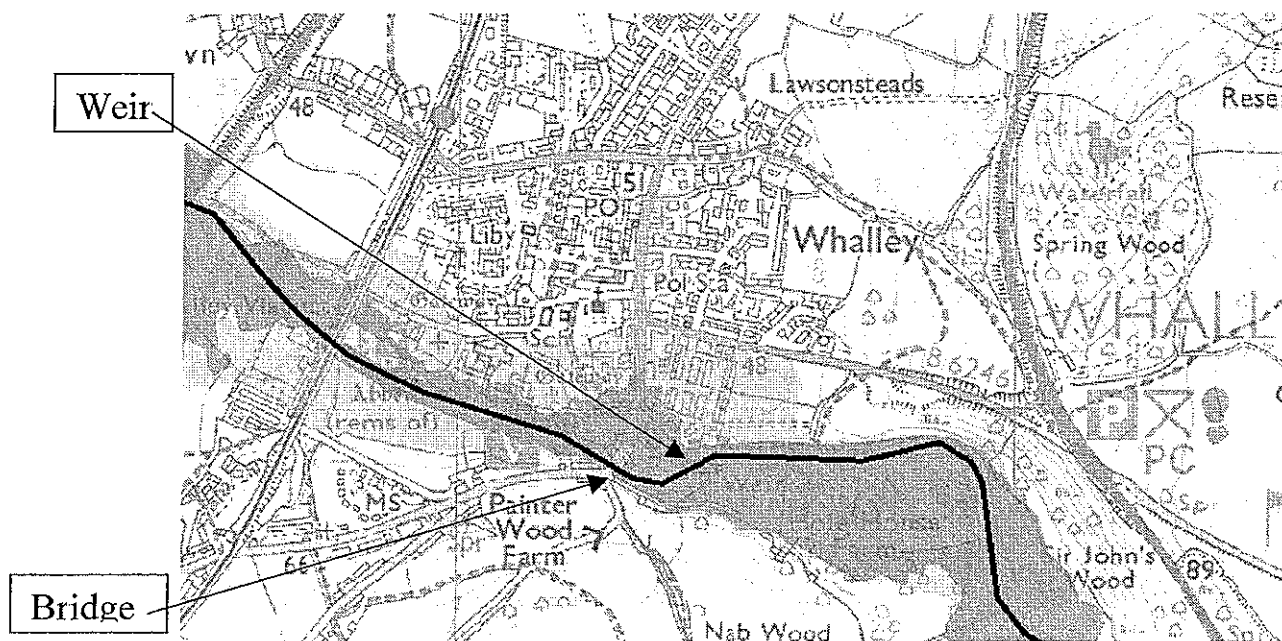


Flood Risk Assessment for Whalley Hydro

The Archimedian Screw will have an electricity output of 100kW derived from a river characteristic shown in the table entitled "Target Flow Division" and the abstraction flow rate is shown on the graph with the same name.

A residual flow at Q95 of 1.950 m³/sec is envisaged.

Control gear will be installed that regulates the flow over the weir, the fish pass and finally into the screw so that sufficient water is available for the weir and the fish pass.



Flood Map Whalley, Lancashire at scale 1:10,000

The scheme will be located adjacent to the weir and so the flow over the weir in flood conditions will not be reduced. The proposed works will improve the flood protection regime upstream of the weir due to increase capacity at the weir. The extra channels created for the fish pass and Archimedian Screw should reduce the localised flooding caused by the restrictive flow through the downstream bridge by hastening the flow in the build up to flood conditions thereby reducing the total height of the flood water.

The building housing the generator and control gear could restrict the flow of floodwater but the added flow of water beneath the building will more than compensate. With reference to the Detailed Contour Map (attached), the expected flood height around the building should be lessened due to being sited a little higher than the surrounding area.

