Introduction

The two competing hydropower schemes were modelled. This report shows the impact of how the two schemes could utilise the volume of water available for hydropower generation; and the resultant impact that would have on the river flow.

Flow estimations

The daily flow estimates were created for the Avoncliff site using the Bradford-on-Avon gauging station (~2km upstream of Avoncliff) and the Bathford gauging station (~10km downstream of Avoncliff) to produce a 1990-2007 timeseries data sequence. Please refer to section 11 of the Determination Report, Appendix 1.

Proposed scheme details

North Mill scheme	Turbine maximum flow (T_{MAX})	10.033m^3/s*
	Turbine minimum flow (T_{MIN})	0.160m^3/s**
	Applied for annual volume	334,281,600m^3/year
Weavers Mill scheme	Turbine maximum flow (T_{MAX})	7.900m^3/s
	Turbine minimum flow (T_{MIN})	0.450m^3/s**
	Applied for annual volume	249,134,400m^3/year

* The maximum turbine flow taken from ANDRITZ performance curve data. See section 8 of the Determination Report Appendix 1 and relevant text within the AMEC report Appendix 4.
** The minimum turbine flows are as described on pages 14 and 15 of the AMEC report, Appendix 4.

Modelling assumptions

The impact of the two competing schemes was modelled using the derived flow sequence for Avoncliff. Each scheme was modelled using data from known historically wet, dry and average years:

2000 is considered an historically wet year.
2003 is considered an historically dry year.
1993 is considered an historically average year.

The influenced Q95 of 0.951m^3/s was applied as the Hands Off Flow (HOF).

In addition to the HOF, a flow of 0.162m^3/s for the existing Weavers Mill leat was made unavailable for use by either scheme.

Within the analysis an attempt has been made to include a period of no generation due the presence of extreme high river flow. In this analysis it has been assumed that the weir will become non-modular and generation by either scheme will cease at river flow >Q5. At this point all water is allocated to the weir.

The analysis assumes no turbine downtime for maintenance or unforeseen circumstances.

Both competing schemes include the provision of a fish pass (and the Weavers Mill scheme a fish bywash). The final design flow required to operate these structures has yet to be agreed but will form component parts of the stated HOF of 0.951m^3/s.

Both schemes include the provision of an eel pass but no allowance of water has been made for their operation. This is because the amount of water usually required by an eel pass is small and will have no overall bearing on the results of this analysis.

Flow Duration Curve (FDC) Analysis

Turbine flows:
Table 1 shows the potential volume of water available to the two schemes.

Table 1.

Percentile (%)	**North Mill turbine(s) (m^3/s)**	**Weavers Mill turbine (m^3/s)**
0.1	0	0
1	0	0
5	10.033	7.900
10	10.033	7.900
15	10.033	7.900
20	10.033	7.900
25	10.033	7.900
30	9.812	7.900
35	7.560	7.560
40	5.598	5.598
45	4.315	4.315
50	3.446	3.446
55	2.743	2.743
60	2.197	2.197
65	1.734	1.734
70	1.307	1.307
75	0.949	0.949
80	0.626	0.626
85	0.376	0
90	0	0
95	0	0
99	0	0
99.9	0	0

Weir flows:

Table 2 compares the flow over the weir impacted by the two schemes. This does not include the 0.162m^3/s flow allocated to the Weavers Mill leat.

Table 2.

Percentile (%)	**Weir flow impacted by North Mill scheme (m^3/s)**	**Weir flow impacted by Weavers Mill scheme (m^3/s)**
0.1	146.374	146.374
1	78.595	78.595
5	35.975	38.108
10	20.965	23.098
15	12.870	15.003
20	7.533	9.666
25	3.564	5.697
30	0.951	2.863
35	0.951	0.951
40	0.951	0.951
45	0.951	0.951
50	0.951	0.951
55	0.951	0.951
60	0.951	0.951
65	0.951	0.951
70	0.951	0.951
75	0.951	0.951
80	0.951	0.951
85	0.951	1.327
90	1.071	1.071
95	0.789	0.789
99	0.238	0.238
99.9	0.000	0.000

Figures 1 and 2 below show graphically the data provided in Tables 1 and 2 above.

