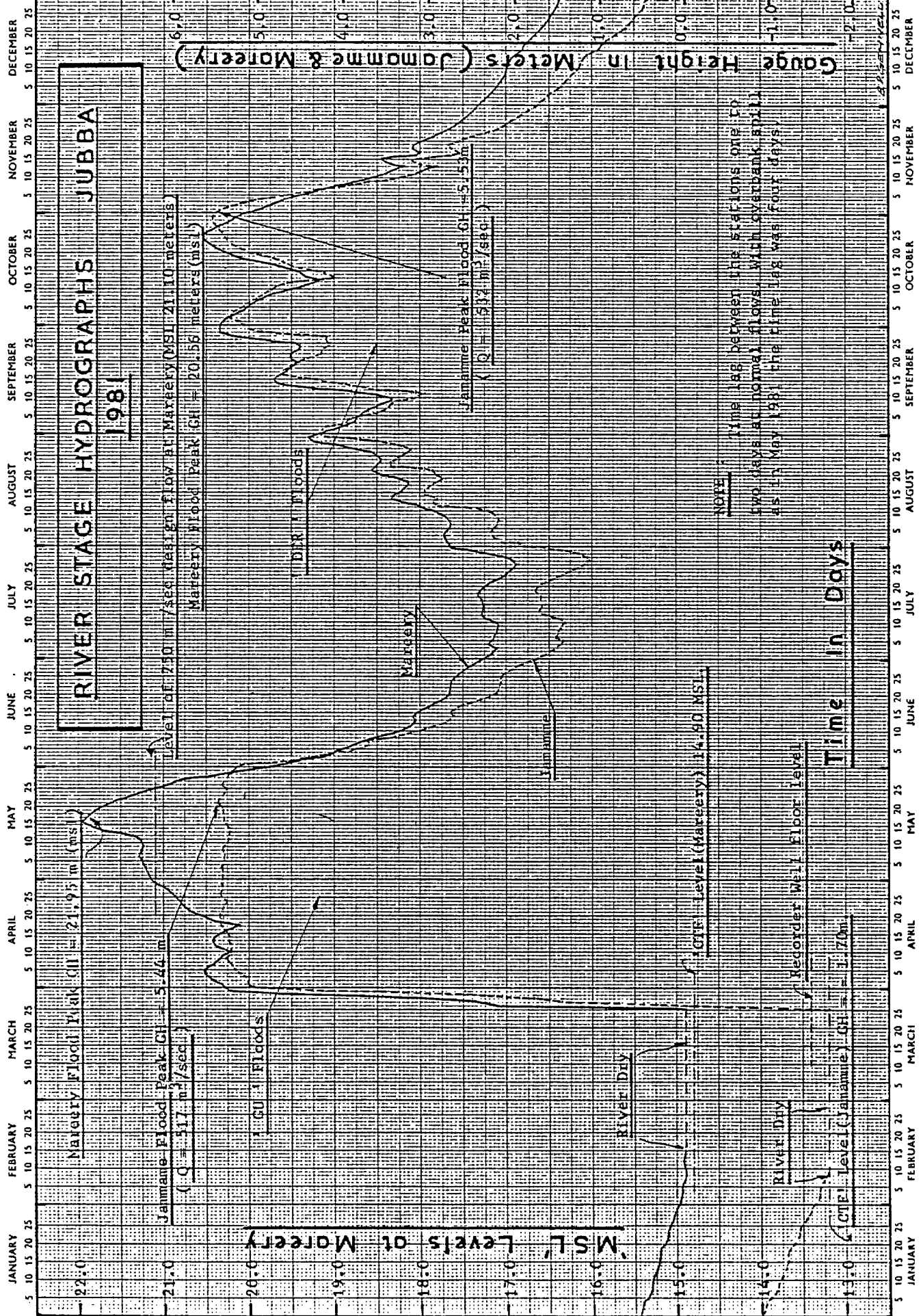
i). Mareery

ii). Jamamme









S E C T I O N (G)

WATER LEVEL DATA QUALITY ' BAR CHARTS '

1. - JUBBA & SHEBELLI - (1980)

2. - JUBBA & SHEBELLI - (1981)

JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER		
5	10	15	20	25	5	10	15	20	25	5	10	15	20	25	5	10	15	20	25	5	10	15	20	25
1980 WATER LEVEL DATA QUALITY SUBMISSION																								
RECORDED & OBSERVED DATA																								
OBSERVER DATA																								
STATION TYPE (MISSION & SPOT OBSERVATIONS)																								
SPOT OBSERVATIONS																								
CORRELATION (Water Levels)																								
Bulo Burti																								
Mahaddei Uen																								
Balaad																								
NO DATA																								
STATION CLOSED																								
Argoi																								
Audegic																								
JUBBA RIVER																								
Lugh Ganana																								
Bardheere																								
Mareery																								
Jamame																								
DRY																								

JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER																																										
5	10	15	20	25	5	10	15	20	25	5	10	15	20	25	5	10	15	20	25	5	10	15	20	25	5	10	15	20	25	5	10	15	20	25	5	10	15	20	25	5	10	15	20	25	5	10	15	20	25	5	10	15	20	25	5	10	15	20	25	5	10	15	20	25
1981 WATER LEVEL DATA QUALITY SUBMISSION																																																																
Recorder & Observer data.																																																																
Observer data.																																																																
Straight line recession & spot observations.																																																																
Spot observations.																																																																
Correlation (Water Levels).																																																																
SHEBELLI RIVER																																																																
Belet Uen																																																																
Bulo Burti																																																																
Mahaddel Uen																																																																
Balgaad																																																																
NO DATA																																																																
STATION CLOSED																																																																
Algoi																																																																
Audeqle																																																																
JUBBA RIVER																																																																
Lugh Ganana																																																																
Bardheere																																																																
Mareery																																																																
Jamame																																																																
DRY																																																																
DRY																																																																

S E C T I O N (H)

ORIGINAL INSTALLATION DATA (JUBBA)

1. - RATING NOMOGRAMS
2. - LUGH GANANA
 - a. Site sketch - March 1965.
 - b. Benchmark installation data.
 - c. Original History Notes.
 - d. " " "
3. - BARDHEERE
 - a. Site sketch - March 1965.
 - b. Benchmark installation data.
 - c. Original History Notes & Sketches
 - d. " " " "
 - e. Benchmark details (from 'MMP').
4. KAITOI
 - a. Site sketch - March 1965.
5. JAMAMME
 - a. Site sketch - March 1965.

