

## Environmental Protection Report

**MICRO LOW FLOWS  
AVERAGE AND LOW FLOWS  
ESTIMATION IN THE SW REGION  
VALIDATION OF REGIONAL VERSION  
1.3 SOFTWARE**

**JULY 1992  
WR/92/4  
Water Resources Planning**

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## List of Symbols and Abbreviations

AAY - Average Annual Yield  
ADFMAP - the natural mean daily flow at the same location as compensation flows  
ADFREC - recorded daily flow at the dam or maintained flow point  
AE - Actual Evaporation  
C.A - Catchment Area  
cumecs - metres cubed per second  
COMPCODE - the compensation code categorising the type of release policy operated  
FDC - flow duration curve  
FFC - flow frequency curve  
GHOST - Grouped Hydrology of Soil Types  
HOST - Hydrology of Soil Types  
HYA - Hydrometric Area  
IH - Institute of Hydrology  
km<sup>2</sup> - square kilometres  
LID - Line Identification Number  
MF - Mean Flow  
MLFs - Micro Low Flows  
mm - millimetres  
MSDOS - MicroSoft Disk Operating System  
NGR - National Grid Reference  
NRA SW - National Rivers Authority South West Region  
PCDOS - Personal Computer Disk Operating System  
PE - Potential Evaporation  
Q50(10) - 50 percentile exceedance (median) flow of 10 day duration  
Q50(1) - 50 percentile exceedance (median) flow of 1 day duration  
Q95(10) - 95 percentile exceedance flow of 10 day duration  
Q95(1) - 95 percentile exceedance flow of 1 day duration  
r - Adjustment factor for the estimation of actual evaporation  
SAAR - Standard period (1941 - 1970) Average Annual Rainfall  
SGL - Simple Graphics Library

## SUMMARY

Micro Low Flows is a computer based software system developed by the Institute of Hydrology for estimating theoretical flow statistics for individual river reaches. Both nationally and regionally calibrated copies of Version 1.3 of the software were installed at NRA SW on 14/2/92. The Regional version has been subjected to a series of tests designed to identify errors, limitations and recommendations for future improvements.

A few, relatively minor errors with the Regional version have been reported to the Institute of Hydrology.

Overall, the Regional version is relatively easy to use and will help improve the hydrological service provided by Water Resources Planning.

Testing of the National version will be undertaken in more detail after the publication by the Institute of Hydrology of the 1992 Low Flows Study Report due in August.

## MICRO LOW FLOWS AVERAGE AND LOW FLOW ESTIMATION IN THE SW REGION

### VALIDATION OF THE REGIONAL VERSION OF 1.3

#### 1. Introduction.

The Micro Low Flows system (MLFs) is a PC based software package for the rapid and repeatable estimation of theoretical flow statistics for individual river reaches.

Both Nationally and Regionally calibrated versions of 1.3 of the Micro Low Flows software system were supplied to NRA SW on 14/2/92. The Regional Version of 1.3 contains all the facilities of Version 1.2 plus several additional features (for detailed results of testing of Version 1.2 please refer to document "Micro Low Flows Average and Low Flow Estimation in the South West Region, Validation of Version 1.2 software").

The Institute of Hydrology (IH), on the request of NRA SW supplied a regionally calibrated version of 1.3 as well as the nationally calibrated copy initially covered by the contract. The nationally calibrated version is being developed by IH for use elsewhere in the UK. NRA SW will test and report on both Versions of 1.3. This report summarises the results of the testing of the Regional version. Testing of the National version has not yet been completed.

Errors were reported to the Institute of Hydrology on 10/4/92.

#### 2. Aim and Objectives of the Validation Study

##### 2.1 Aim

To assess the performance of the software system, associated documentation and installation instructions and recommend developments of the software system for future versions.

##### 2.2 Objectives

- a. To determine whether the MLFs system corresponds to that described in the document entitled "Purchase, Maintenance and Development Contract for Institute of Hydrology MICRO LOW FLOWS - NETWORK (Release 1.3) Software" (January 1991).
- b. To identify errors and where possible determine their cause.
- c. To identify the limits of the software system.