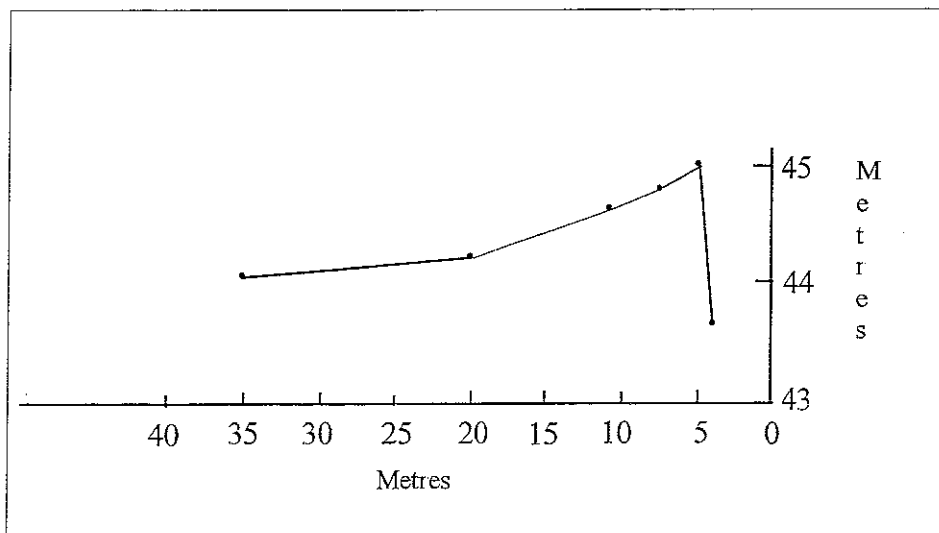
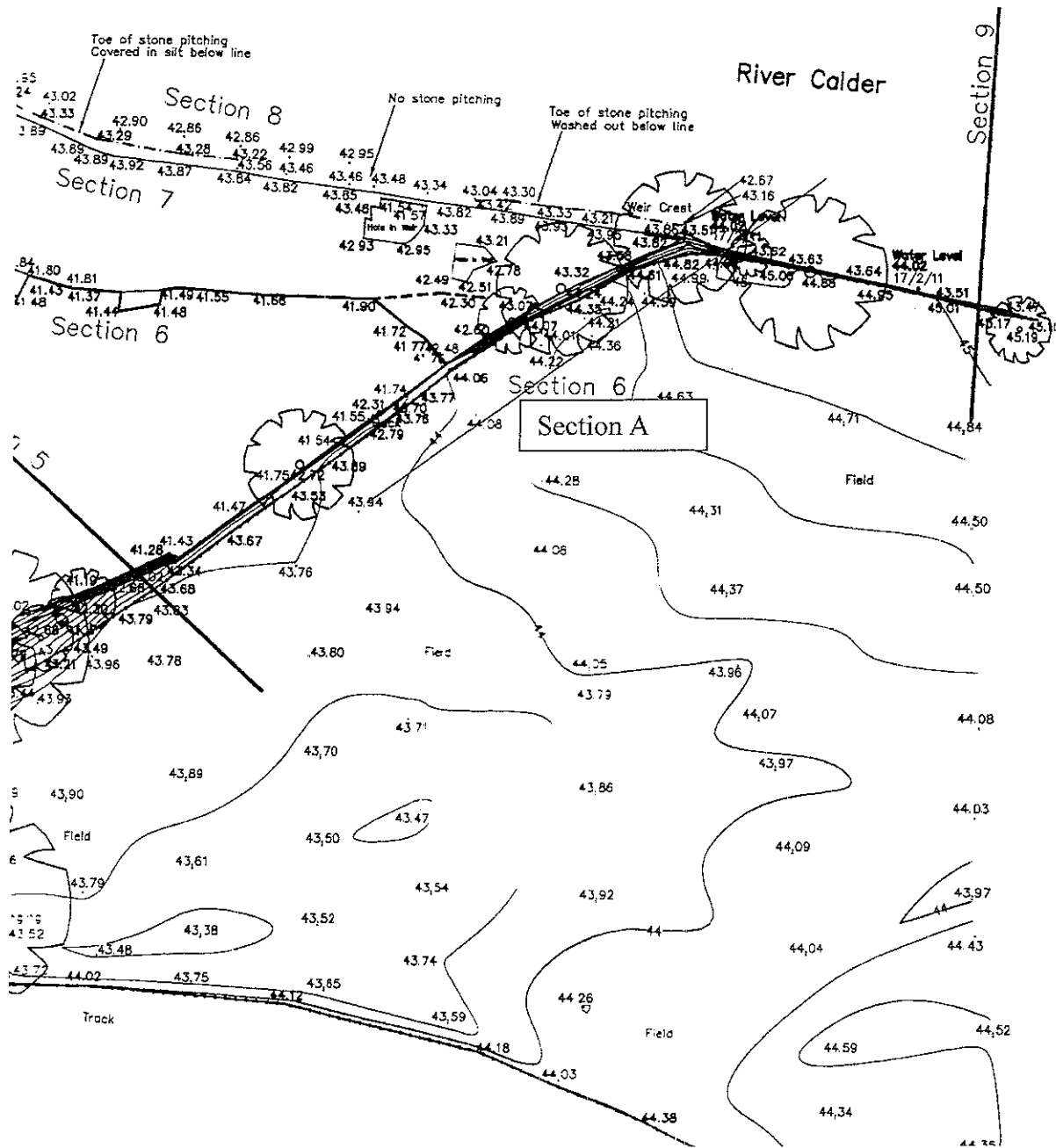
All sensitive equipment within the building will be sited above the 100-year flood level and the inlets for the internal breathing will be sited above this level too with the outlet at eaves level. The floor area will rely on the integrity of the entrance doors but no items subject to water damage will be kept at this level.