RATING NOMOGRAMS (JUBA RIVER)



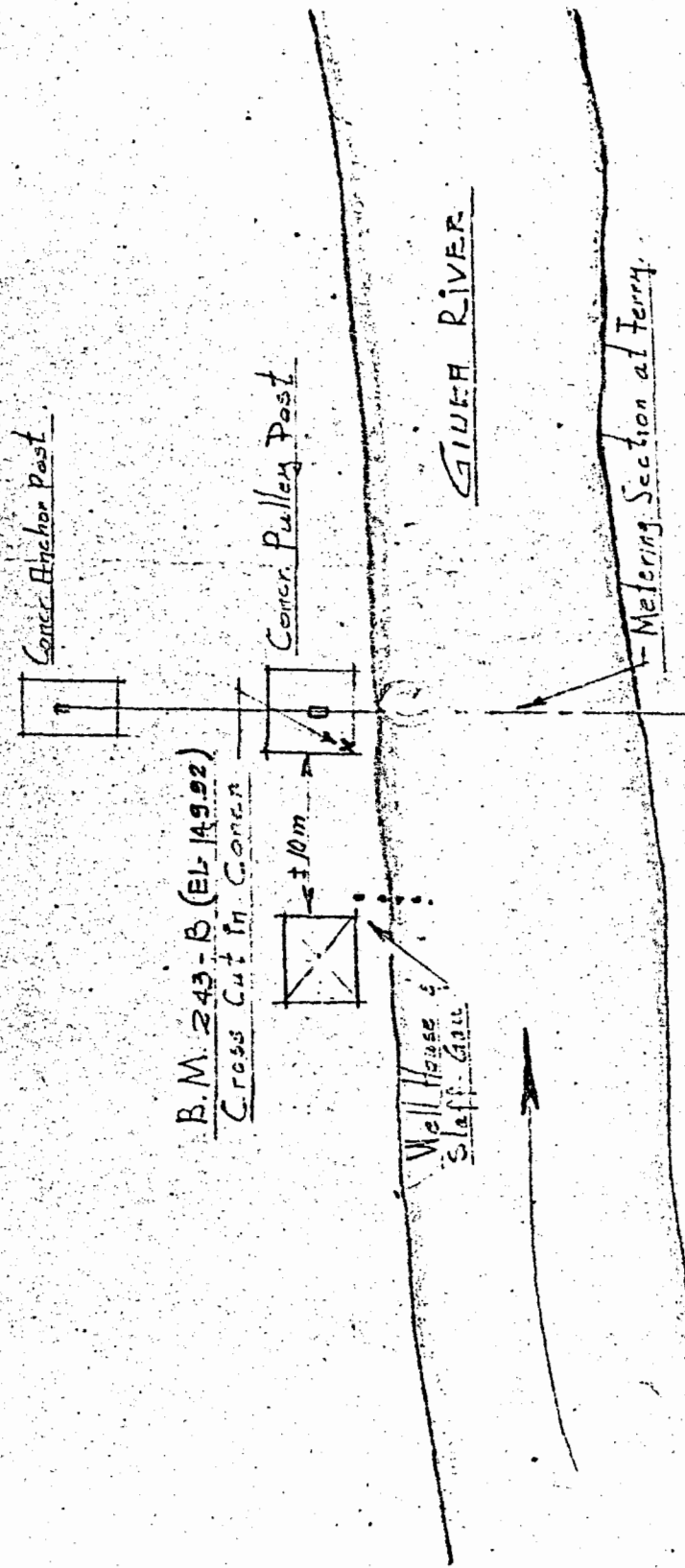
Figure 19

Elevations in metres above M.S.L. (A.B.W.S.)

Zero of Stage Gauges ()

LAND & WATER SURVEY
HYDROLOGY SECTION

LOCATION PLAN
METERING SECTION
AT
"LUGH GANANA"



AGRICULTURAL AND WATER SURVEY

HYDROLOGY SECTION

STAFF-GAUGE RECORD

*Data located at
Pamela Hill Mt. 1430*

Station *LUSH GAUGING*

River Basin *L. D. 56*

Longitude *126° 30'*

Latitude *33° 15'*

Date Installed <i>Checked</i>	Staff-Gauge Zero			Reference B.M. & E.L. M.S.L.	T. B. M. No.	Date abandoned
	<i>6605</i> Alt.	Ref. Datum	Date tied or checked			
30-5-63		Mean Sealed	30-5-63 11-6-64	243-B E.L. 150.174	M.P. (Well)	
2-4-64	<i>141.84</i>		15-9-63	*		
11-6-64	M.P. Well 150.56	M.S.L.	11-6-64			
	<i>141.84</i>			Collected	✓	
9-9-64	M.P. Well 150.33		9-9-64	243-B 149.98		
9-9-64	Zero 142.67	(New St. gauge) +1-7'				St. Gauge (175' up str.) E.L. 142.34
27-3-65	142.67	(New St. #1)				42-143.18
" "	141.45	old St. g.				43-143.99
14-10-72	B.G. 2 141.42			242-A 153.313		44-145.03
" "	Well 150.31			" "		

Remarks

*Notes of leveling 11-6-64
in Book L-1 p. 28*

*New E.L's given to B.M.S.
from 9-9-64
Corr. - 0.25*

~~*Corr. = 150.17*~~

LUGH GANANE

4 July 1963

WATER LEVELS

THE M.P. ON CONCRETE WELL CASING
OF RECORDER, IS TIED TO A T.B.M. (CROSS-CUT
IN CORNER OF AN EXISTING CONCRETE SUB.)
AS SHOWN ON DIAGRAM.
ASSUMED EL. OF T.B.M. = 100.00 m
" " EL OF MP = 100.375 checked twice
4-7-63

