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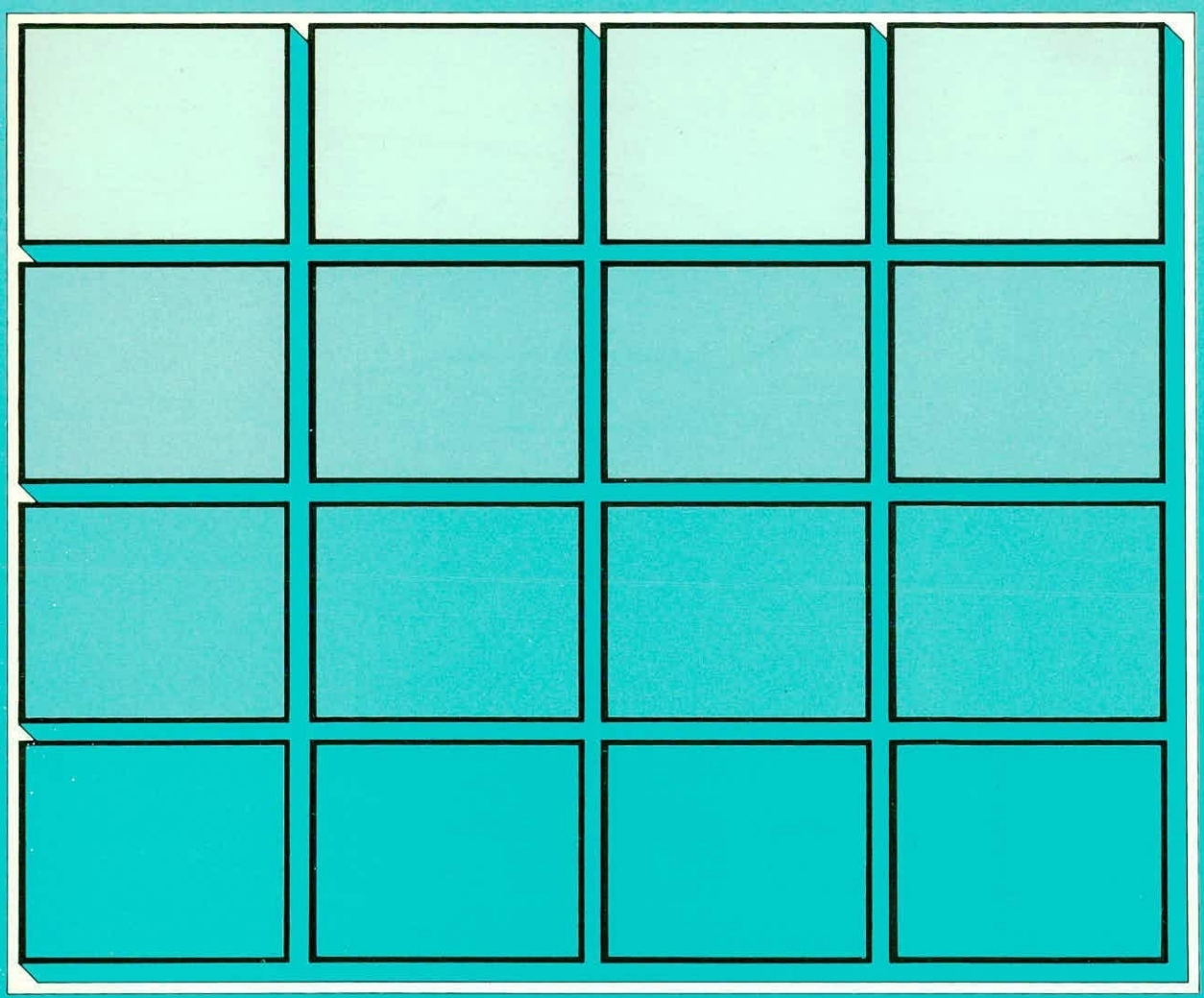

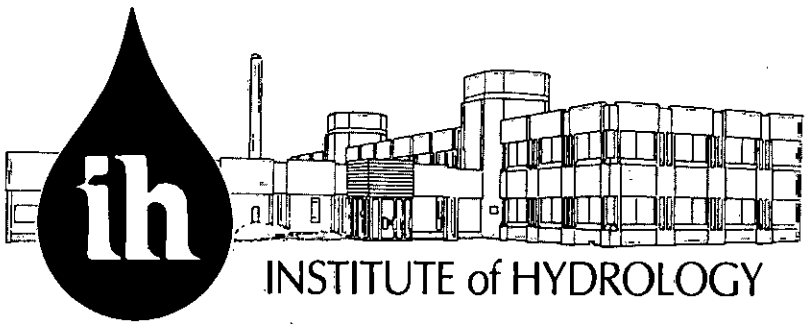

The **Institute of Hydrology** is a component establishment of the UK Natural Environment Research Council, grant-aided from Government by the Department of Education and Science. For over 20 years the Institute has been at the forefront of research exploration of hydrological systems within complete catchment areas and into the physical processes by which rain or snow is transformed into flow in rivers. Applied studies, undertaken both in the UK and overseas, ensures that research activities are closely related to practical needs and that newly developed methods and instruments are tested for a wide range of environmental conditions.