Figure 1 below shows the North Mill scheme operating, the turbine starts operating at approximately Q89, maximum turbine capacity is reached at approximately Q30. Therefore flow over the weir is at the HOF approximately 59% of the time.

Figure 1.

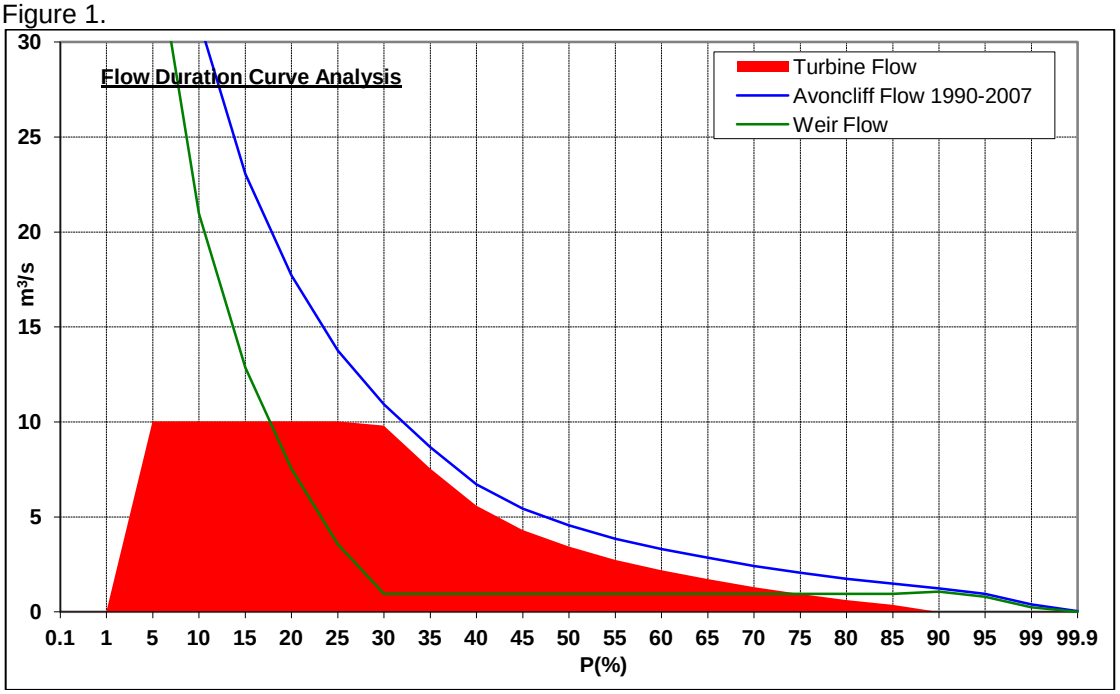
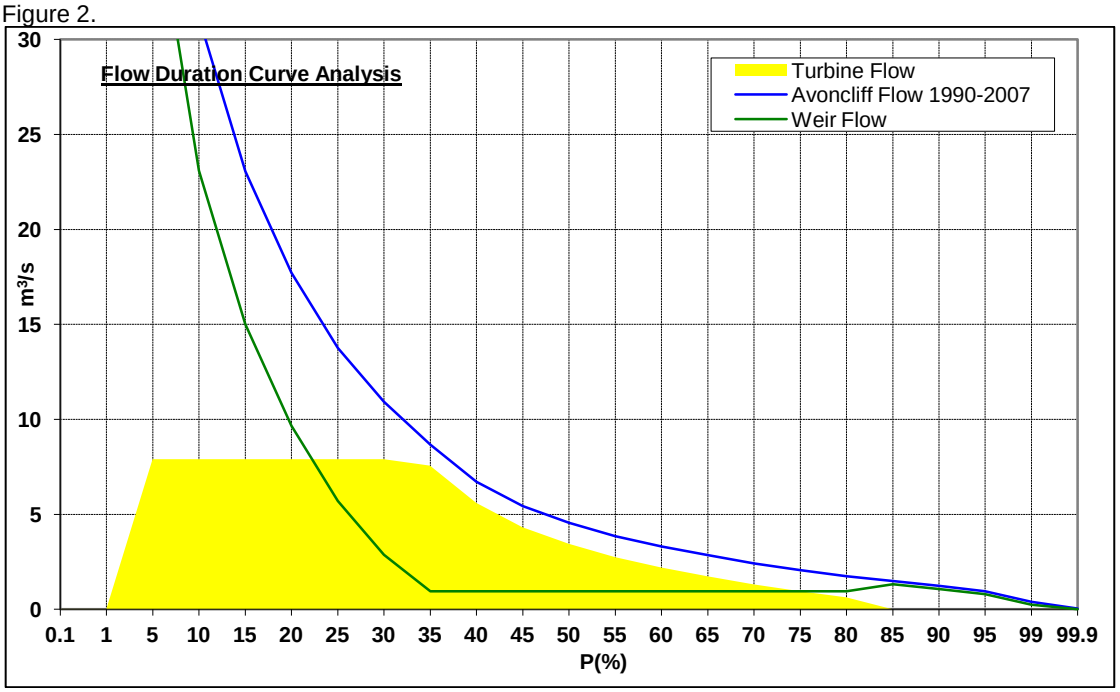