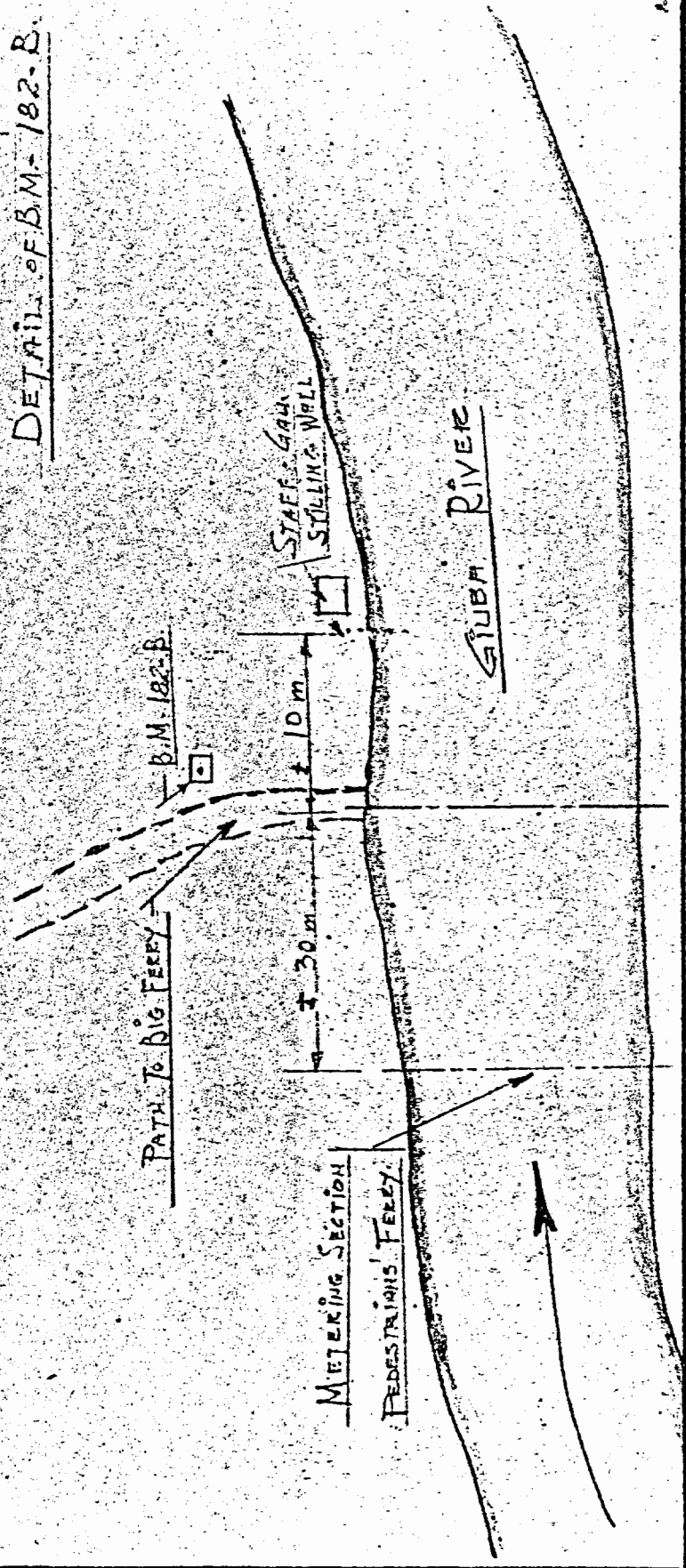
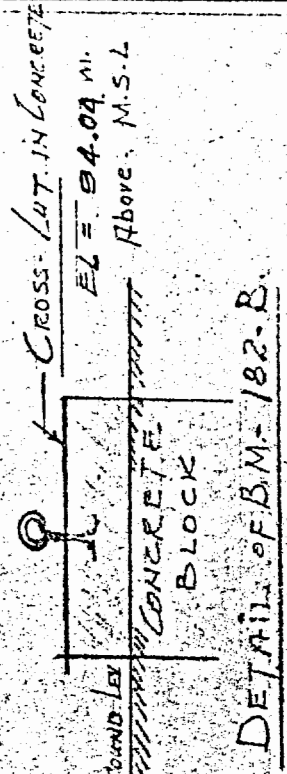
DURING THAT METERING W.L. WAS COMPARED
BY DIRECT LEVELING FROM T.B.M. AND
TAPE-READING FROM M.P. AT TOP OF WELL.

W.L. (LEVELING) = 94.08 - checks OK
W.L. (TAPE-READ) = 94.12 (Heavy wind)

LAND & WATER SURVEY
HYDROLOGY SECTION

23.1.68.

LOCATION PLAN
MEJERING SECTION
BARDEERA



MAR 1968

AGRICULTURAL AND WATER SURVEY

HYDROLOGY SECTION

STAFF-GAUGE RECORD

Station. BARDERA

River Basin. GAUBA

Longitude.

Latitude.

Date Installed	Staff-Gauge Zero			Reference B.M. & EL	T. B.M. No.	Date abandoned
	Alt.	Ref. Datum	Date tied or checked			
May '63	100.17 M.P. Well	Assumed 100.00	4-6-63	Assd. 100.00		
29-2-64	89.65 M.P. Well	Mean Sea Level	4-6-64	182-B (94.52)		
	95.00					
2-9-64	M.P. Well 94.57		9-9-64	182-B 94.57	STATION 0' EL'S.	UPSTR. ST. Gau.
	89.23				1' 89.23	1- 89.016
			27-3-65		1- 90.23	2- 89.984
			5-May-65	182-B 94.04	2- 91.04	3- 90.958
					3- 92.04	4- 92.297
					4- 93.18	

Remarks

~~Corrected~~ 47

Coll (99.64) -- 043

BARBERA

4-7-63

EXIST' BM. (CEMENT BLOCK); EL (ASSUMED) = 100.00
T.B.M. (Concrete Stair) and M.P. Well Tile,
were tied.

EL. T.B.M. = 100.79

EL. M.P. (Well) = $\boxed{100.47}$ Roy Nichols
100.475 G. J. Jette 31-7-63

ROUTINE Check 4-7-63 Dr. Metering

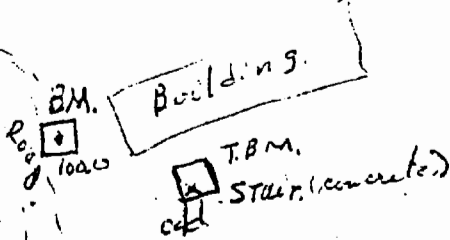
W.L. (DIRECT. LEVUNG - B.M.) = $\boxed{96.41}$ - OK.
W.L. (Tape From M.P. Well) = $\boxed{96.40}$

New Float Line Installed for Saa. Recorder (10m.)

31-7-63 - 4. I Beams. (2 under water) + Fica-Plates.

BARDERA

Ferry.