The Institute, based at Wallingford, employs 140 staff, some 100 of whom are graduates. Staff structure is multidisciplinary involving physicists, geographers, geologists, computer scientists, mathematicians, chemists, environmental scientists, soil scientists and botanists. Research departments include catchment research, remote sensing, instrumentation, data processing, mathematical modelling, hydrogeology, hydrochemistry, soil hydrology, evaporation flux studies, vegetation-atmospheric interactions, flood and low-flow predictions, catchment response and engineering hydrology.

The budget of the Institute comprises £4.5 million per year. About 50 percent relates to research programmes funded directly by the Natural Environment Research Council. Extensive commissioned research is also carried out on behalf of government departments (both UK and overseas), various international agencies, environmental organisations and private sector clients. The Institute is also responsible for nationally archived hydrological data and for publishing annually HYDROLOGICAL DATA: UNITED KINGDOM.

IFIM Technical Note No. 1

Hydraulic Simulation Routines and Options applied to Blithe and Gwash sites

Andy Bullock and Emma Grainger
September 1990

Site: Hamstall Ridware

Source File: SRID.IN4

1) The source data file was edited using RIFG4IN to;

a) Set IOC(5) = 1
IOC(8) = 0
IOC(13) = 1

b) The QARD flows were entered, the flows selected were between the recommended limits of; Upper limit = 340.8
Lower limit = 7.8

The QARD flows chosen were, 10, 25,. 50, 75, 100, 150, 200, 250, 300, 350.

These were supplemented by the mean of the series of calibration flows, 22.36, 76.74, 140.21.

2) A file was created containing one velocity set, retaining the middle calibration set (in this case set 2), by running MAK1VL on SRID.IN4 to create a file called SRIDMED.DAT.

3) Internal S/Q relationships, B coefficients etc. were calculated by running REVI4 on SRIDMED.DAT to create a file called REVRIDME.

4) By running IFG4 on SRIDMED.DAT the WSL's associated with QARDS in Tape 4 were calculated, to create a file called HIFG4OUT.

5) WSEI4 was run on SRIDMED.DAT to load WSL's for QARD flows into the WSL lines, the output file was SRIDMED2.DAT. SRIDMED2.DAT was then edited to alter IOC(8) to 1 and IOC(5) to 0. The flows were checked visually to ensure that they were entered correctly.

6) By running I4VAF on ZVAFF (the result of action (5)) the VAF's were plotted, to create a file called RIDMEDVA.

7) The VAF plots were examined for anomalous curves, in this case transects 1, 2, 3, 9, 10, 11, 12, 13.

8) A MANSQ data set was created from SRIDMED2.DAT, in the process WSL and Q values from calibration set 2, and B coefficients from

RIVRIDME were entered. The new data set was called RIDMSQ.

9) Optimising the B Coefficients

1) RIDMSQ was copied to RIDMSQ2
2) RIDMSQ2 was then edited to;
   a) Set IOC(3)=1 and IOC(6)=1
   b) Delete all QARD lines and enter those which equal calibration set 1 and calibration set 2.
   c) Delete all data except that for transect 1.

B was optimised by running RMANSQ on RIDMSQ2 with different B values creating a MANOUT file for each value of B. The predicted WSL's for each run were noted. This process was repeated for all transects with anomalous VAF's.

Transect	Flow	B	Target WSL	Predicted WSL
1	22.9	-0.13	325.03	324.98
		0.10		325.06
		0.15		325.08
	136.3	-0.13	326.12	325.91
		0.10		325.83
		0.15		325.81

The optimal value of B was taken to be 0.1. B has an empirical minimum of 0.1 and must be positive. To optimise further (ie. beyond 0.1) is not sensible.

Transect	Flow	B	Target WSL	Predicted WSL
2	22.9	-0.27	324.91	325.01
		0.10		324.94
		0.30		324.90
		0.50		324.84
		0.60		324.81
		0.55		324.83
	140.2	-0.27	326.08	325.75
		0.10		325.82
		0.30		325.88
		0.50		325.97
		0.60		326.20
		0.55		325.99

The optimal value of B was taken to be O.55.