Figure 2 below shows the Weavers Mill scheme operating, the turbine starts operating at approximately Q84, maximum turbine capacity is reached at approximately Q34. Therefore the flow over the weir is at the HOF approximately 50% of the time.

Figure 2.



Wet year (2000)

Table 3 shows the potential volume of water used and impact of this on the flow over the weir if the North Mill scheme operated. This is also shown graphically in Figure 3.

Table 3.

Total number of days weir at HOF	Average number of days weir at HOF	Max no. days weir at HOF	Volume of water for turbine (m^3)
180	14	74	188,907,302

Figure 3.

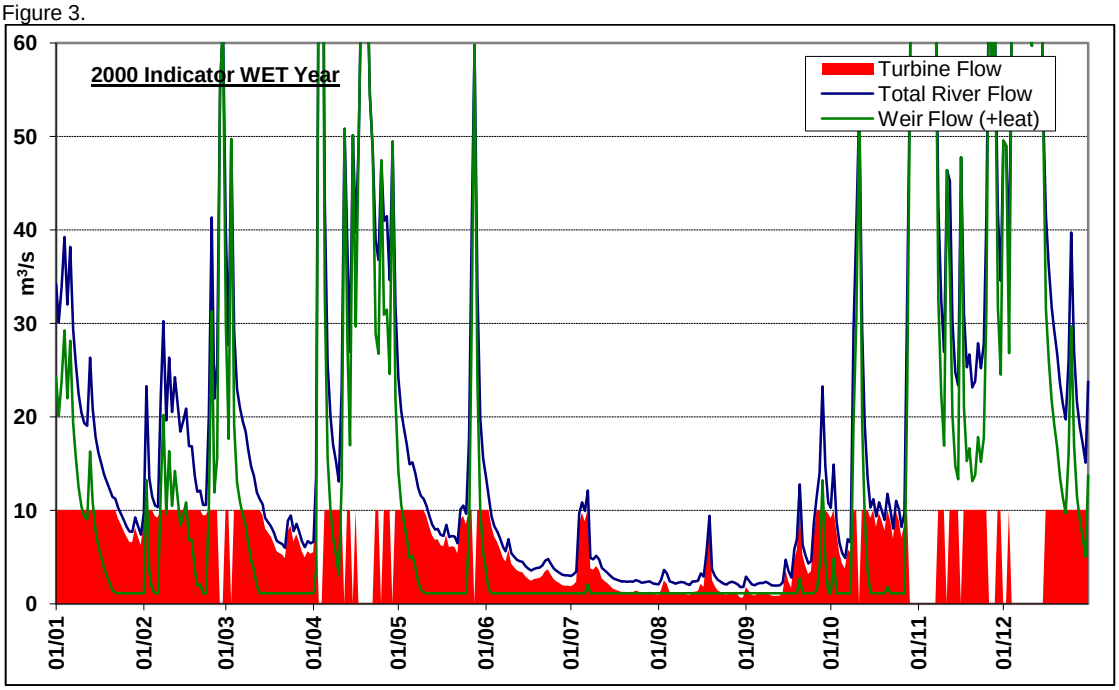
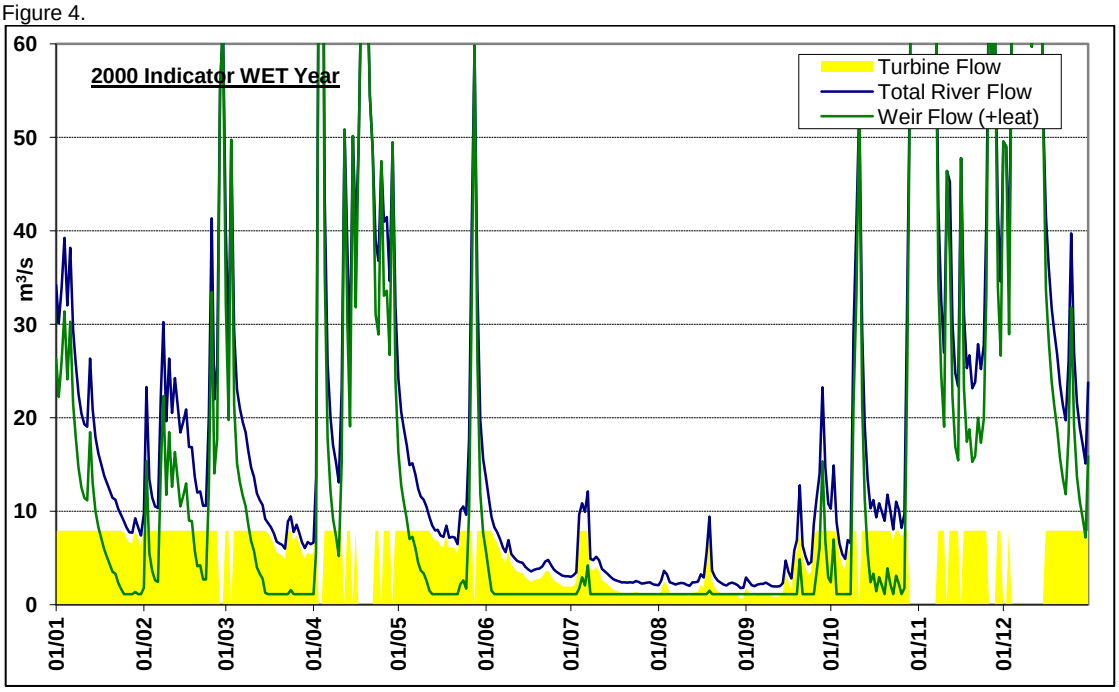


Table 4 shows the potential volume of water used and impact of this on the flow over the weir if the Weavers Mill scheme operated. This is also shown graphically in Figure 4.

Table 4.

Total number of days weir at HOF	Average number of days weir at HOF	Max no. days weir at HOF	Volume of water for turbine (m^3)
149	11	42	160,321,950

Figure 4.



Dry year (2003)

Table 5 shows the potential volume of water used and impact of this on the flow over the weir if the North Mill scheme operated. This is also shown graphically in Figure 5.

Total number of days weir at HOF	Average number of days weir at HOF	Max no. days weir at HOF	Volume of water for turbine (m^3)
172	11	76	88,592,851

Figure 5.