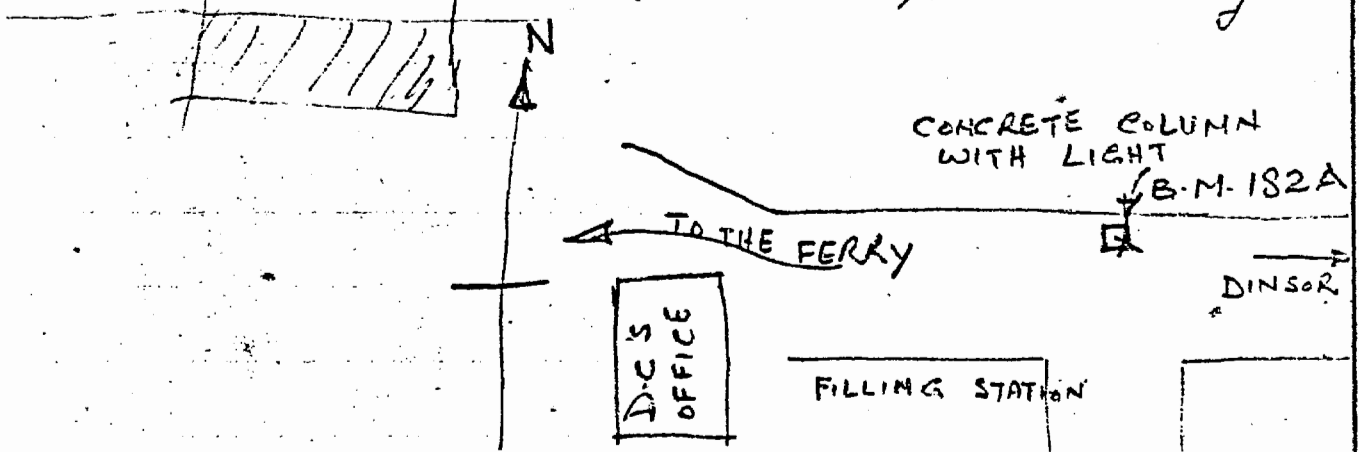


M.P. (cut cross outside).
 O WELL Below floor.

Levelling From. B.M. To M.P.

BM.	1.11	-	101-11	100.00	✓ Checked O.K. 1/28/66 9/6/1967 Roy Nichols (S.)
T.B.M.	1.14	0.32	101.93	100.47	
M.P.		1.46		100.47	

BM. 100 (taken for W.L) metering done. May-29, 1963.
 100.00 (x on concrete) for this levelling.



B.M. 182A = 102.988

BARDERA

Bansal
 10.3.1966

DUGUHA

TABLE 2.3

Bench Marks

Source	Bench Mark (B.M.) description	B.M. No.	FAO value	Soviet value
Department of Survey and Mapping	Base of Monument, Bardheere.	182a*	102.988	103.055
	Ringbolt in concrete anchor block at ferry, Bardheere.	182b	94.042	94.110
	Base of flagstaff outside D.C.'s office, Gelib	27	23.977	24.128
Department of Hydrology, Ministry of Agriculture	Wooden floor of river gauging station, Bardheere.	-	94.570 ✓	-
	Zero of river gauge staff, Bardheere.	-	89.230	-