- d. To determine whether Version 1.3 is an improvement upon Version 1.2 of the Micro Low Flows software system.

### 3. Attributes of the Micro Low Flows Software System Version 1.3.

In the "Purchase, Maintenance and Development Contract", IH undertakes to supply Micro Low Flows Version 1.3 with all the facilities present in Version 1.2 plus the ability to add, edit or delete the information contained in the gauging station, reservoir, abstraction licensing, discharge consent and spot gauging databases.

### 4. Validation Methodology.

The testing procedure followed during the validation of Version 1.2 was repeated for the Regional Version of 1.3. However a new test was included to cover differences in the methodology used to calculate flow duration curves between Version 1.2 and 1.3. The scheduled tests are detailed in Appendix 1. The extra test, Test 8 involved the comparison of the real long term flow duration curve for a selected gauging station in each hydrometric area with the theoretical flow duration curve for that stretch generated by Version 1.2 and the Regional Version of 1.3.

### 5. Results.

The results of tests in which no errors were encountered, including those dealing with flow duration curves were recorded on comment sheets and are documented separately (available on request from Water Resources Planning). From these tests the updated method used to produce flow duration curves in version 1.3 appears more accurate than that used in version 1.2, the shape of the new flow duration curves are similar to curves produced from real data for the same sites.

#### 5.1 Attributes.

The system contains all the content, retrieval, output facilities and software as outlined in the Contract for version 1.3 (available on request from Water Resources Planning).

## 5.2 Errors

The error classification scheme used was the same as that used in the validation of Versions 1.1 and 1.2 of the software.

### 5.2.1 Data Base Content Errors.

- a. In some cases the value for Q95 is given as -0.000. See Appendix 2.

### 5.2.2 Data Base Retrieval Errors.

- a. Some of the help messages do not correspond with the printing options. These need to be changed. See Appendix 3.
- b. Extra lines shown on the hardcopy plot are not stretches and are not shown on the screen. See Appendix 4.
- c. On the screen display stretches are drawn outside the boundary box but these are not then shown on the hardcopy plot. See Appendix 5.
- d. After entering information into the notepad and saving it the system crashes. This information cannot be retrieved. See Appendix 6.

## 5.3 Software and Hardware Standards

The required software and hardware standards were specified in the MLFs contract in sections 1.3 and 1.4 respectively. The source code, graphics language, operating system, menu handling, machine requirements and hardcopy output are the same as those described in section 5.4 of the report "Validation of Version 1.1 software".

## 6. General Software Recommendations.

### 6.1 Hardcopy Presentation.

As stated in the report on Version 1.2 of Micro Low Flows the following recommendations would improve the hardcopy presentation of statistics;

- a. highlighting different sections, either in bold or by boxing sections (for example a box around the stretch estimates and a border around the notepad)



- b. the addition of a zero in front of figures <1
- c. preventing printed information associated with one river reach being split over two pages.

## 6.2 Other Recommendations.

- a. As they stand, the sub-catchment boundaries within the Hydrometric Area are not particularly useful. It would be better if these boundaries were based on our licensing sub-catchments.
- b. Six figure grid references are used throughout NRA SW with the appropriate two letter prefix (eg SX). The one digit prefix generated by Micro Low Flows is confusing. It would be less confusing if the one digit prefix shown on the display and on the hardcopy printout was smaller than the other numbers.

## 7. Conclusion

Overall the testing of the Regional version of Micro Low Flows 1.3 has run smoothly and only a few minor errors have been discovered. The updated method used to produce flow duration curves at ungauged sites appears more accurate.

Other regions of the NRA have purchased copies of Micro Low Flows. IH have agreed to supply us with a further copy of 1.3 to replace the nationally calibrated version currently installed. This version will allow a choice of units and the ability to use National Grid Reference full coordinates or Eastings and Northings.

Testing of the National version of 1.3 will be undertaken in more detail after publication of the 1992 Low Flows Studies Report in August. This report will detail the procedure used to calculate flow frequency curves and return periods for various durations.

## References

Bullock, A. and Gustard, A. (1989). "Average and Low Flow Estimation in the South West Region."