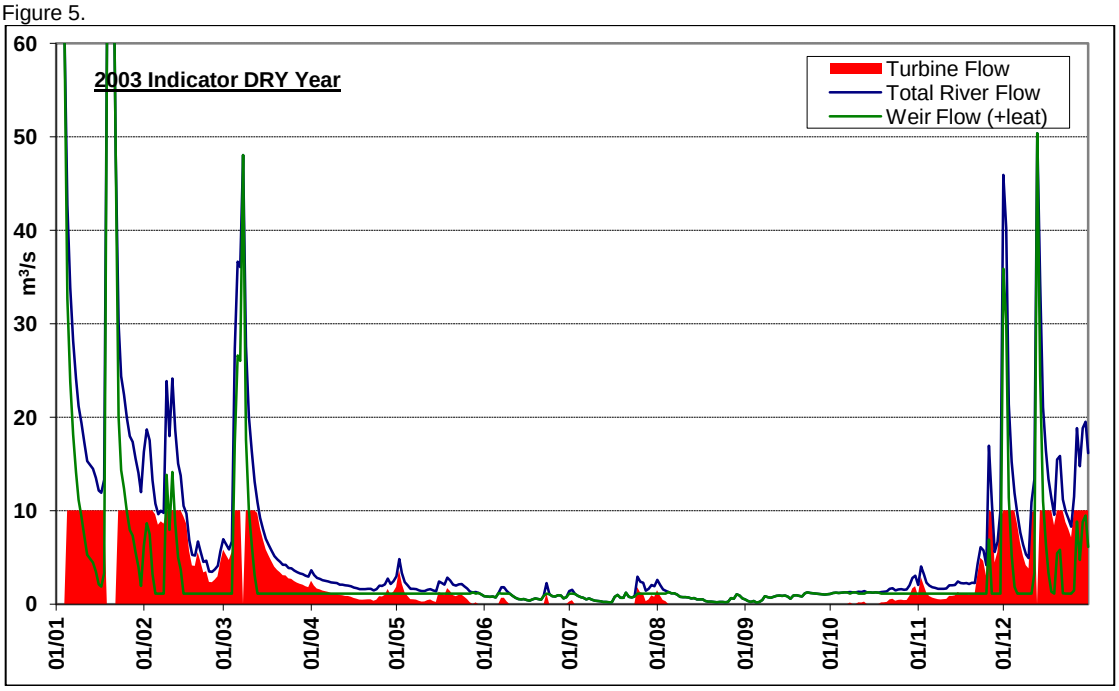
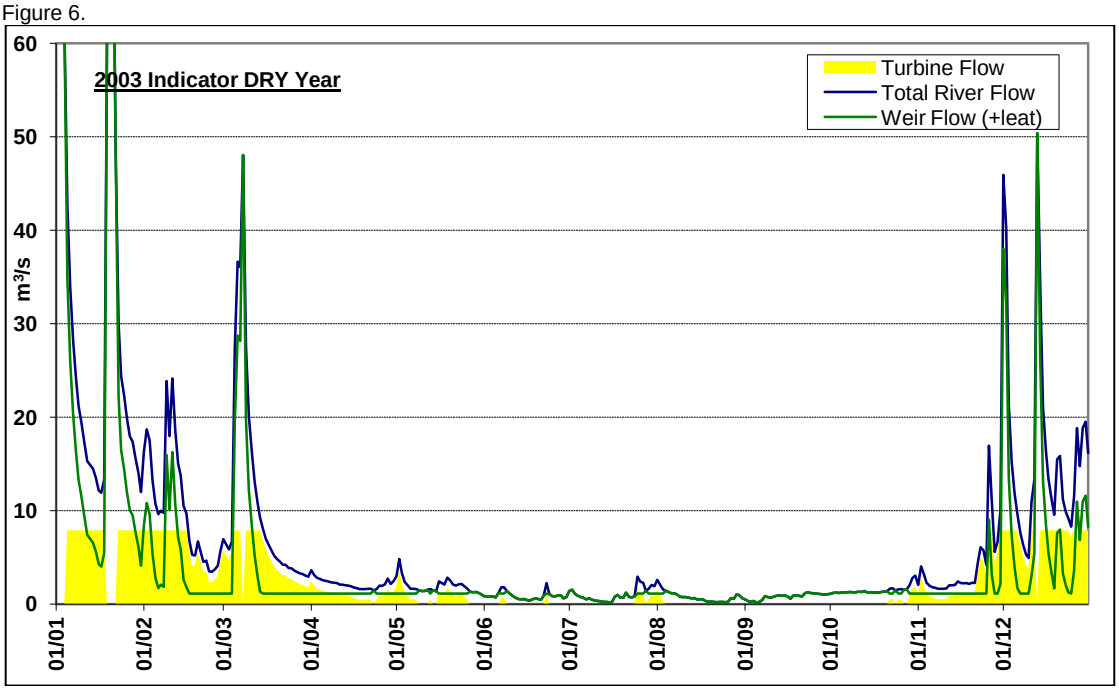