Target Flow Division

Percentage Time Exceedance	River Flow Rate [m ³ /s] (Whalley Weir Gauge Data)	River Flow Rate [m ³ /s] (Low Flows 2000 Data)	Regime Identifier	Residual Flow Rate [m ³ /s]	Abstracted Flow Rate [m ³ /s]
0.20%	87.500		5	80.190	7.310
0.30%	76.000		5	68.690	7.310
0.40%	70.000		5	62.690	7.310
0.50%	66.000		5	58.690	7.310
0.60%	64.000		5	56.690	7.310
0.70%	51.000		5	43.690	7.310
0.80%	50.800		5	43.490	7.310
0.90%	50.500		5	43.190	7.310
1.00%	50.400		5	43.090	7.310
2.00%	42.000		5	34.690	7.310
3.00%	36.000		5	28.690	7.310
4.00%	31.000		5	23.690	7.310
5.00%	28.000	26.730	5	20.690	7.310
10.00%	19.490	18.720	5	12.180	7.310
15.00%	15.500		5	8.190	7.310
20.00%	12.200	11.250	5	4.890	7.310
25.00%	9.450		5	2.140	7.310
30.00%	8.020	7.686	4	1.980	6.040
35.00%	6.730		3	1.980	4.750
40.00%	5.900	5.570	3	1.980	3.920
45.00%	5.200		3	1.980	3.220
50.00%	4.638	4.325	3	1.980	2.658
55.00%	4.220		3	1.980	2.240
60.00%	3.800	3.470	2	3.800	0.000
65.00%	3.480		2	3.480	0.000
70.00%	3.142	2.856	2	3.142	0.000
75.00%	2.870		2	2.870	0.000
80.00%	2.650	2.372	2	2.650	0.000
85.00%	2.540	2.173	2	2.540	0.000
90.00%	2.230	1.974	2	2.230	0.000
95.00%	1.950	1.784	1	1.950	0.000
96.00%	1.945		1	1.945	0.000
97.00%	1.910		1	1.910	0.000
98.00%	1.830		1	1.830	0.000
99.00%	1.710		1	1.710	0.000
99.50%	1.570	1.493	1	1.570	0.000
100.00%	1.350		1	1.350	0.000

Detailed Contour Map of Site



Section A



Fish pass design proposal, Whalley Weir Hydro Scheme

Client:
Whalley Community Hydro Limited

Our reference: SG/3238/Design
Wednesday, November 23, 2011

Fish pass design proposal

Revision	Date	Reason
0	31/10/11	Original
A	23/11/11	Included are the responses from the EA, 10 November 2011 11:07

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1 Introduction

This report contains a design proposal for a fish pass and eel/elver pass for the proposed hydro scheme at Whalley Weir.

2 Fish pass

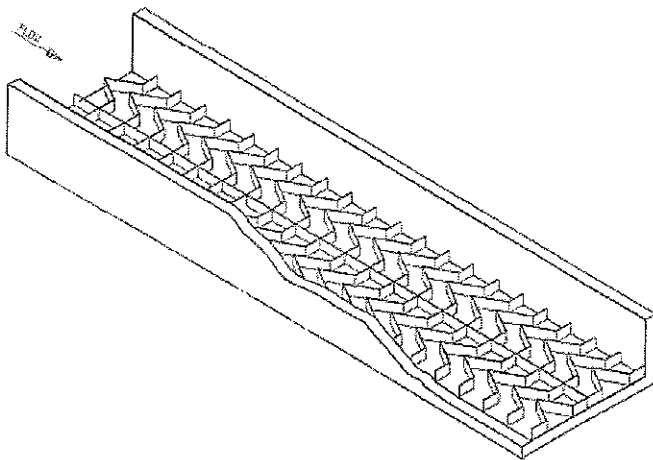
We are proposing for this type of river a Larinier super active baffle fish pass of double width. The pass is designed for a water level $H_a = 270\text{mm}$. This will result in a flow speed of 1.18m/s and water passage of 700l/s . The 700l/s is about 10% of the turbine flow.

A H_a of 270mm will be maintained till $Q_{28.9}$ with flows above the head will increase and the flow and flow speed will increase.