Bullock, A., Gustard, A. and Sekulin, A.E. (1990). "Supplement to Average and Low Flow Estimation in the South West Region - estimates for 14000 river stretches."

NRA SW. (1991). "Average and Low Flow Estimation in the South West Region. Validation of Version 1.1 Software."

Bullock, A. and Murdoch, N. (1991). "Purchase, Maintenance and Development Contract for Institute of Hydrology MICRO LOW FLOWS \_ NETWORK (Release 1.3) software."

Institute of Hydrology. (1991). "Micro Low Flow System Beta Release Version 1.2 User Guide for the South West Region."

## SCHEDULED TESTS

ID NO.	PURPOSE	TESTER	DATE
INTEGRATED TESTS PHASE 1			
1	To familiarise the user with the system and its main features.		
COMMENT			
2a	To test basic menu structure; river name entry, mouse and print facilities.		
2b	To test basic menu structure; LID entry and print facilities.		
2c	To test basic menu structure; NGR entry and print facilities.		
Tests 2a -c are completed as a package using the same river reach. This package should be repeated for a reach in each hydrometric area.			
	TESTER	DATE	COMMENT
2a-CHYA45			
2a-CHYA47			
2a-CHYA49			
2a-CHYA51			
	TESTER	DATE	COMMENT
2a-CHYA46			
2a-CHYA48			
2a-CHYA50			
3 To test data content; river name entry and the multiple print facility.			
Test 3 should be repeated for a named river catchment in each hydrometric area. Compare the downloaded print with listings derived from the tables. Choose the Tavy in hydrometric area 46 and smaller named rivers in the other areas.			
	TESTER	DATE	COMMENT
3HYA45			
3HYA47			
3HYA49			
3HY51			
	TESTER	DATE	COMMENT
3HYA46			
3HYA48			
3HYA50			

## INTEGRATED TESTS PHASE 1

TESTER DATE

1 To familiarise the user with the system and its main features.

COMMENT

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	TESTER	DATE	COMMENT	TESTER	DATE	COMMENT
2a-CHYA45				2a-CHYA46		
2a-CHYA47				2a-CHYA48		
2a-CHYA49				2a-CHYA50		
2a-CHYA51						

3 To test data content; river name entry and the multiple print facility.

Test 3 should be repeated for a named river catchment in each hydrometric area. Compare the downloaded print with listings derived from the tables. Choose the Tavy in hydrometric area 46 and smaller named rivers in the other areas.

	TESTER	DATE	COMMENT	TESTER	DATE	COMMENT
3HYA45				3HYA46		
3HYA47				3HYA48		
3HYA49				3HYA50		
3HY51						

## MICRO LOW FLOWS ERROR REPORT

Ref. No. 1 Version No. REGIONAL V1.3.PC No. 381M Date 12/3/92.Identified during test? Yes  No If Yes, Test No. 4.Name of tester A. HIGGINS.

## Summary of problem

The helpfiles for two of the printing options do not correspond with the option menu or the combination of results generated.  
The helpfiles need to be changed.

## Impact Assessment (circle as appropriate)

A B C  D E F

## Reported to IOH (All A, B &amp; C errors)

Date 10/4/1992 Mode mail Sign A.L. Higgins

## Reply

Date \_\_\_\_\_ 1991 Mode \_\_\_\_\_ Sign \_\_\_\_\_

Please refer to accompanying notes when completing this form

## MICRO LOW FLOWS ERROR REPORT



NRA

National Rivers Authority  
South West RegionRef. No. 3 Version No. V1.3 RegionalPC No. 381M Date 24/3/92Identified during test? Yes  No If Yes, Test No. 5Name of tester A. HIGGINS

## Summary of problem

Hardcopy plot on laserjet for part of Hydrometric Area 45.

Several lines are shown on the plot but were not shown on the screen.