Transect	Flow	B	Target WSL	Predicted WSL
3	26.3	-0.076	324.88	324.87
		0.10		324.83
		0.30		324.78
		0.40		324.75
		0.35		324.77
	140.2	-0.076	326.08	325.82
		0.10		325.87
		0.30		325.95
		0.40		326.00
		0.35		325.97

The optimal value of B was taken to be O.35.

Transect	Flow	B	Target WSL	Predicted WSL
9	27.1	-0.281	324.48	324.47
		0.10		324.41
		0.50		324.32
		0.70		324.27
		1.00		324.21
	140.2	-0.281	325.91	325.20
		0.10		325.26
		0.50		325.35
		0.70		325.43
		1.00		325.64

The optimal value of B was taken to be O.95. B has a maximum value of 0.95 and it is not sensible to optimise further.

Transect	Flow	B	Target WSL	Predicted WSL
10	21.9	-0.608	324.34	324.47
		0.10		324.38
		0.50		324.31
		1.00		324.25
	140.2	-0.608	325.91	325.03
		0.10		325.12
		0.50		325.22
		1.00		325.50

The optimal value of B was taken to be O.95. B has a maximum value of 0.95 and it is not sensible to optimise further.

Transect	Flow	B	Target WSL	Predicted WSL
11	23.0	-0.448	324.09	324.26
		0.10		324.16
		0.50		324.05
		0.70		323.98
		0.95		323.93
		0.85		323.93
	145.4	-0.48	325.87	325.14
		0.1		325.29
		0.5		325.50
		0.7		325.66
		0.95		325.98
		0.85		325.83

The optimal value of B was taken to be O.85.

Transect	Flow	B	Target WSL	Predicted WSL
12	23.4	-0.293	323.98	324.06
		0.10		323.98
		0.60		323.83
		0.95		323.77
		0.80		323.77
	140.2	-0.293	325.78	325.08
		0.10		325.18
		0.60		325.39
		0.95		325.63
		0.80		325.51

The optimal value of B was taken to be 0.95.

Transect	Flow	B	Target WSL	Predicted WSL
13	22.9	-0.218	323.90	323.93
		0.10		323.85
		0.60		323.68
		0.80		323.59
		0.70		323.64
		0.75		323.61
	137.1	-0.218	325.78	325.11
		0.10		325.19
		0.60		325.41
		0.80		325.57
		0.70		325.48
		0.75		325.52

The optimal value of B was taken to be 0.75.

10) The optimal values of B were entered into RIDMSQ.

11) MANSQ was run on RIDMSQ creating a MANOUT file, the predicted WSL's at the QARD flows were extracted.

	TRANSECT							
QARD	1	2	3	9	10	11	12	13
10.0	324.89	325.05	324.78	324.89	324.77	324.56	324.48	324.21
22.4	325.06	325.18	324.96	324.91	324.79	324.62	324.53	324.34
25.0	325.08	325.20	324.99	324.91	324.79	324.63	324.54	324.36
50.0	325.31	325.34	325.22	324.93	324.81	324.70	324.59	324.49
75.0	325.49	325.43	325.37	324.94	324.82	324.74	324.62	324.58
76.7	325.50	325.44	325.38	324.94	324.82	324.74	324.63	324.59
100	325.64	325.51	325.50	324.96	324.83	324.77	324.66	324.67
140.2	325.85	325.60	325.68	324.97	324.83	324.81	324.69	324.75
150	325.89	325.62	325.71	324.97	324.84	324.81	324.69	324.76
200	326.11	325.71	325.88	324.98	324.97	324.84	324.88	324.82
250	326.30	325.78	326.03	325.12	325.11	325.01	325.10	324.88
300	326.48	325.84	326.16	325.26	325.23	325.18	325.29	324.92
350	326.65	325.94	326.27	325.38	325.34	325.34	324.49	324.95

12) SRIDMED2.DAT was edited to enter these predicted WSL's, overwriting those generated previously by internal S/Q. The IOC values were checked to ensure that IOC(8) = 1 and IOC(13) = 1.

13) IFG4 was run on SRIDMED2.DAT, creating HIFG4OU2 and generating a Tape 4.

14) The VAF's were checked by running I4VAF on ZVAFF, creating RIDMAF2. The VAF's then appeared correct at all transects.

15) The thalweg values and WSL elevations held on Tape 4 were plotted by running LPTHWE creating RIDTHWE. These were all satisfactory, although some fluctuations were seen.