The level is maintained at constant by an automatic sluice and the speed reduction of the turbine till flows up to nominal ($6.25\text{m}^3/\text{s}$) + HoF of the system which is set $1.98\text{m}^3/\text{s}$. The $1.98\text{m}^3/\text{s}$ includes the nominal flow of the fish pass which is $0.7\text{m}^3/\text{s}$. total flow on which this head is maintained will be $8.23\text{m}^3/\text{s}$. this equals to as described above to $Q_{28.9}$.

Please find a table with water levels in Appendix A and Appendix B. These tables are showing the levels over the full range of flows. Graphs can be found in Appendix C

According to the good practice guidance of the EA these values are well within the guidelines and suitable for most fish.



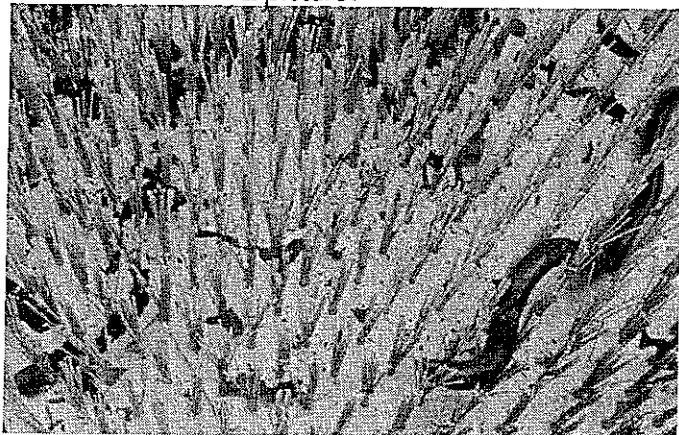
3 Eel or Elver pass

We have proposed an up and over eel/elver pass. We can supply brushes with 20mm (for elvers) or 30mm suitable for larger size eels. For the design this doesn't make a difference. We have included a double 150mm brush. The trunk is 300mm square with lid for easy maintenance.

Total brush width is 300mm.

We are using a bilge pump able to pump 25-50 l/s at the highest point. This pump will run from dusk till dawn.

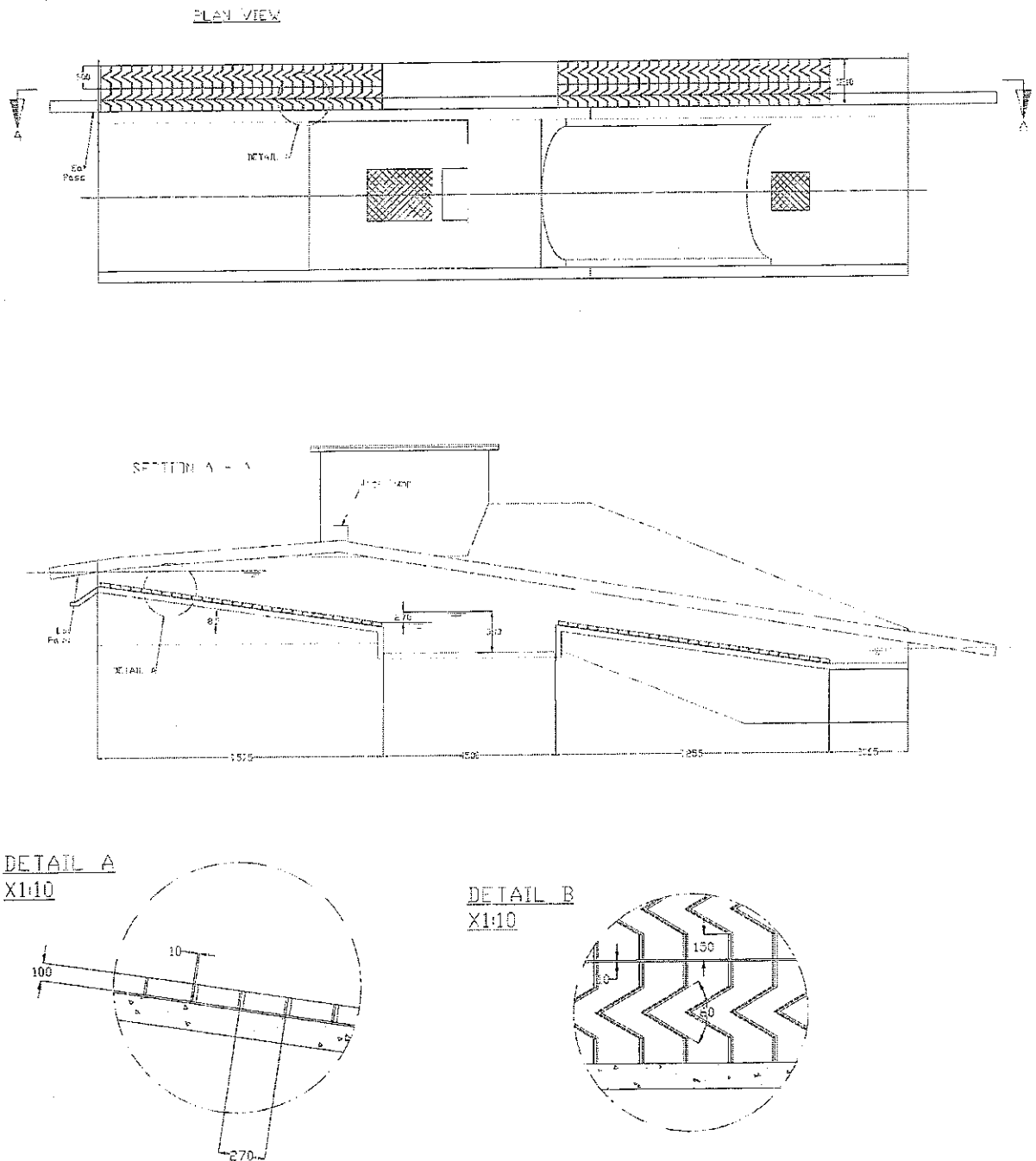
Please find below a picture:

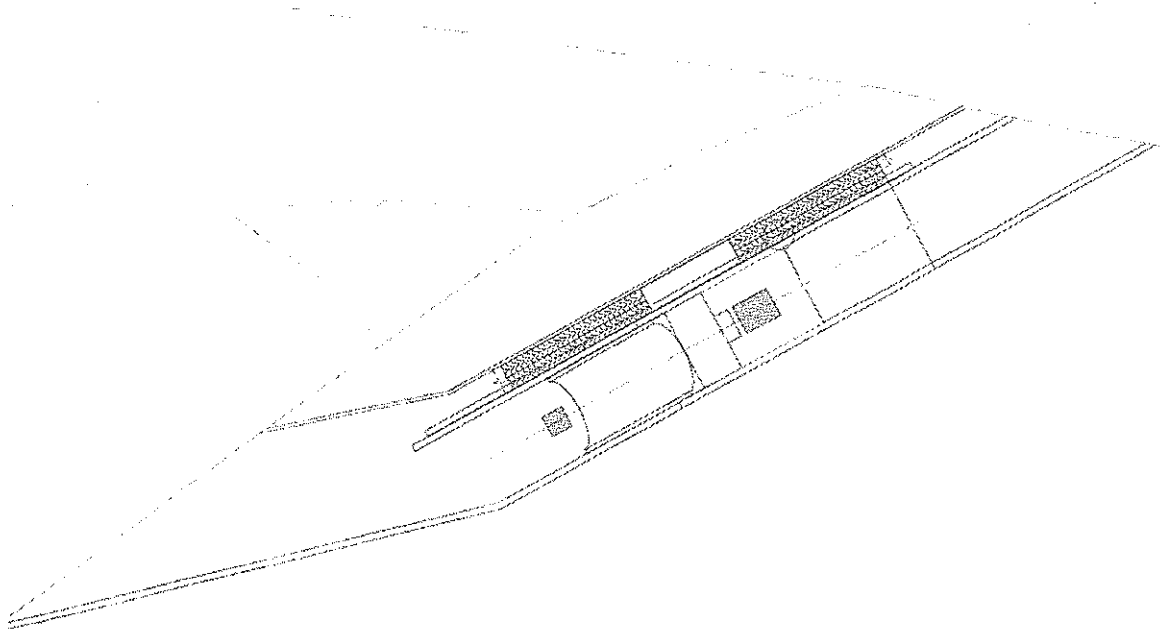


We intent to use:

1000x150x12, 0.8mm diameter black or green polyester 4mm tufts at 20 or 30mm spacing.

4 Design proposal at Whalley Weir





We trust our proposal meets with your requirements however if you should have need for any explanation of our proposal or additional information please do not hesitate to contact us.