Table 6 shows the potential volume of water used and impact of this on the flow over the weir if the Weavers Mill scheme operated. This is also shown graphically in Figure 6.

Table 6.

Total number of days weir at HOF	Average number of days weir at HOF	Max no. days weir at HOF	Volume of water for turbine (m^3)
133	9	39	75,433,345

Figure 6.



Average year (1993)

Table 7 shows the potential volume of water used and impact of this on the flow over the weir if the North Mill scheme operated. This is also shown graphically in Figure 7.

Table 7.

Total number of days weir at HOF	Average number of days weir at HOF	Max no. days weir at HOF	Volume of water for turbine (m^3)
248	19	82	118,878,609

Figure 7.

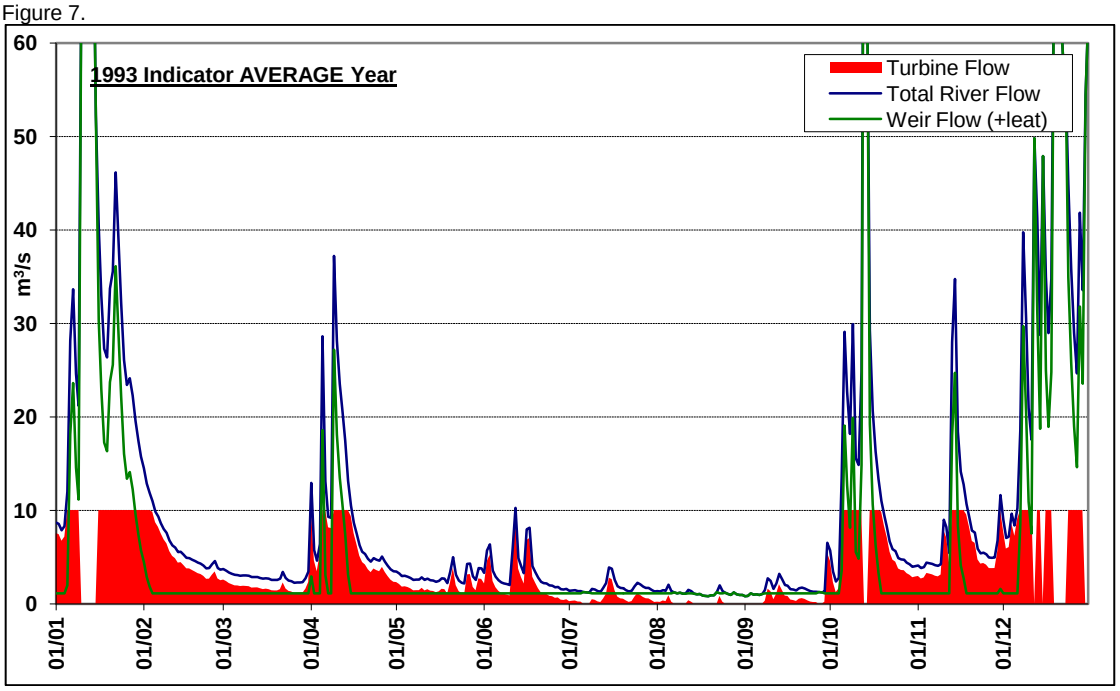