## Impact Assessment (circle as appropriate)

A B C D E F

## Reported to IoH (All A, B &amp; C errors)

Date 10/4/1992 Mode MailSign A. Higgins

## Reply

Date \_\_\_\_\_ 1991 Mode \_\_\_\_\_

Sign \_\_\_\_\_

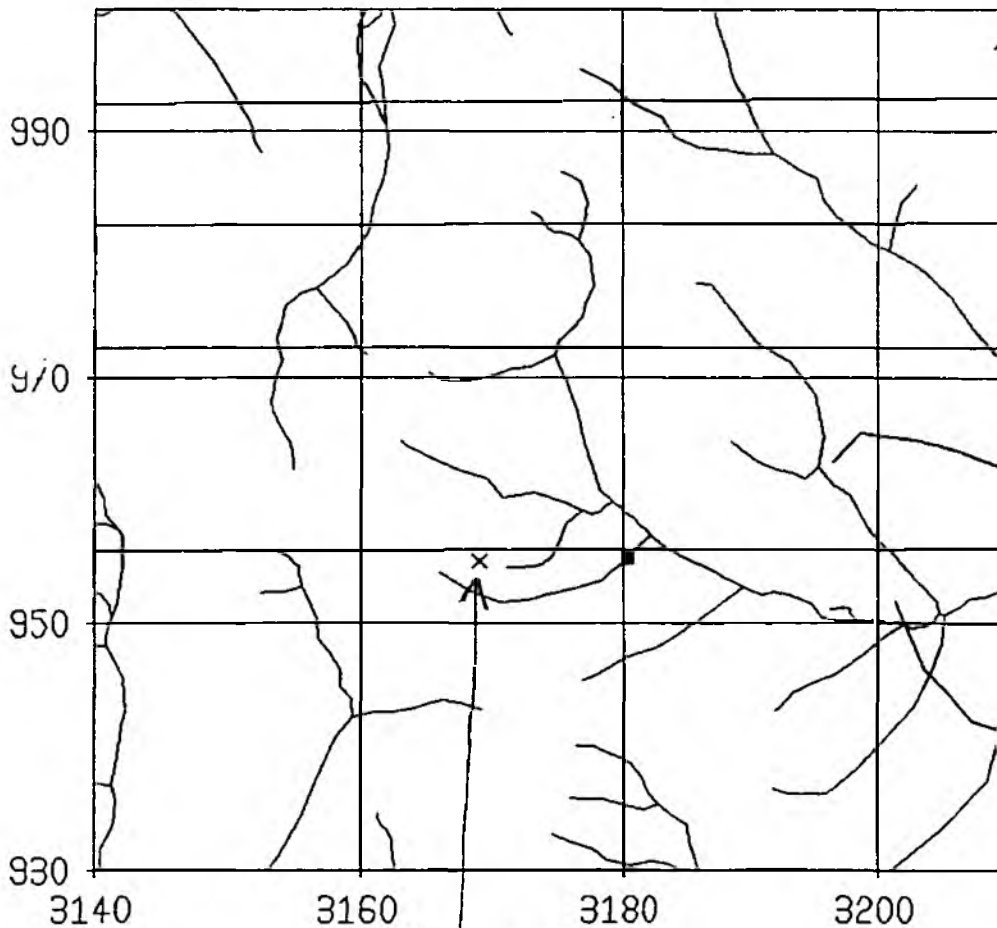
Please refer to accompanying notes when completing this form

Manley House  
Kestrel Way  
Exeter  
Devon  
EX2 7L0  
Tel: Exeter (0392) 444000  
Fax: (0392) 444238



- × Gauging station
- ◇ Reservoir
- Discharge
- Abstraction
- △ Spot gauge

Regional - HYA 45 - GS



Estimates at ■ :

Easting	3180
Northing	0955
Line ID (LID)	17505
Area (sq.km)	2.00
SAAR (1941-70)(mm/yr)	1096
Actual evap. (mm/yr)	535
GHOST % of MF	6.113
MF (cuneacs)	.036e- .005
095 (cuneacs)	.002e- .001
050 (cuneacs)	.018e- .003

The lines highlighted appears on the hardcopy plot but were not shown on the screen

Gauging station not on stretch.

## COMMENT SHEET

(To be filled in following the successful completion of a scheduled test.  
Please use separate error reporting form for specific errors/problems.)

PC No. 381M MICRO LOW FLOWS VERSION No. 1.3 DATE 24/3/92  
Regional

TEST No. 5.