Yours Faithfully
SPAANS BABCOCK LTD



Bert Boersma
Technical Sales Manager

Appendix A Table with levels

Occurrence (%)	Flow (m³/s)	Residual flow (m³/s)	Nominal flow (m³/s)	Usable flow (m³/s)	How through fishpass (m³/s)	% total flow	% turbine flow	Flow over weir (m³/s)	Head over fishpass (m)	Level drop (m)	Upstream level (m)	Upstream level (m)	Down stream level (m)	Net head (m)
5.0	27.93	2.64	6.25	6.25	1.36	5%	22%	20.32	0.43	0.00	4.93	5.09	3.07	1.86
7.5	22.67	2.50	6.25	6.25	1.22	5%	20%	15.20	0.39	0.00	4.93	5.05	2.98	1.95
10.0	19.53	2.41	6.25	6.25	1.13	6%	18%	12.16	0.36	0.00	4.93	5.03	2.92	2.01
12.5	17.34	2.34	6.25	6.25	1.06	6%	17%	10.03	0.35	0.00	4.93	5.01	2.88	2.05
15.0	15.49	2.28	6.25	6.25	1.00	6%	16%	8.24	0.33	0.00	4.93	5.00	2.85	2.08
17.5	13.76	2.22	6.25	6.25	0.94	7%	15%	6.57	0.32	0.00	4.93	4.98	2.82	2.11
20.0	12.15	2.17	6.25	6.25	0.89	7%	14%	5.01	0.31	0.00	4.93	4.97	2.79	2.14
22.5	10.72	2.11	6.25	6.25	0.83	8%	13%	3.64	0.30	0.00	4.93	4.96	2.76	2.16
25.0	9.55	2.07	6.25	6.25	0.79	8%	13%	2.51	0.29	0.00	4.93	4.95	2.74	2.19
27.5	8.65	2.04	6.25	6.25	0.76	9%	12%	1.65	0.28	0.00	4.93	4.94	2.73	2.20
30.0	7.96	1.98	6.25	6.25	0.70	9%	12%	1.28	0.27	0.00	4.93	4.94	2.71	2.21
32.5	7.37	1.99	6.25	6.25	0.71	10%	13%	1.28	0.27	0.00	4.93	4.94	2.70	2.23
35.0	6.78	1.98	6.25	6.25	0.70	10%	15%	1.28	0.27	0.00	4.93	4.94	2.69	2.24
37.5	6.22	1.98	6.25	6.25	0.70	11%	16%	1.28	0.27	0.00	4.93	4.94	2.68	2.25
40.0	5.94	1.98	6.25	6.25	0.70	12%	18%	1.28	0.27	0.00	4.93	4.94	2.68	2.25
42.5	5.51	1.98	6.25	6.25	0.70	13%	20%	1.28	0.27	0.00	4.93	4.94	2.67	2.26
45.0	5.18	1.98	6.25	6.25	0.70	13%	22%	1.28	0.27	0.00	4.93	4.94	2.66	2.12
47.5	4.90	1.98	6.25	6.25	0.70	14%	24%	1.28	0.27	0.00	4.93	4.94	2.65	1.98
50.0	4.65	1.98	6.25	6.25	0.70	15%	26%	1.28	0.27	0.15	4.78	4.94	2.65	1.88
52.5	4.42	1.98	6.25	6.25	0.70	16%	29%	1.28	0.27	0.30	4.63	4.94	2.65	1.88
55.0	4.20	1.98	6.25	6.25	0.70	17%	31%	1.28	0.27	0.41	4.52	4.94	2.65	1.79
57.5	3.99	1.98	6.25	6.25	0.70	17%	35%	1.28	0.27	0.50	4.43	4.94	2.65	1.71
60.0	3.60	1.98	6.25	6.25	0.70	18%	38%	1.28	0.27	0.58	4.35	4.94	2.64	1.64
62.5	3.61	1.98	6.25	6.25	0.70	19%	43%	1.28	0.27	0.65	4.28	4.94	2.64	1.58
65.0	3.43	1.98	6.25	6.25	0.70	19%	48%	1.28	0.27	0.71	4.22	4.94	2.63	1.53
67.5	3.27	1.98	6.25	6.25	0.70	20%	54%	1.28	0.27	0.81	4.17	4.94	2.63	1.49
70.0	3.12	1.98	6.25	6.25	0.70	21%	61%	1.28	0.27	0.86	4.12	4.94	2.63	1.45
72.5	2.98	1.98	6.25	6.25	0.70	22%	70%	1.28	0.27	0.90	4.07	4.94	2.62	1.41
75.0	2.85	1.98	6.25	6.25	0.70	23%	80%	1.28	0.27	0.93	4.03	4.94	2.62	1.38
77.5	2.74	1.98	6.25	6.25	0.69	24%	100%	2.04	0.27	0.93	4.00	4.94	2.62	na
80.0	2.63	1.98	6.25	6.25	0.70	25%	100%	2.04	0.27	0.93	4.00	4.94	2.62	na
82.5	2.53	1.98	6.25	6.25	0.70	26%	100%	1.94	0.27	0.93	4.00	4.94	2.62	na
85.0	2.43	1.98	6.25	6.25	0.70	28%	100%	1.83	0.27	0.93	4.00	4.94	2.61	na
87.5	2.32	1.98	6.25	6.25	0.70	29%	100%	1.73	0.27	0.93	4.00	4.94	2.61	na
90.0	2.20	1.98	6.25	6.25	0.70	30%	100%	1.63	0.27	0.93	4.00	4.94	2.61	na
92.5	2.05	1.98	6.25	6.25	0.70	32%	100%	1.50	0.27	0.93	4.00	4.94	2.61	na
95.0	1.86	1.97	6.25	6.25	0.69	34%	100%	1.35	0.27	0.93	4.00	4.94	2.61	na
						37%	100%	1.17	0.27	0.93	4.00	4.94	2.60	