Table 8 shows the potential volume of water used and impact of this on the flow over the weir if the Weavers Mill scheme operated. This is also shown graphically in Figure 8.

Total number of days weir at HOF	Average number of days weir at HOF	Max no. days weir at HOF	Volume of water for turbine (m^3)
204	11	57	104,653,321

Figure 8.

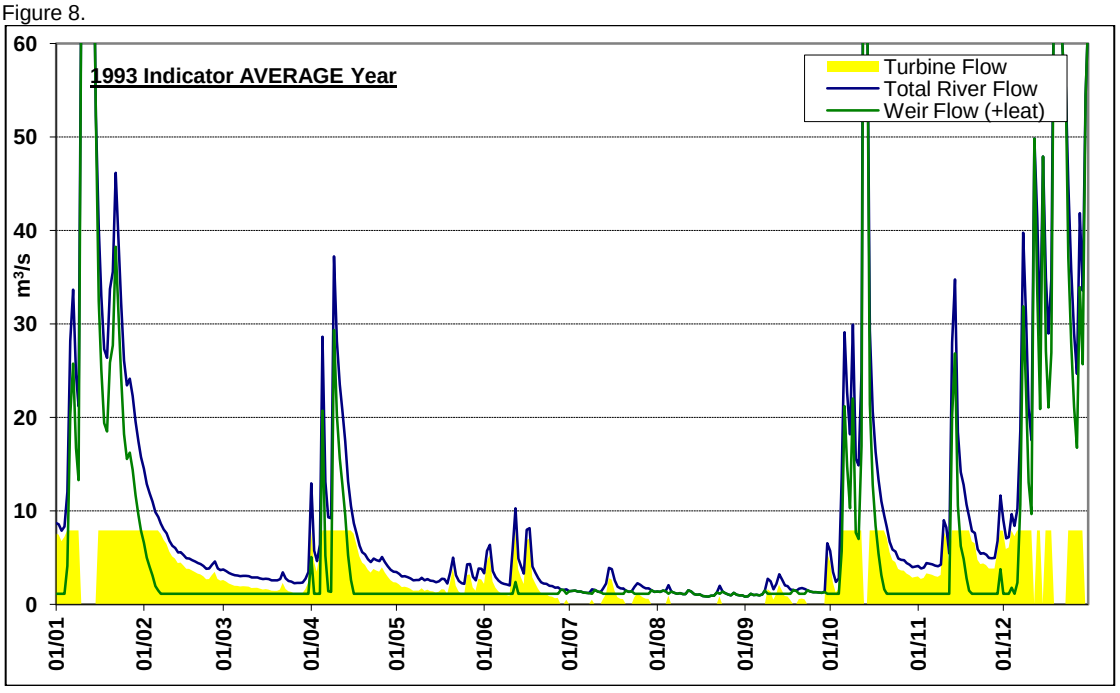


Table 9 shows the volume of water available to each scheme for the three indicator years.

Table 9.

Year	North Mill scheme (m^3)	Weavers Mill scheme (m^3)
Wet 2000	188,907,302	160,321,950
Dry 2003	88,592,851	75,433,345
Average 1993	118,878,609	104,653,321

Table 10 shows the percentage of the applied for annual total that each scheme could have used in each of the indicator years.

Table 10.

Year	North Mill scheme (%)	Weavers Mill scheme (%)
Wet 2000	57	64
Dry 2003	27	30
Average 1993	36	42