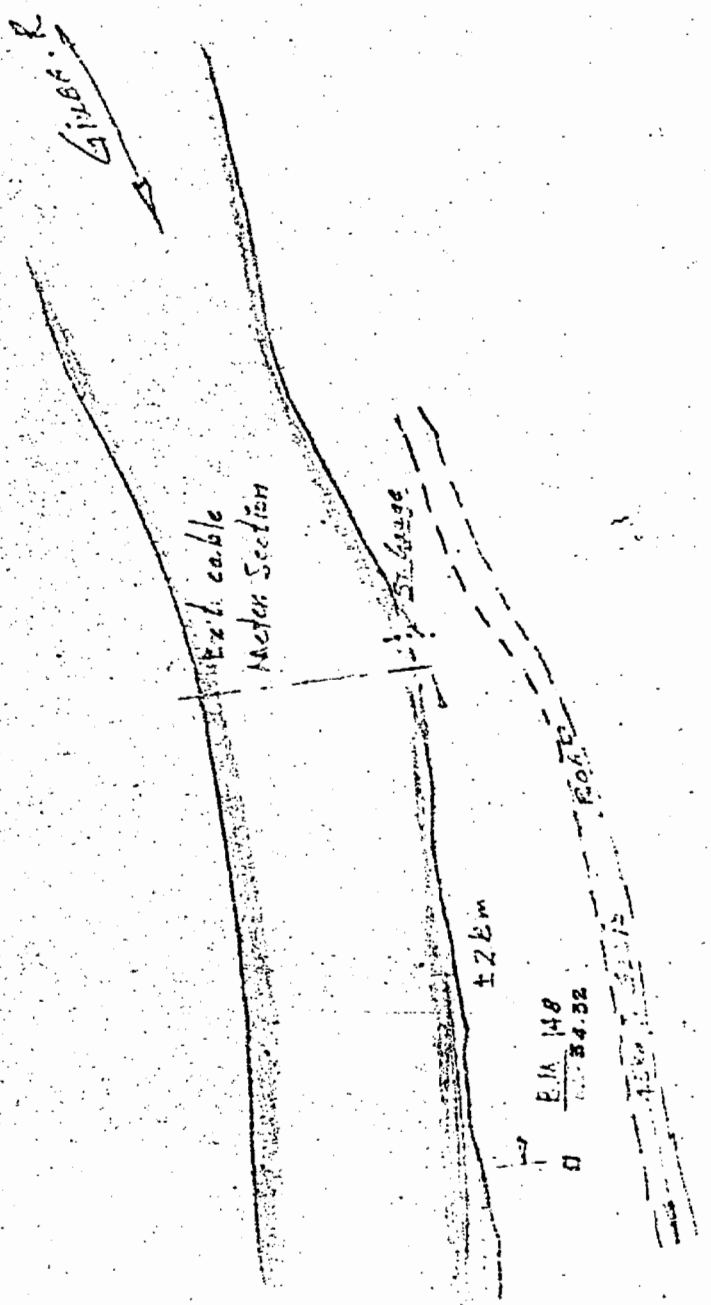
* Destroyed

2.3.1.9

LOCATION PLAN

METERING SECTION

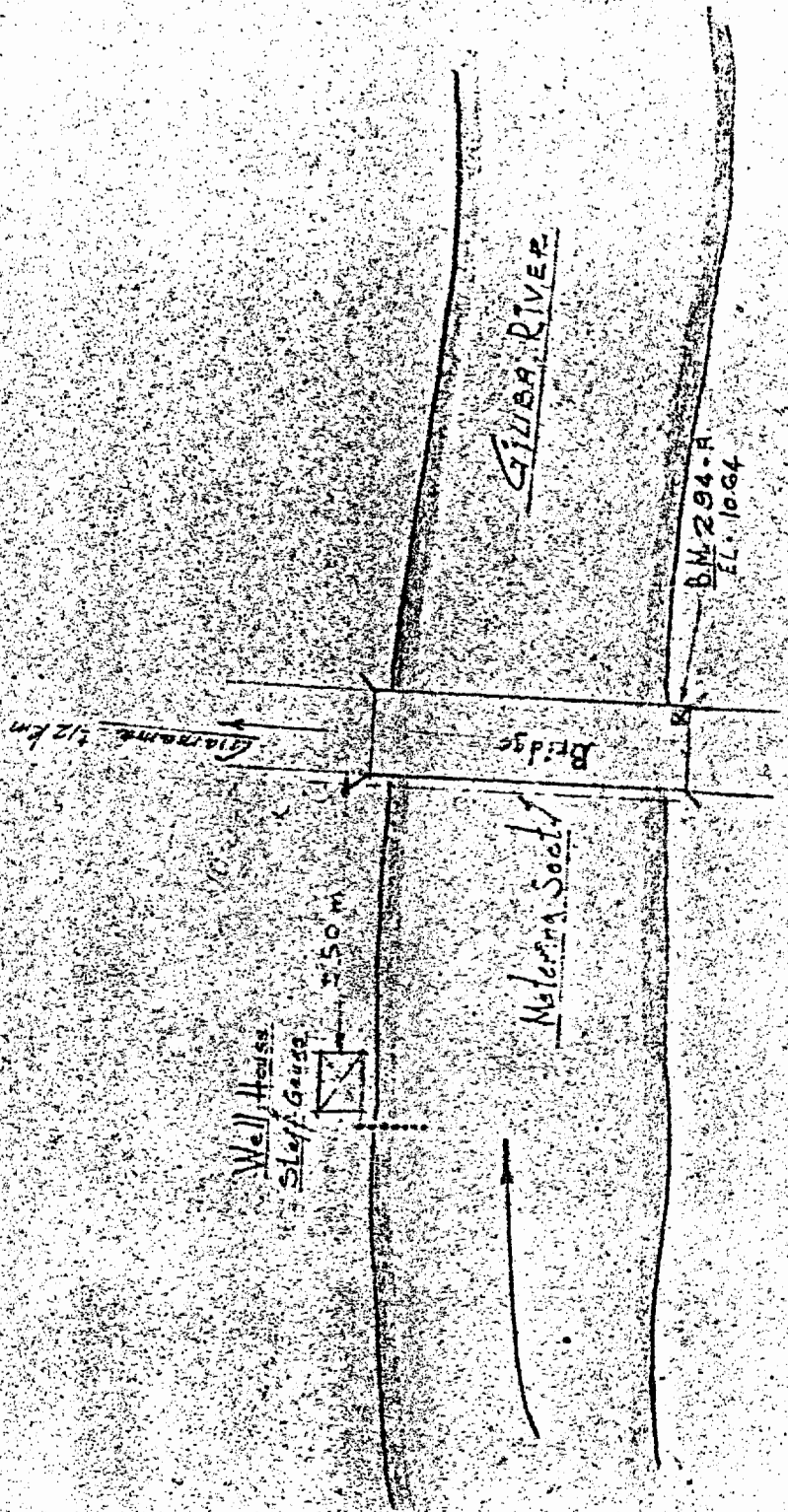
BY
'KAITOI'



2.3.1.10

LAND & WATER SURVEY
HYDROLOGY SECTION

LOCATION PLAN
METERING STATION
RT
SIAMANGA



Measuring Station

S E C T I O N (I)

JUBBA RIVER

HISTORICAL DISCHARGE MEASUREMENTS

1. - Discharge Rating Curves 1963 to 1981
2. - Detailed list of Discharge Measurements
from 1963 to 1977.

JUBBA RIVER AT LUGH GANANA

RATING CURVES

(Historical Plots 1963 / 81)

KEY	DATE
●	1980/81
○	1977
■	1976
▲	1975
△	1974
+	1973
×	1972
•	1964
◊	1963

Gauge Height in Meters

Gauge Height in Meters

Gauge Height in Meters

Gauge Height in Meters (M.S.L.)

Velocity Curve
1980/81

Area Curve - 1980/81

RUSSIAN CURVE
(Schonprognose)

1975/77 CURVE

1963/64 & 74 CURVE

Velocity in M/Sec

Area in M²

Discharge in M³/Sec

DISCHARGE MEASUREMENTS

NO: .1.

STREAM : J U B B A AT : L U G H G A N A N A STATION NO : JB:1:.....

NO	DATE	OBSERVER	GH m	WIDTH m	AREA m	Vm m/sec	Q m / sec	METH	TIME Hr.	R E M A R K S
	(1963)									Note: MSL Adjusted 9.9.64 to 149.917(BM)
1	30.5.63	C.ABDALAH	2.69	118.0	312.7	0.66	206.0	CMM	144.11	(From Ferry).GH Adjusted by -0.25m.
2	21.6.63	"	2.35	122.0	276.8	0.56	154.7	02/0.8	143.77	" " " " " "
3	4.7.63	"	2.39	104.5	250.0	0.69	173.2	"	143.81	" " " " " (Steady)
4	12.9.63	"	2.41	130.0	268.9	0.79	213.1	"	143.83	(From Boat) GH. Adjusted by -0.25m.
5	19.10.63	"	2.49	130.0	258.4	0.88	226.7	"	143.91	" " " " " "
6	20.11.63	"	2.88	141.8	352.2	1.09	383.6	"	144.30	" " " " " "
7	10.12.63	"	3.03	-	403.5	0.97	391.4	"	144.45	(From Ferry) GH. Adj. (Steady)
8	20.12.63	"	2.36	130.0	205.3	0.67	136.4	"	143.78	" " " " " "
	(1964)									
9	17.1.64	"	2.00	86.0	153.8	0.51	78.6	"	143.42	W.L. Steady
10	31.1.64	"	1.76	76.0	165.7	0.28	47.5	"	143.18	
11	11.3.64	OSMAN	1.27	78.7	97.3	0.15	14.7	"	142.69	
12	2.4.64	"	0.95	75.0	80.4	0.06	4.6	"	142.37	
13	22.4.64	"	2.00	91.3	149.4	0.49	72.6	"	143.42	
14	25.4.64	"	2.46	141.1	255.0	0.80	202.6	"	143.88	
15	1.8.64	CAFFI	2.10	141.0	158.8	0.65	103.6	"	143.52	
16	2.11.64	"	3.41	135.0	386.3	1.03	399.0	"	144.83	
17	14.11.64	"	2.49	128.0	299.9	0.63	189.2	"	143.91	
18	18.3.65	OSMAN	0.73	79.7	82.0	0.15	13.0	"	142.15	(1965)
19	17.9.65	"	2.41	110.0	167.6	0.66	110.8	"	143.53	GH. Adjusted by - 0.25m.

DISCHARGE MEASUREMENTS

NO: .2.

STREAM : J U B B A AT : L U G H G A N A N A STATION NO : JB.1.