16) HABINS was run to create a file called ZHABIN, all the curve ID's were entered.

17) HABTAT was run on ZHABIN to create files called RIDOUT and ZHAQF.

18) LPTHQN was run on ZHAQF to create a final output file called RIDPLOUT.

Site: Blithe Dam

Source File: SDAM.IN4

1) The source data file was edited using RIFG4IN to;

a) Set IOC(5) = 1
IOC(8) = 0
IOC(13) = 1

b) QARD flows were entered. The flows selected were between the recommended limits of; Upper limit = 182.0
Lower limit = 8.0

The QARD flows chosen were; 10, 20, 40, 60, 80, 100, 120, 140, 160, 180.

These were supplemented by the mean of the series of calibration flows, these were; 13.58, 72.85, 80.22.

2) A file was created containing one velocity set, retaining the highest calibration set (in this case set 2), by running MAK1VL on SDAM.IN4 to create a file called SDAMHI.DAT.

3) Internal S/Q relationships, B coefficients etc. were calculated by running REVI4 on SDAMHI.DAT to create a file called REVDAMHI.

4) By running IFG4 on SDAMHI.DAT the WSL's associated with QARDS in Tape 4 were calculated, to create a file called DIFG4OUT.

5) WSEI4 was run on SDAMHI.DAT to load WSL's for QARD flows into the WSL lines the output file was SDAMHI2.DAT. SDAMHI2.DAT was then edited to alter IOC(8) to 1 and IOC(5) to 0. The flows were checked visually to ensure that they were entered correctly.

6) By running I4VAF on ZVAFF (the result of action (5)) the VAF's were plotted, to create a file called DAMHIVAF.

7) The VAF plots were examined for anomalous curves, in this case transects 2, 13, 14.

8) A MANSQ data set was created from SDAMHI.DAT by running I4TMSQ, in the process WSL and Q values from calibration set 2, and B coefficients from REVDAMHI were entered. The new data set was called DAMMSQ.

9) Optimising the B Coefficients

1) DAMMSQ was copied to DAMMSQ2.
2) DAMMSQ2 was then edited to;
   a) Set IOC(3)=1 and IOC(6)=1
   b) Delete all QARD lines and enter those which equal calibration set 1 and calibration set 3.
   c) Delete all data except that for transect 2.

B was optimised by running MANSQ on DAMMSQ2 with different B values creating a MANOUT file for each value of B. The predicted WSL's for each run were noted. This process was repeated for all transects with anomalous VAF's.

Transect	Flow	B	Target WSL	Predicted WSL
2	12.6	-0.079	324.23	324.29
		0.10		324.23
	81.8	-0.079	325.39	325.30
		0.10		325.39

The optimal value of B was taken to be 0.1. B has an empirical minimum of 0.1 and must be positive. To optimise further (ie. beyond 0.1) is not sensible.

Transect	Flow	B	Target WSL	Predicted WSL
13	20.1	-0.1	323.85	323.90
		0.1		323.85
		0.2		323.82
		0.4		323.76
	81.8	-0.1	324.68	324.56
		0.1		324.56
		0.2		324.55
		0.4		324.54

The optimal value of B was taken to be 0.1.

Transect	Flow	B	Target WSL	Predicted WSL
14	13.6	-0.17	323.75	323.90
		0.10		323.81
		0.50		323.68
		0.30		323.74
	75.9	-0.17	324.65	324.60
		0.10		324.60
		0.50		324.60
		0.30		324.60

The optimal value of B was taken to be 0.3.

10) The optimal values of B were entered into DAMMSQ.

11) MANSQ was run on DAMMSQ creating a MANOUT file, the predicted WSL's at the QARD flows were extracted.

	TRANSECT		
QARD	2	13	14
10.00	324.26	323.73	323.95
13.80	324.35	323.80	324.01
20.00	324.49	323.93	324.11
40.00	324.81	324.22	324.34
60.00	325.07	324.40	324.50
72.85	325.21	324.50	324.59
80.00	325.29	324.56	324.63
80.22	325.29	324.56	324.63
100.0	325.48	324.69	324.75
120.0	325.66	324.82	324.85
140.0	325.82	324.93	324.94
160.00	325.97	325.04	325.02
180.00	326.12	325.14	325.10

12) SDAMHI2.DAT was edited to enter these predicted WSL's, overwriting those generated previously by internal S/Q. The IOC values were checked to ensure that IOC(8) = 1 and IOC(13) = 1.

13) IFG4 was run on SDAMHI2.DAT, creating DIFG4OU2 file and generating a Tape 4.