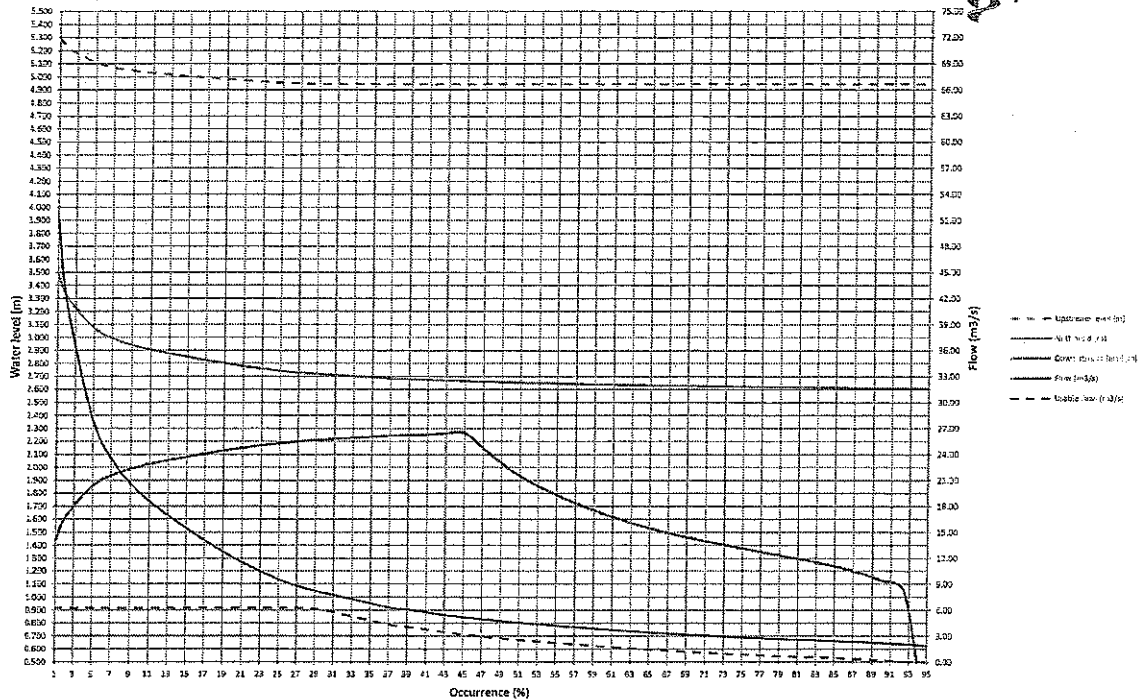
Appendix B Simplified Table

Occurrence (%)	Flow (m ³ /s)	Residual flow (m ³ /s)	Usable flow (m ³ /s)	Flow through fishpass (m ³ /s)	% total flow	% turbine flow	Flow over weir (m ³ /s)	Head over fishpass (m)	Upstream level used (m)	Upstream level (m)	Down stream level (m)	Nett head (m)
5.0	27.93	2.64	6.25	1.36	5%	22%	20.32	0.43	4.93	5.09	3.07	1.86
10.0	19.53	2.41	6.25	1.13	6%	18%	12.16	0.36	4.93	5.03	2.92	2.01
15.0	15.49	2.28	6.25	1.00	6%	16%	8.24	0.33	4.93	5.00	2.85	2.08
20.0	12.15	2.17	6.25	0.89	7%	14%	5.01	0.31	4.93	4.97	2.79	2.14
25.0	9.55	2.07	6.25	0.79	8%	13%	2.51	0.29	4.93	4.95	2.74	2.19
30.0	7.96	1.98	5.98	0.70	9%	12%	1.28	0.27	4.93	4.94	2.71	2.21
35.0	6.78	1.98	4.80	0.70	10%	15%	1.28	0.27	4.93	4.94	2.69	2.24
40.0	5.94	1.98	3.96	0.70	12%	18%	1.28	0.27	4.93	4.94	2.68	2.25
45.0	5.18	1.98	3.20	0.70	13%	22%	1.28	0.27	4.93	4.94	2.66	2.26