NO	DATE	OBSERVER	GH m	WIDTH m	AREA m	Vm m/sec	Q m / sec	METH	TIME Hr.	R E M A R K S
	(1969)									
20	2.10.69	IBRAHIM	2.45	142.0	313.8	0.62	195.1	CMM	143.87	GH - Adjusted by -0.25m.
	(1972)									
21	16.03.72	SULEIMAN	1.40	68.0	192.9	0.22	42.6	0.2/Q.8	142.82	GH + 0.22m(overlap) - From New Bridge.
22	11.06.72	IBRAHIM	2.86	129.0	378.5	0.80	301.8	"	144.28	"
23	8.9.72	HASSAN	2.88	129.0	340.2	0.70	237.4	"	144.30	"
24	10.09.72	"	2.97	129.0	355.2	0.64	227.9	"	144.39	"
25	17.09.72	"	2.78	128.0	339.7	0.66	224.4	"	144.20	"
26	23.09.72	"	2.61	127.0	307.6	0.60	183.5	"	144.03	"
27	14.10.72	IBRAHIM	3.18	145.0	433.1	0.63	274.5	"	144.60	"
28	15.10.72	ABDULKADIR	3.15	145.0	427.0	0.64	271.5	"	144.57	"
29	16.10.72	"	3.17	145.0	428.9	0.56	240.4	"	144.59	"
30	19.10.72	"	2.99	144.0	433.5	0.37	162.9	"	144.41	"
31	23.10.72	"	3.00	145.0	492.1	0.62	306.1	"	144.42	"
32	29.10.72	MAHAMED	3.00	145.0	463.9	0.52	241.5	"	144.42	"
33	10.11.72	"	2.36	146.0	290.7	0.94	273.7	"	143.78	"
34	22.11.72	ABDULKADIR	2.83	144.0	394.1	0.93	369.5	"	144.25	"
35	6.12.72	MAHAMED	2.60	136.0	360.3	0.55	199.8	"	144.02	"
36	10.12.72	"	2.37	136.0	399.5	0.37	147.9	"	143.79	"
37	12.12.37	"	1.96	124.0	275.3	0.43	119.4	"	143.38	GH + 0.22m(Overlap) -

DISCHARGE MEASUREMENTS

NO: .3.

STREAM : J U B B A AT : L U G H G A N A N A STATION NO : .. JB. 3.

NO	DATE	OBSERVER	GH m	WIDTH m	AREA m	Vm m/sec	Q m / sec	METH	'MSL'	R E M A R K S
	(1973)							CMM		
38	4.02.73	MAHMED	0.88	134.0	212.1	0.18	39.1	0.2/Q.8	142.30	GH + 0.22m.
39	2.05.73	"	2.68	144.0	305.9	0.62	189.9	"	144.10	
40	23.05.73	"	1.07	140.0	220.0	0.30	66.9	"	142.46	GH + 0.22m.
41	27.05.73	ABDULKADIR	2.27	140.0	243.5	0.45	108.9	"	143.66	
42	2.07.73	"	1.20	136.0	224.7	0.59	131.9	"	142.62	GH + 0.22m.
43	22.07.73	"	1.63	136.0	224.1	0.72	161.4	"	143.05	"
44	24.07.73	"	2.01	140.0	238.2	1.00	238.2	"	143.43	"
45	27.07.73	"	1.96	140.0	291.6	0.49	143.3	"	143.38	"
46	30.07.73	"	2.11	140.0	352.0	0.52	183.9	"	143.53	
47	4.08.73	"	1.66	136.0	249.5	0.43	107.9	"	143.08	GH + 0.22m.
48	6.08.73	"	2.00	140.0	297.6	0.52	156.2	"	143.42	
49	9.08.73	"	2.66	140.0	279.5	0.48	134.4	"	144.08	
50	13.08.73	"	2.75	140.0	294.3	0.45	133.7	"	144.17	
51	18.08.73	"	3.08	140.0	346.3	0.47	162.3	"	144.50	
52	20.08.73	"	3.76	147.0	469.0	0.60	282.7	"	145.18	
53	25.08.73	"	3.22	144.0	423.1	0.49	206.8	"	144.64	
54	28.08.73	"	3.52	144.0	469.2	0.52	243.8	"	144.94	
55	7.09.73	"	3.33	140.0	428.2	0.49	210.4	"	144.75	
56	12.09.73	"	3.32	144.0	394.2	0.55	215.4	"	144.74	
57	18.09.73	"	3.00	140.0	318.2	0.48	153.1	"	144.42	

DISCHARGE MEASUREMENTS

NO: .4.

STREAM : J U B B A L U G H C A N A N A STATION NO : JB:1:.....
 AT :
 REMARKS

NO	DATE	OBSERVER	GH m	WIDTH m	AREA m	Vm m/sec	Q m / sec	METH	TIME Hr.	REMARKS
58	27.09.73	ABDULKADIR	3.17	144.0	414.4	0.48	196.9	CMM	144.59	
59	7.10.73	"	3.06	144.0	374.4	0.49	182.9	Q.2/Q8	144.48	
60	15.10.73	"	3.75	144.0	493.9	0.61	300.2	"	145.17	
61	17.10.73	"	4.15	144.0	569.5	0.66	374.4	"	145.59	
62	24.10.73	"	3.74	144.0	507.6	0.56	285.9	"	145.16	
63	10.11.73	"	2.81	143.0	371.0	0.42	157.3	"	144.23	
64	11.11.73	"	3.30	146.0	410.3	0.53	219.4	"	144.72	
65	15.11.73	"	2.69	142.0	327.7	0.46	151.3	"	144.11	
66	22.11.73	"	2.46	141.0	300.6	0.48	144.4	"	143.88	
67	8.12.73	"	1.90	112.0	232.3	0.86	200.2	"	143.32	GH + 0.22m. NOTE: GH and details of
68	18.12.73	"	1.63	108.0	196.9	1.17	231.0	"	143.05	" these measurements must be
69	26.12.73	"	1.49	108.0	208.0	0.65	136.1	"	142.91	" treated with caution. It
70	30.12.73	"	1.44	108.0	198.8	0.80	159.8	"	142.86	" is possible that the gaug-
	(1974)									ings taken at different
71	7.01.74	MOHAMED	1.37	108.0	172.6	0.75	129.8	"	142.79	GH + 0.22m. section. Gauge heights
72	20.01.74	"	1.32	108.0	167.1	0.89	148.8	"	142.74	" some what dubious.
73	28.01.74	"	1.25	104.0	159.1	0.71	111.9	"	142.67	"
74	12.03.74	"	1.25	100.0	153.0	0.48	74.2	"	142.67	"
75	16.03.74	"	1.22	103.0	128.0	0.29	37.0	"	142.64	"
76	20.03.74	"	1.22	104.0	134.9	0.27	36.5	"	142.64	"
77	27.03.74	"	2.02	110.0	110.3	0.90	98.9	"	143.44	"

DISCHARGE MEASUREMENTS

NO: .5.

STREAM : J U B B A AT : L U G H G A N A N A STATION NO : JB. 1.