14) The VAF's were checked by running I4VAF on ZVAFF, creating a DAMHVAF2 file. The VAF's then appeared correct at all transects.

15) The thalweg values and WSL elevations held on Tape 4 were plotted by running LPTHWE creating DAMTHWE. These were all satisfactory, although some fluctuations were seen.

16) HABINS was run to create a file called ZHABIN, all the curve ID's were entered.

17) HABTAT was run on ZHABIN to create files called DAMOUT and ZHAQF.

18) LPTHQN was run on ZHAQF to create a final output file called DAMPLOUT.

Site: Blithe Bridge

Source File: SBDG.IN4

1) The source data file was edited using RIFG4IN to;

a) Set IOC(5) = 1
IOC(8) = 0
IOC(13) = 1

b) QARD flows were entered. The flows selected were between the recommended limits of; Upper limit = 82.5
Lower limit = 6.7

The QARD flows chosen were; 10, 20, 30, 40, 50, 60, 70, 80.

These were supplemented by the mean of the series of calibration flows, these were; 69.07, 10.34, 29.32.

2) A file was created containing one velocity set, retaining the highest calibration set (in this case set 1), by running MAK1VL on SBDG.IN4 to create a file called SBDGHI.DAT.

3) Internal S/Q relationships, B coefficients etc. were calculated by running REVI4 on SBDGHI.DAT to create a file called REVBDGHI.

4) By running IFG4 on SBDGHI.DAT the WSL's associated with QARDS in Tape 4 were calculated, to create a file called IFG4OUT1.

5) WSEI4 was run on SBDGHI.DAT to load WSL's for QARD flows into the WSL lines, the output file was SBDGHI2.DAT. SBDGHI2.DAT was then edited to alter IOC(8) to 1 and IOC(5) to 0. The flows were checked visually to ensure that they were entered correctly.

6) By running I4VAF on ZVAFF (the result of action (5)) the VAF's were plotted, to create a file called BDGHIVAF.

7) The VAF plots were examined for anomalous curves, in this case transects 2 and 7.

8) A MANSQ data set was created from SBDGHI.DAT by running 14TMSQ, in the process WSL and Q values from calibration set 1, and B coefficients from REVBDGHI were entered. The new data set was called BDGMSQ.

9) Optimising the B Coefficients

1) BDGMSQ was copied to BDGMSQ2.
2) BDGMSQ2 was then edited to;
   a) Set IOC(3)=1 and IOC(6)=1
   b) Delete all QARD lines and enter those which equal calibration set 2 and calibration set 3.
   c) Delete all data except that for transect 2.

B was optimised by running MANSQ on BDGMSQ2 with different B values creating a MANOUT file for each value of B. The predicted WSL's for each run were noted. This process was repeated for all transects with anomalous VAF's.

Transect	Flow	B	Target WSL	Predicted WSL
2	16.6	-0.15	325.26	325.26
		0.15		325.40
		0.10		325.37
	37.1	-0.15	325.49	325.55
		0.15		325.66
		0.10		325.64

The optimal value of B was taken to be 0.10. B has an empirical minimum of 0.1 and must be positive. To optimise further (ie. beyond 0.1) is not sensible.

Transect	Flow	B	Target WSL	Predicted WSL
7	12.1	-0.067	325.05	325.03
		0.10		325.10
		0.05		325.08
	25.5	-0.067	325.07	325.22
		0.10		325.29
		0.05		325.27

The optimal value of B was taken to be 0.10.

10) The optimal values of B were entered into BDGMSQ.

11) MANSQ was run on BDGMSQ creating a MANOUT file, the predicted WSL's at the QARD flows were extracted.

QARD	TRANSECT	TRANSECT
10.00	325.25	325.06
10.34	325.26	325.07
20.00	325.43	325.22
29.32	325.55	325.33
30.00	325.56	325.34
40.00	325.67	325.44
50.00	325.76	325.53
60.00	325.85	325.61
69.07	325.92	325.68
70.00	325.93	325.69
80.00	326.00	325.76

12) SBDGHI2.DAT was edited to enter these predicted WSL's, overwriting those generated previously by internal S/Q. The IOC values were checked to ensure that IOC(8) = 1 and IOC(13) = 1.

13) IFG4 was run on SBDGHI2.DAT, creating IFG4OUT2 and generating a Tape 4.

14) The VAF's were checked by running I4VAF on ZVAFF, creating BDGHVAF2. The VAF's then appeared correct at all transects.

15) The thalweg values and WSL elevations held on Tape 4 were plotted by running LPTHWE creating BDGTHWE. These were all satisfactory, although some fluctuations were seen.