COMMENT Plot on laserjets of part of Hydrometric Area 45

eg. Test ran smoothly.  
Results shown in maps and tables incorrect.  
Found the testing instructions difficult to follow.

See also error report form ref No 3.

Other Comments

- 1) Stretches are drawn outside of the boundary box - see example - these stretches are not shown on the hardcopy plot.
- 2) Gauging Station shown is not on a stretch.

SIGNATURE A.L. Higgins

ih

x Gauging station

◇ Reservoir

□ Abstraction

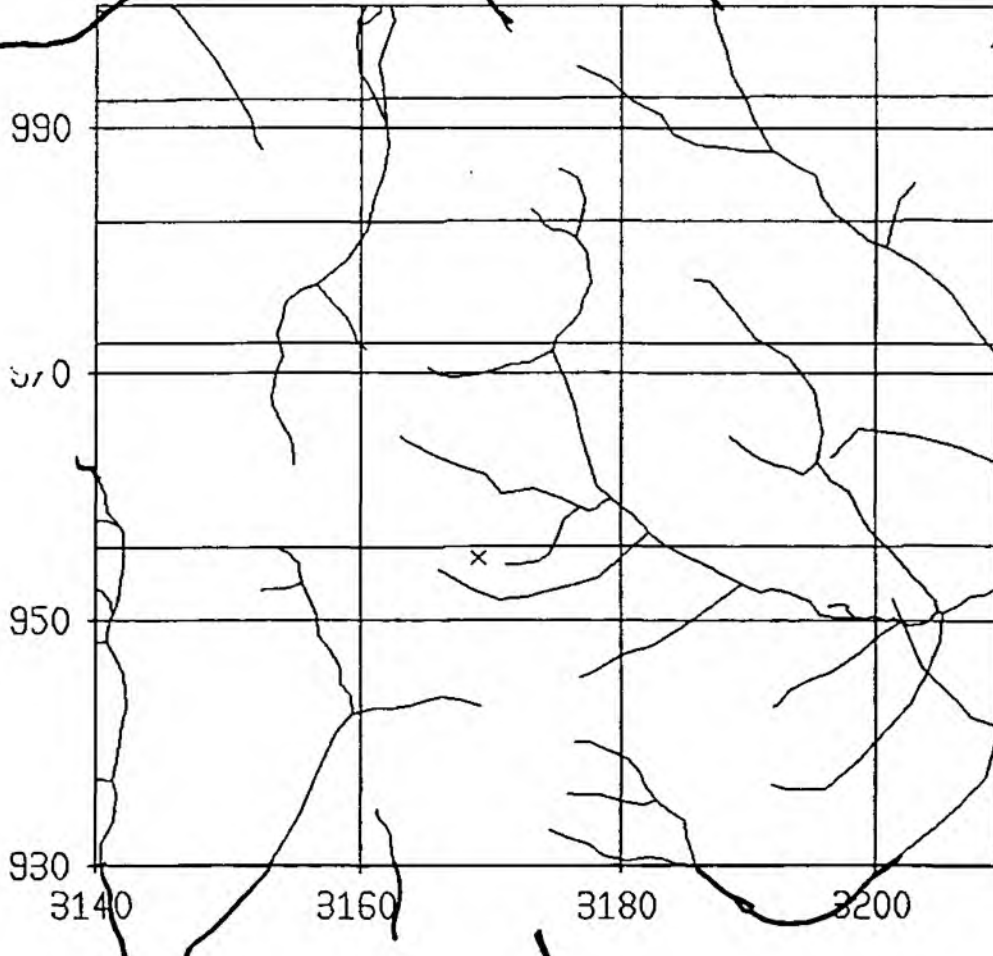
○ Discharge

△ Spot gauge

HYA 45 plot

Estimates at ■ :

Easting	3213
Northing	0960
Line ID (LID)	17490
Area (sq.km)	10.00
SAAR (1941-70)(mm/yr)	1081
Actual evap. (mm/yr)	521
GHOST % of MF	20.843
MF (cunecs)	.177e= .027
Q95 (cunecs)	.035e= .009
Q50 (cunecs)	.119e= .019



The lines drawn in blue do not appear on the hardcopy plot but are drawn across the screen over if they are outside the boundary box.