NO	DATE	OBSERVER	GH m	WIDTH m	AREA m	Vm m/sec	Q m / sec	METH	R E M A R K S
78	29.03.74	MOHAMED	2.02	141.0	204.2	0.36	72.8	CMM	GH + 0.22m.
79	31.03.74	"	2.30	141.0	274.5	0.38	103.6	0.2/0.8	
80	1.04.74	"	2.31	141.0	288.0	0.48	138.5	"	143.73
81	2.04.74	"	2.94	144.0	347.1	0.70	243.5	"	144.36
82	8.04.74	"	2.37	142.0	270.2	1.09	293.7	"	143.79
83	21.04.74	"	1.92	138.0	217.9	0.77	167.2	"	GH + 0.22m.
84	30.04.74	"	1.52	102.0	174.9	0.53	92.3	"	"
85	20.05.74	"	2.39	140.0	285.2	0.76	218.1	"	143.81
86	29.05.74	"	2.13	140.0	208.6	0.68	142.2	"	GH + 0.22m.
87	2.06.74	"	2.71	144.0	323.5	0.99	321.3	"	144.13
88	11.06.74	"	2.81	144.0	317.5	0.77	245.9	"	144.23
89	22.06.74	"	2.02	142.0	197.6	0.70	138.0	"	143.44
90	29.06.74	"	1.91	140.0	175.2	0.48	84.1	"	GH + 0.22m.
91	4.07.74	"	2.20	142.0	245.0	0.58	143.0	"	143.62
92	14.07.74	"	2.46	144.0	242.0	0.80	193.0	"	143.88
93	16.07.74	"	3.24	146.0	367.4	0.77	278.3	"	144.66
94	22.07.74	"	2.99	145.0	360.0	0.88	318.0	"	144.41
95	28.07.74	"	2.41	143.0	288.0	0.71	204.0	"	143.83
96	15.08.74	"	2.96	144.0	331.0	0.98	323.0	"	144.38
97	24.08.74	"	2.39	142.0	262.8	0.59	155.7	"	143.84
98	31.08.74	"	2.59	144.0	314.9	0.73	230.4	"	144.01

DISCHARGE MEASUREMENTS

NO: .6.

STREAM : J U B B A AT : L U G H G A N A N A STATION NO : .. JB: 1: ..

NO	DATE	OBSERVER	GH m	WIDTH m	AREA m	V _m m/sec	Q m / sec	METH	TIME Hr.	R E M A R K S
99	4.09.74	MOHAMED	3.10	145.0	394.8	0.91	360.1	CMM	144.52	
100	7.09.74	"	3.85	147.0	472.3	1.18	557.4	0.20.8	145.27	
101	21.09.74	"	2.94	144.0	395.6	0.80	317.9	"	144.36	
102	25.09.74	"	2.88	144.0	392.1	0.74	288.6	"	144.30	
103	29.09.74	ABDULKADIR	3.01	145.0	407.2	0.77	312.6	"	144.43	
104	3.10.74	"	3.24	145.0	425.7	0.82	348.6	"	144.66	
105	7.10.74	"	3.01	144.0	402.7	0.75	304.3	"	144.43	
106	12.10.74	"	2.95	144.0	384.6	0.71	273.4	"	144.37	
107	16.10.74	"	2.76	143.0	346.4	0.67	233.8	"	144.18	
108	20.10.74	"	2.55	142.0	297.9	0.55	165.5	"	143.97	
109	24.10.74	"	2.41	136.0	262.6	0.44	114.7	"	143.83	
110	28.10.74	"	2.59	143.0	301.0	0.63	190.4	"	144.01	
111	2.11.74	"	2.57	139.0	317.4	0.74	235.5	"	143.99	
112	6.11.74	"	2.89	139.0	359.0	0.85	505.5	"	144.31	
113	10.11.74	"	2.88	144.0	348.4	0.85	296.5	"	144.30	
114	14.11.74	"	2.73	143.0	290.9	0.77	222.9	"	144.15	
115	3.12.74	"	1.75	140.0	189.8	0.45	84.8	"	143.17	GH + 0.22m.
116	11.12.74	"	1.56	139.0	153.9	0.31	47.6	"	142.98	" "
117	21.12.74	"	1.42	138.0	137.4	0.22	30.7	"	142.84	" "
118	25.12.74	"	1.36	137.0	119.6	0.21	25.2	"	142.78	" "

DISCHARGE MEASUREMENTS

NO: .7.

STREAM : J U B B A AT : L U C H G A N A N A STATION NO : JB. 1.

NO	DATE	OBSERVER	GH m	WIDTH m	AREA m	Vm m/sec	Q m ³ /sec	METH	TIME Hr.	R E M A R K S
	(1975)									
119	8.01.75	XASAN	-	-	61.20	0.11	6.68	"	-	No Gauge Height.
120	15.01.75	"	1.17	116.0	80.20	0.12	9.64	"	142.59	GH + 0.22m.
121	21.01.75	"	1.12	116.0	76.80	0.12	8.96	"	142.54	"
122	27.01.75	"	1.09	116.0	69.64	0.11	7.94	"	142.51	"
123	1.02.75	"	1.05	"	66.80	0.11	7.30	"	142.47	"
124	8.02.75	"	1.04	"	64.80	0.10	7.72	"	142.46	"
125	15.02.75	"	1.03	"	-	-	6.09	"	142.45	"
126	22.02.75	"	0.99	"	-	-	4.27	"	142.41	"
127	27.02.75	"	0.96	"	-	-	3.85	"	142.38	"
128	10.03.75	"	0.91	"	-	-	1.65	"	142.33	"
129	20.03.75	"	0.86	"	Insuff	icient	flow	"	142.28	"
130	29.03.75	"	0.22	"	"	"	"	"	142.24	"
131	8.04.75	"	0.79	"	"	"	"	"	142.21	"
132	12.04.75	"	1.30	118.0	-	-	21.10	"	142.72	"
133	15.04.75	"	1.62	121.0	-	-	45.60	"	143.04	"
134	17.04.75	"	1.90	"	188.00	0.42	79.70	"	143.32	"
135	21.04.75	"	2.10	"	209.80	0.56	116.60	"	143.52	"
136	26.04.75	"	2.35	"	238.90	0.73	173.30	"	143.77	Rising stage
137	30.04.75	"	2.51	"	260.50	0.79	206.10	"	143.93	Steady flow
138	5.05.75	"	2.96	"	305.20	0.95	288.90	"	144.38	Falling stage

DISCHARGE MEASUREMENTS

NO: .8.