16) HABINS was run to create a file called ZHABIN, all the curve ID's were entered.

17) HABTAT was run on ZHABIN to create files called BDGOUT and ZHAQF.

18) LPTHQN was run on ZHAQF to create a final output file called BDGPLOUT.

Site: Gwash Belmesthorpe

Source File: SBEL.IN4

1) The source data file was edited using RIFG4IN to;

a) Set IOC(5) = 1
IOC(8) = 0
IOC(13) = 1

b) The QARD flows were entered, the flows selected were between the recommended limits of; Upper limit = 39.0
Lower limit = 5.1

The QARD flows chosen were, 5.1, 7.5, 10.0, 12.5, 15.0, 22.5, 25.0, 27.5, 30.0, 35.0, 37.0, 39.0.

These were supplemented by the mean of the series of calibration flows, 10.53, 19.8.

2) A file was created containing one velocity set, retaining the highest calibration set (in this case set 2), by running MAK1VL on SBEL.IN4 to create a file called SBELHI.DAT.

3) Internal S/Q relationships, B coefficients etc. were calculated by running REVI4 on SBELHI.DAT to create a file called REVBELHI.

4) By running IFG4 on SBELHI.DAT the WSL's associated with QARDS in Tape 4 were calculated, to create a file called BIFG4OUT.

5) WSEI4 was run on SBELHI.DAT to load WSL's for QARD flows into the WSL lines, the output file was SBELHI2.DAT. SBELHI2.DAT was then edited to alter IOC(8) to 1 and IOC(5) to 0. The flows were checked visually to ensure that they were entered correctly.

6) By running I4VAF on ZVAFF (the result of action (5)) the VAF's were plotted, to create a file called BELHIVAF.

7) The VAF plots were examined for anomalous curves, in this case, all the VAF curves were satisfactory.

8) IFG4 was run on SBELHI2.DAT, creating BIFG4OU2 and generating a Tape 4.

9) The thalweg values and WSL elevations held on Tape 4 were plotted by running LPTHWE creating BELTHWE. These were all satisfactory, although some fluctuations were seen.

10) HABINS was run to create a file called ZHABIN, all the curve ID's were entered.

11) HABTAT was run on ZHABIN to create files called BELOUT and ZHAQF.

12) LPTHQN was run on ZHAQF to create a final output file called BELPLOUT.

Site: Gwash Ryhall

Source File: SRYH.IN4

1) The source data file was edited using RIFG4IN to;

a) Set IOC(5) = 1
IOC(8) = 0
IOC(13) = 1

b) QARD flows were entered. The flows selected were between the recommended limits of; Upper limit = 33.3
Lower limit = 7.0

The QARD flows chosen were; 8.0, 10.0, 15.0, 20.0, 22.0, 25.0, 27.0, 30.0, 32.O.

These were supplemented by the mean of the series of calibration flows, these were; 12.81, 18.76.

2) A file was created containing one velocity set, retaining the highest calibration set (in this case set 2), by running MAK1VL on SRYH.IN4 to create a file called SRYHHI.DAT.

3) Internal S/Q relationships, B coefficients etc. were calculated by running REVI4 on SRYHHI.DAT to create a file called REVRYHHI.

4) By running IFG4 on SRYHHI.DAT the WSL's associated with QARDS in Tape 4 were calculated, to create a file called GRIFG4OU.

5) WSEI4 was run on SRYHHI.DAT to load WSL's for QARD flows into the WSL lines, the output file was SRYHHI2.DAT. SRYHHI2.DAT was then edited to alter IOC(8) to 1 and IOC(5) to 0. The flows were checked visually to ensure that they were entered correctly.

6) By running I4VAF on ZVAFF (the result of action (5)) the VAF's were plotted, to create a file called RYHHIVAF.

7) The VAF plots were examined for anomalous curves, in this case transects 2, 7, 10, 11, 12, 13, 14, 15, 16 and 17.

8) A MANSQ data set was created from SRYHHI.DAT by running 14TMSQ, in the process WSL and Q values from calibration set 1, and B coefficients from REVRYHHI were entered. The new data set was called RYHMSQ.

9) Optimising the B Coefficients

1) RYHMSQ was copied to RYHMSQ2.
2) RYHMSQ2 was then edited to;
   a) Set IOC(3)=1 and IOC(6)=1
   b) Delete all QARD lines and enter those which equal calibration set 2 and calibration set 3.
   c) Delete all data except that for transect 2.

B was optimised by running MANSQ on RYHMSQ2 with different B values creating a MANOUT file for each value of B. The predicted WSL's for each run were noted. This process was repeated for all transects with anomalous VAF's.