50.0	4.65	1.98	2.67	0.70	15%	26%	1.28	0.27	4.63	4.94	2.65	1.98
55.0	4.20	1.98	2.22	0.70	17%	31%	1.28	0.27	4.43	4.94	2.65	1.79
60.0	3.80	1.98	1.82	0.70	18%	38%	1.28	0.27	4.28	4.94	2.64	1.64
65.0	3.43	1.98	1.46	0.70	20%	48%	1.28	0.27	4.17	4.94	2.63	1.53
70.0	3.12	1.98	1.14	0.70	22%	61%	1.28	0.27	4.07	4.94	2.63	1.45
75.0	2.85	1.98	0.87	0.70	24%	80%	1.28	0.27	4.00	4.94	2.62	1.38
80.0	2.63	1.98	0.00	0.70	26%	100%	1.94	0.27	4.95	4.95	2.62	na
85.0	2.43	1.98	0.00	0.70	29%	100%	1.73	0.27	4.94	4.94	2.61	na
90.0	2.20	1.98	0.00	0.70	32%	100%	1.50	0.27	4.94	4.94	2.61	na
95.0	1.86	1.97	0.00	0.69	37%	100%	1.17	0.27	4.94	4.94	2.60	

Appendix C Graphs

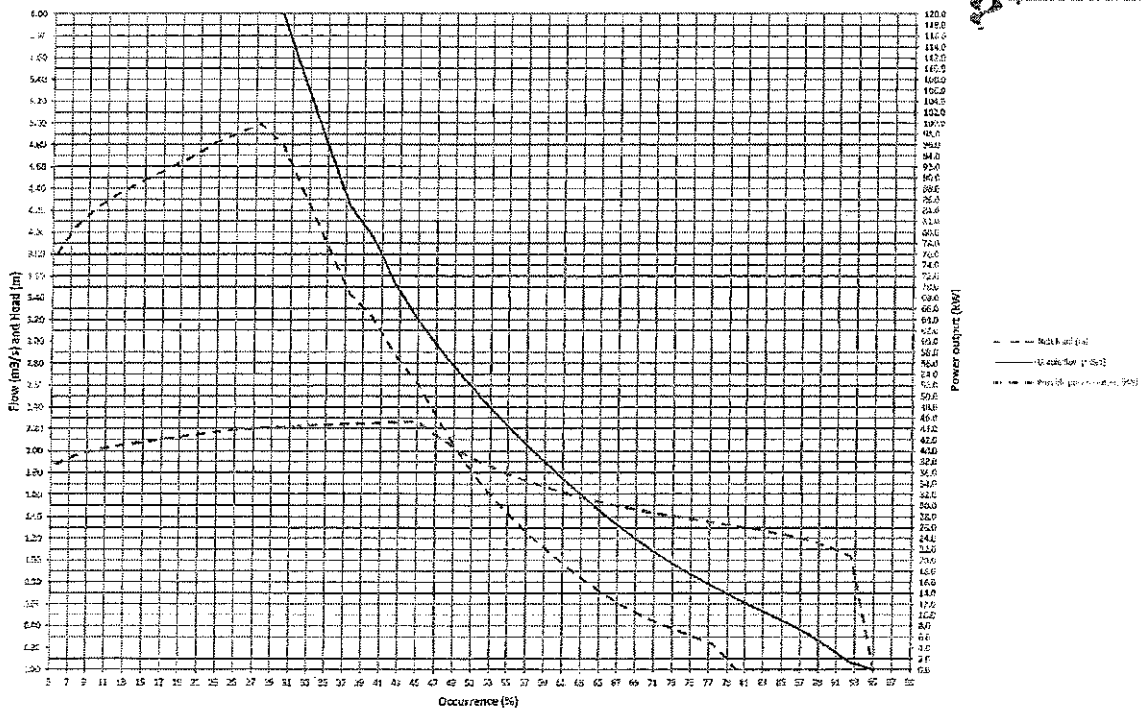
Whalley Weir 100kW 2.2m net head 1 98m³/s HoF

 Spaans Babcock Ltd.



Flow, Head and Power output 1 x 100KW variable speed

 Spaans Babcock Ltd.



Whalley Hydro Scheme Target Flow Division