STREAM : J U B B A AT : L U G H G A N A N A R E M A R K S STATION NO : JB.1:

NO	DATE	OBSERVER	GH m	WIDTH m	AREA m	Vm m/sec	Q m / sec	METH	TIME Hr.	R E M A R K S
139	11.05.75	ABDUL	1.73	121.0	149.0	0.46	68.2	CMM	143.15	GH + 0.22m. (Falling stage)
140	17.05.75	"	1.63	"	137.0	0.45	61.2	"	143.05	" (Rising stage)
141	20.05.75	"	2.29	"	238.0	0.68	162.0	"	143.71	" "
142	31.05.75	"	3.26	"	370.0	1.07	397.0	"	144.68	(Falling stage)
143	7.06.75	"	2.55	"	311.0	0.72	223.0	"	143.97	(" ")
144	14.06.75	"	2.09	"	236.0	0.51	120.0	"	143.51	GH + 0.22m. (Steady flow)
145	21.06.75	"	1.94	"	205.0	0.51	105.0	"	143.36	" " "
146	28.06.75	"	2.46	"	277.0	0.72	200.0	"	143.88	" " "
147	3.07.75	"	2.56	"	306.1	0.76	233.5	"	143.98	" " "
148	10.07.75	"	2.54	-	307.0	0.71	218.0	"	143.96	" " "
149	21.07.75	"	2.31	-	255.0	0.69	176.0	"	143.73	" " "
150	24.07.75	"	2.75	-	311.6	0.92	285.9	"	144.17	" " "
151	31.07.75	"	2.95	-	382.7	0.85	325.1	"	144.37	(Rising stage)
152	5.08.75	"	3.18	-	392.0	0.99	390.0	"	144.60	" " "
153	8.08.75	"	3.44	-	417.0	1.06	444.0	"	144.86	(Steady flow)
154	16.08.75	"	3.22	-	403.0	0.96	388.0	"	144.64	" " "
155	23.08.75	"	3.52	-	450.0	1.05	473.0	"	144.94	(Falling stage)
156	30.08.75	"	3.20	-	419.0	0.94	388.0	"	144.62	(Steady Stage)
157	6.09.75	"	3.12	-	405.0	0.87	355.5	"	144.54	" " "
158	14.09.75	"	3.10	-	437.0	0.93	407.0	"	144.52	(Rising Stage)
159	21.09.75	"	2.86	-	387.0	0.74	289.0	"	144.28	(Steady Flow)

DISCHARGE MEASUREMENTS

NO: .9.

STREAM : J U B B A AT : L U G H C A N A N A STATION NO : JB.1......

NO	DATE	OBSERVER	GH m	WIDTH m	AREA m	V _m m/sec	Q m / sec	METH	TIME Hr.	R E M A R K S
160	11.10.75	ABDULKADIR	3.80	-	521.4	1.09	566.0	CMM	145.22	(Rising Stage)
161	16.10.75	"	3.40	146.0	479.0	0.97	467.0	"	144.82	
162	23.10.75	"	3.46	146.0	482.0	1.01	489.0	"	144.88	
163	10.11.75	"	2.88	145.0	389.0	0.80	313.0	"	144.30	
164	16.11.75	"	2.74	144.0	353.0	0.74	261.0	"	144.16	
165	22.11.75	"	2.56	143.0	314.0	0.69	216.0	"	143.98	
166	30.11.75	"	2.12	141.0	259.0	0.59	152.0	"	143.54	(Recession)
167	7.12.75	"	1.89	139.0	234.0	0.30	70.0	"	143.31	GH + 0.22m.
168	15.12.75	"	1.70	134.0	229.0	0.30	69.0	"	143.12	" "
169	22.12.75	"	1.59	124.0	220.0	0.24	55.0	"	143.01	" "
	(1976)									
170	28.01.76	"	1.15	132.0	107.0	0.16	17.0	"	142.57	GH + 0.22m. (Recession)
171	16.02.76	"	1.05	131.0	107.4	0.06	6.3	"	142.47	" "
172	26.02.76	"	1.06	131.0	110.2	0.08	8.9	"	142.48	" "
173	4.03.76	"	1.00	105.0	83.4	0.07	6.2	"	142.42	" "
174	13.03.76	"	1.02	104.0	102.7	0.06	5.5	"	142.44	" " Base Flow
175	29.03.76	"	0.92	104.0	103.2	0.06	7.8	"	142.34	" "
176	8.09.76	"	2.82	144.0	359.0	0.70	251.0	"	144.24	
177	15.09.76	"	3.04	144.5	341.0	0.91	309.0	"	144.46	
178	29.09.76	"	2.49	141.0	265.0	0.63	167.0	"	143.91	
179	5.10.76	"	2.71	144.2	300.0	0.67	200.0	"	144.13	

DISCHARGE MEASUREMENTS

NO: .10.

STREAM : J U B B A L U C H C A N A N A STATION NO : ..JB.1..

NO	DATE	OBSERVER	GH m	WIDTH m	AREA m	Vm m/sec	Q m / sec	METH	TIME Hr.	R E M A R K S
180	13.10.76	MAHMED	2.86	145.0	315.0	0.68	214.0	CMM	144.28	(Steady Flow)
181	22.10.76	"	2.76	144.0	328.0	0.69	225.0	"	144.18	(Falling stage)
182	2.11.76	"	3.34	146.0	439.0	0.98	431.0	"	144.76	(Rising stage)
183	11.11.76	"	3.54	146.0	508.0	1.00	518.0	"	144.96	" "
184	28.11.76	"	2.51	142.0	383.0	0.36	138.0	"	143.93	(Steady Stage)
185	9.12.76	"	2.07	141.0	308.0	0.35	108.0	"	143.49	GH + 0.22m.
186	15.12.76	"	1.86	140.0	284.0	0.32	91.5	"	143.08	" "
187	7.01.77	(1977)	1.58	137.0	240.0	0.25	60.0	"	143.00	" "
188	20.01.77	"	1.49	137.0	231.0	0.23	52.0	"	142.91	" "
189	29.01.77	"	1.65	138.0	252.0	0.26	66.0	"	143.07	" "
190	8.02.77	"	1.75	139.0	270.0	0.38	97.0	"	143.17	" "
191	28.02.77	"	1.43	136.0	203.0	0.20	41.2	"	142.85	" "
192	10.03.77	"	1.23	137.0	163.0	0.16	27.0	"	142.65	" "
193	26.03.77	"	1.14	137.0	149.0	0.13	20.0	"	142.57	" "
194	6.04.77	"	3.33	146.0	446.0	0.97	432.0	"	144.75	" "
195	18.04.77	"	2.80	143.0	417.0	0.82	339.0	"	144.22	" "
196	28.04.77	"	2.15	142.0	380.0	0.40	151.0	"	143.33	GH + 0.22m.
197	3.05.77	"	3.21	146.0	464.8	1.05	412.5	"	143.63	" "
198	9.05.77	"	5.30	150.0	778.4	1.24	966.1	"	146.72	Highest Measurement to date.
199	12.06.77	"	3.34	145.0	513.4	0.94	351.7	"	144.76	" "
200	28.06.77	"	2.92	144.0	432.9	0.81	349.1	"	144.34	Last gauging before start of TCP Project