Transect	Flow	B	Target WSL	Predicted WSL
2	14.9	-0.677	324.63	324.72
		0.10		324.69
		0.50		324.66
		0.95		324.59
		0.80		324.62
		0.75		324.63

The optimal value of B was taken to be 0.75.

Transect	Flow	B	Target WSL	Predicted WSL
7	12.3	-2.280	324.15	324.31
		0.10		324.28
		0.60		324.26
		0.95		324.24

The optimal value of B was taken to be 0.95. B has a maximum of 0.95 so it was not sensible to optimise further.

Transect	Flow	B	Target WSL	Predicted WSL
10	14.7	-1.450	323.96	324.10
		0.10		324.06
		0.50		324.04
		0.95		324.24

The optimal value of B was taken to be 0.95. B has an maximum of 0.95, so it was not sensible to optimise further.

Transect	Flow	B	Target WSL	Predicted WSL
11	13.2	-1.163	323.82	324.00
		0.95		323.84

The optimal value of B was taken to be 0.95. B has an maximum of 0.95, so it was not sensible to optimise further.

Transect	Flow	B	Target WSL	Predicted WSL
12	16.00	-1.903	323.88	324.05
		0.95		323.95

The optimal value of B was taken to be 0.95. B has an maximum of 0.95, so

it was not sensible to optimise further.

Transect	Flow	B	Target WSL	Predicted WSL
13	12.8	-0.206	323.71	323.77
		0.10		323.74
		0.50		323.68
		0.30		323.71

The optimal value of B was taken to be 0.30.

Transect	Flow	B	Target WSL	Predicted WSL
14	9.4	-0.352	323.58	323.69
		0.10		323.64
		0.50		323.58

The optimal value of B was taken to be 0.50.

Transect	Flow	B	Target WSL	Predicted WSL
15	12.6	-0.638	323.59	323.75
		0.50		323.64
		0.75		323.58
		0.80		323.57

The optimal value of B was taken to be 0.75.

Transect	Flow	B	Target WSL	Predicted WSL
16	12.5	-0.484	323.51	323.66
		0.50		323.54
		0.70		323.49
		0.60		323.51

The optimal value of B was taken to be 0.60.

Transect	Flow	B	Target WSL	Predicted WSL
17	12.8	-0.380	323.50	323.61
		0.50		323.50

The optimal value of B was taken to be 0.50.

10) The optimal values of B were entered into RYHMSQ.

11) MANSQ was run on RYHMSQ creating a MANOUT file, the predicted WSL's at the QARD flows were extracted.

	TRANSECT				
QARD	2	7	10	11	12
8.00	324.72	324.32	324.12	324.07	324.06
10.00	324.74	324.33	324.12	324.07	324.07
12.81	324.76	324.34	324.13	324.08	324.08
15.00	324.77	324.35	324.14	324.08	324.08
18.76	324.79	324.35	324.15	324.10	324.09
20.00	324.79	324.35	324.15	324.10	324.10
22.00	324.80	324.36	324.16	324.10	324.10
25.00	324.82	324.36	324.16	324.10	324.10
27.00	324.82	324.36	324.17	324.11	324.10
30.00	324.83	324.37	324.17	324.11	324.11
32.00	324.84	324.37	324.17	324.11	324.11

	TRANSECT				
QARD	13	14	15	16	17
8.00	323.68	323.73	323.78	323.67	323.58
10.00	323.74	323.78	323.81	323.71	323.63
12.81	323.81	323.82	323.85	323.76	323.69
15.00	323.86	323.86	323.87	323.79	323.73
18.76	323.94	323.91	323.91	323.84	323.79
20.00	323.97	323.92	323.92	323.85	323.81
22.00	324.00	323.94	323.94	323.88	323.83
25.00	324.05	323.98	323.96	323.91	324.87
27.00	324.09	323.99	323.97	323.93	323.89
30.00	324.13	324.02	323.99	323.95	323.93
32.00	324.16	324.04	324.00	323.97	323.95

12) SRYHHI2.DAT was edited to enter these predicted WSL's, overwriting those generated previously by internal S/Q. The IOC values were checked to ensure that IOC(8) = 1 and IOC(13) = 1.

13) IFG4 was run on SRYHHI2.DAT, creating GRIFG4O2 and generating a Tape 4.

14) The VAF's were checked by running I4VAF on ZVAFF, creating RYHHVAF2. The VAF's then appeared correct at all transects.

15) The thalweg values and WSL elevations held on Tape 4 were plotted by running LPTHWE creating RYHTHWE. These were all satisfactory, although some fluctuations were seen.

16) HABINS was run to create a file called ZHABIN, all the curve ID's were entered.

17) HABTAT was run on ZHABIN to create files called RYHOUT and ZHAQF.

18) LPTHQN was run on ZHAQF to create a final output file called RYHPLOUT.

The demand for long-term scientific capabilities concerning the resources of the land and its freshwaters is rising sharply as the power of man to change his environment is growing, and with it the scale of his impact. Comprehensive research facilities (laboratories, field studies, computer modelling, instrumentation, remote sensing) are needed to provide solutions to the challenging problems of the modern world in its concern for appropriate and sympathetic management of the fragile systems of the land's surface.

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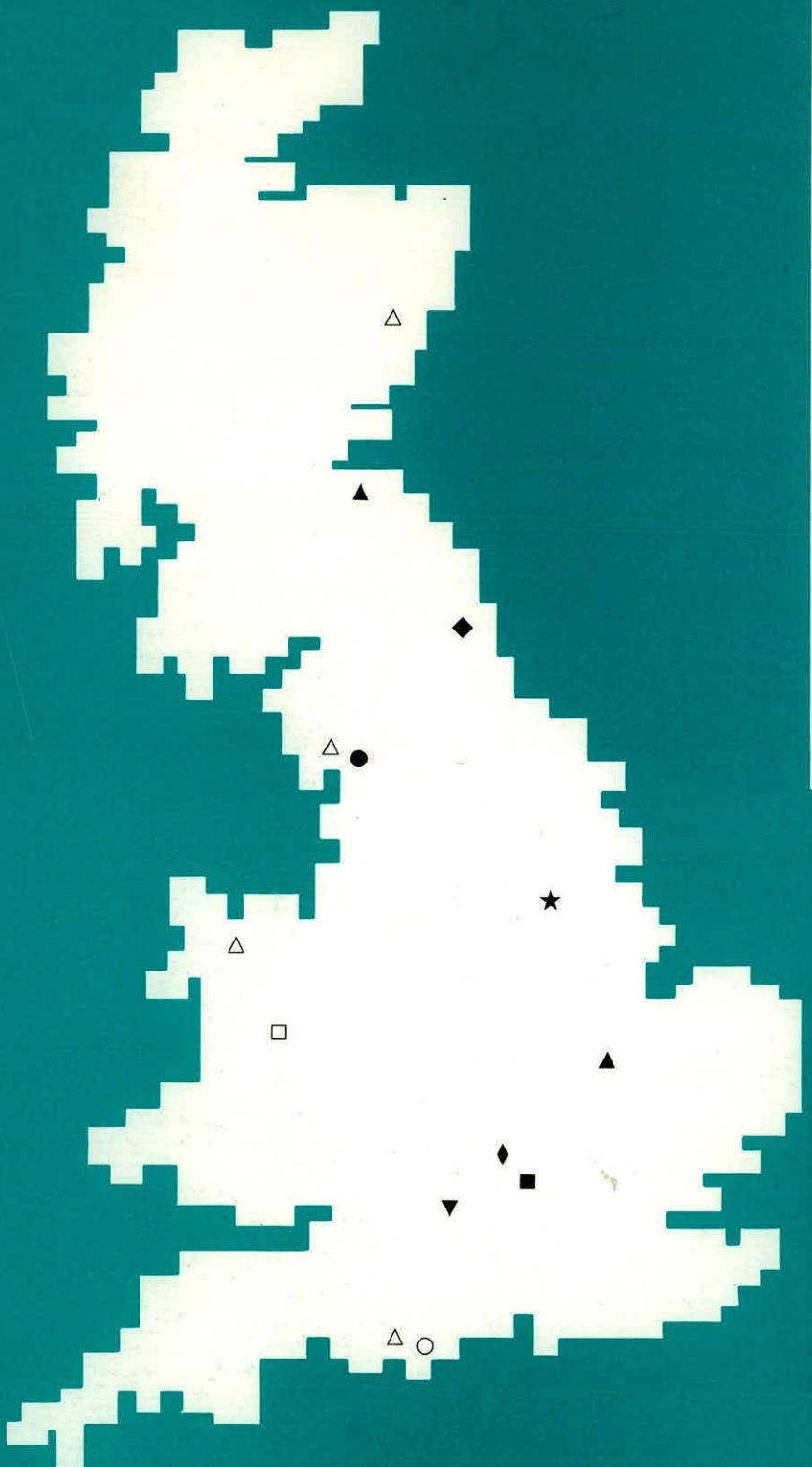

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